Considering the Human Factor

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Have you ever wondered why many devices that we use daily are so difficult to use? Why has no one designed a universal adapter for all the tools and equipment that use rechargeable batteries? If you're anything like me, you could likely fill drawers with all the different adapters you have acquired for cellphones, computers and peripherals, Bluetooth™ accessories, portable music players, cordless phones, drills and the like; not to mention all the remote controls for televisions, sound systems, and VCR, CD, DVD and Blu-ray Disc™ players. Consider for a moment: Have you ever owned an appliance or device that you particularly liked? Why did you like it? Was it was easy to use? Did it have intuitive displays, or labels that were easy to read and understand? Or did you simply like the appearance of the device – sleek, colourful, modernistic? Companies like Apple have led their competitors in intuitive design features with products such as Mac computers and the iPod. For many years, Apple has offered product lines that are interoperable, aesthetically appealing and intuitive to use. They have also recognized the importance of interoperability with competitors' products.

With regard to the wide array of vendor products for computerized clinical information management, the concept of interoperability has become less problematic with advances in data exchange standards. However, there is much room for improvement in the design of clinical applications and computing devices.

Our daily interactions with technology, whether at home or work, seem to be fraught with issues of poor usability. The seemingly universal frustrations inherent in the use of photocopy machines is rapidly being surpassed by the woes of

workplace computing. Mind you, the problematic photocopier is not disappearing anytime soon. Whether poorly designed applications, complex keyboard commands, poor network response time or connectivity, or a lack of congruence with users' mental models of how things "should" work, issues of design have the potential to be the single point of failure in the successful adoption of clinical information systems. Clearly, good design influences acceptance and use of technology.

> Human factors engineering is the application of what we know about human capabilities and limitations to the design of equipment and devices in order to enable more productive, safe and effective use. (Human Factors MD 2008)

The study of human factors in preventing design-related error has been a key consideration in the aviation industry for a long time. Vicente (2003) cites many examples of errors that resulted from a "dysfunctional relationship" between cockpit designs and pilots. Simple design alterations successfully eliminated the potential for human errors that have dire outcomes. Over the years, healthcare has unfortunately experienced the results of poorly designed tools and technologies: drugs and drug labels easily confused, tubing for different purposes easily interconnected and critical monitoring systems easily silenced, all resulting in incidents with adverse outcomes. The recognition of such design flaws has led to the advance of many remedies to mitigate human error and risk. The study of human factors and the design of everyday things have much to offer healthcare in the design and deployment of such technologies as clinical information systems and the associated devices for data input and information retrieval.

Occupational health and safety are often concerned with ergonomic issues, including workstation design and environmental lighting, noise, temperature and air quality. But how often is the "human factor" considered when introducing new tools or technologies into healthcare settings? Think of human factors as "cognitive ergonomics" – making sure that the way things work is consistent with how users think about the associated processes. "Human factors" considers the following: (1) abilities, behaviours and physical characteristics of users; (2) characteristics of the environment that affect users of the technology and (3) design features of the device that affect how people use it (Human Factors MD 2008).

Many designs can be improved from an aesthetic perspective, but more important in clinical settings is the design of systems that are error tolerant, easy to access and use, and supportive of efficient and effective care delivery. In terms of clinical information systems, clinicians want applications that are integrated and interoperable. Integration may include the "single sign-on" rather than multiple application logons and passwords, reflecting the ideal concept of "data elements

entered once, for use by many." Potential gains in efficiency are often lost when organizations resort to an online replication of the multiple forms associated with the paper record (Nagle 2007). While to a large extent organizations are "stuck" with many of the vendor's basic design features, clinical documentation and orders applications can usually be constructed to optimize clinician efficiency. Effectiveness can be described in relation to the integration of decision support functionality – giving clinicians integrated access to online reference information (e.g., best practices, drug information). Ideally, these links should be embedded in the relevant applications.

The language of information systems has been particularly and unnecessarily punitive and threatening ("you have performed an illegal or fatal operation"). Is it any wonder that novice users get intimidated? It is advisable, however, that clinical systems provide alerts regarding inappropriate access to clinical records and, to a limited extent, alerts regarding potential errors. Experience has begun to demonstrate that clinicians have a limited threshold for alert messages; thus, only those alerts that have the most impact on patient safety (e.g., drug allergies, drug to drug interactions) should be included in an application. Further, the messaging embedded in programs should be friendly, forgiving and instructive. Basic tips for basic and advanced navigation of clinical applications are also good functions to consider. As clinicians become more comfortable with the basics, they will seek to enhance their use of an application's features. The "Help" function of clinical applications should be, well, helpful and easy to use.

The choice of computing devices used to access clinical applications is an equally important consideration. Providing a sufficient number of devices is fundamental to ensuring timely access to clinical information. Portability may be important in some, but not all, clinical units; workflows need to be considered in conjunction with applications to inform the appropriate choice of device. Many organizations use computers on wheels (COW) – a well-intended innovation, but one often deployed without sufficient consideration of ergonomics and human factors. It is important to consider issues of manoeuvrability within the clinical environment and the reliability of portable computing in relation to network connectivity and battery life. Increasingly, handheld devices (personal digital assistants and tablets) are being used to support access to clinical applications. Although these are likely to be embraced by many, consideration needs to be given to issues of readability, infection control and the possibility of new, device-related strain injuries.

Elements of design need to be considered in regard to "soft" as well as "hard" technologies (Vicente 2003). New devices in clinical environments necessitate new workflows, policies, procedures and supports – the "soft" technologies – and these require as much, if not more, clinical engagement in the design of their process

components. Vicente (2003) reflects that healthcare is renowned for expecting human effort and ingenuity to pick up the slack for poorly designed systems. We need to remember that the introduction of clinical information systems is about changing the way work happens, and for this reason, the "soft" work must not be left to the technology experts. Let's face it: by its very nature, clinical computing is a "disruptive technology" (Christensen 1997). Until an optimally usable and unobtrusive clinical information system become available, it behooves us to invest the time to make the most of what we have today. We owe it to our clinicians, and to all consumers of healthcare, to consider the human factor.

References

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