Drug calculations shouldn't be dangerous

With a population of 370 million, Europe has 40,000 AIDS deaths per year, 106,000 car fatalities… and 240,000 hospital deaths from human error — which is under-reported. About 120,000 hospital deaths per year are caused by drug calculation errors.

A "simple" drug calculation is: how many mL/hr should an infusion pump be set to in order to give a patient 5250mg of fluorouracil over 4 days at a concentration of 45.57 mg/mL?

$$\frac{5250\ \text{mg}}{45.57\ \text{mg/mL}} \Big/ (4\ \text{days} \times 24\ \text{hours per day})$$

The **simplest correct** calculation using a basic calculator is:
[AC] [MRC] [MRC] 4 × 24 [MPLUS] [AC] 5250 ÷ 45.57 ÷ [MRC] =

If the nurse does not use the memory feature, the correct calculation is:
[AC] 5250 ÷ 45.57 ÷ 4 ÷ 24 = which uses a sophisticated repeated division, equivalent to the multiplication.

Most nurses are unlikely to be able to do this sum correctly using a calculator.

Calculators are **inconsistent** and give different results for the same keystrokes. Infusion pumps are **completely** different.

Calculators ignore user errors

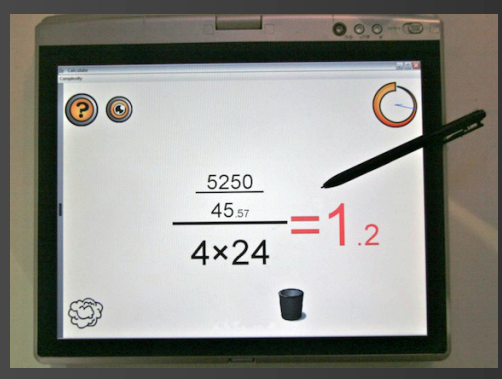
This pump does not review calculations. It just repeats the exact same numbers

Solutions…

Prototype handheld calculator detects and explains 52 types of data and keying error. When the data is correct, the review screen goes from red to green. It then reviews the calculations, all data entered, and estimates the lifetime of 50mL and other doses.

The user sees data entered in several formats to increase redundancy. The calculator displays numbers in a very clear form: with a large decimal point and smaller decimal fractions. Shown here running on an Apple iPhone, but it also runs on larger PDAs or on desktop PCs, which are less likely to be stolen.

A tablet PC general-purpose handwriting recognising calculator has been evaluated with students doing GCSE maths exams. It scored 100% compared to 60% for students using their own standard handhelds.



The user interfaces shown here are all "wipe clean" to reduce risk of cross-infection. Cameras and wireless capability add other useful features: scanning ampoule barcodes, requiring second-user confirmation… and so on.

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References

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Handwriting calculator, designed and implemented by Will Thimbleby: www.cs.swan.ac.uk/calculators

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The calculation illustrating this poster is taken from a 2007 Canadian Institute for Safe Medication Practices report on a fatality caused by two nurses both failing to divide by 24.

EPSRC
EP/F059116/1