Avoiding death by computer

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We all make mistakes. Usually we can sort out the problems, but occasionally the errors lead to terrible outcomes, even death. Many medical devices are not forgiving: they encourage error, they do not warn when errors occur, and they make recovery from errors unnecessarily hard. Sometimes they even lead to the user being blamed when it was not the user's fault. The key message of this talk is that these problems are avoidable.

Denise Melanson, a teacher, died in August 2006 from an overdose of a chemotherapy drug. The seemingly obvious cause was that two nurses unfortunately both made the same mistake doing the drug dose calculation: they both calculated a dose 24 times too high, apparently because they forgot to divide by the number of hours in a day.

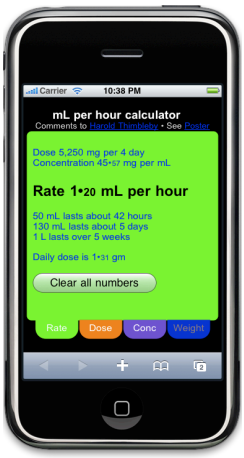
Yet on looking more closely, there were many factors that encouraged them to make this mistake and not to notice it. For example, the computer that printed the label on the drug bag printed a lot of information, including an incorrect dose, which unfortunately agreed with the nurses' incorrect number.

After programming the drug infusion device, nurses should review the dose they have programmed the device with. This is supposed to be a step to help detect errors. Unfortunately the infusion pump used, an Abbott *Aimplus*, makes the review process so trivial that it is easy to miss errors. There are many other design problems with the *Aimplus*, and it is surprising that the manufacturers did not know about them, or appeared not to, before releasing the device for use in hospitals. The lecture will give very many examples of design problems with the *Aimplus*.

Unfortunately the *Aimplus* is by no means unique in having design problems. We'll look at some other medical devices; it is clear that medical devices in general are poorly designed. Some have astonishing problems.

Even though the infusion pump was technically capable of performing the drug dose calculation, it forced the nurse to do it, perhaps either by hand or by using some other calculator. We'll look at calculators, and we'll see they are a thoroughly unreliable way of working out answers to problems such as drug dose calculations. It's not obvious why the hospital pharmacy couldn't have printed the correct numbers clearly on the drug bag and avoided the problems in the first place.

It isn't that infusion pumps, calculators, pharmacy computers were invented yesterday and these problems are news. On the contrary the human factors and programming problems are well known. Thus it seems, unfortunately, that everybody involved is blind to the problems: manufacturers make bad devices; hospitals buy bad devices; nurses and doctors are blamed for the problems.



To see what might be done, I developed a new calculator. My calculator runs on an Apple iPhone. My calculator blocks about 30 different types of error that ordinary devices ignore! It took me about a day to build, which suggests that even a little effort in device design could have significant impact.

Preliminary analysis shows that the general approach of blocking errors will reduce "out by ten errors," a major class of preventable error often leading to overdose and death, by a factor of two.

If manufacturers wanted to make better devices, they could. If hospitals wanted to buy better devices, they could. If incident analyses wanted to criticise bad design that encourages or ignores errors, they could. We need a Ralph Nader for medical devices. In the 1960s, cars killed people because of poor design — Ralph Nader exposed this, and inspired the consumer movement. Today, preventable errors in hospitals are killing more people than cars. It's time to inspire everyone to understand that nurses do not kill people, systems do — and (usually) it's preventable.

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