GET IT RIGHT

José Eric Martinez, age two months, died at Houston's Hermann Hospital in 1996 as a consequence of receiving ten times the prescribed dosage of Digoxin, a digitalis derative.

José had a small hole in his heart. The drug would assist his heart function. For the best predicted outcome, the hole would repair itself. In the second-best outcome, he would be older and larger and able to manage corrective surgery.

He was supposed to get 0.09 mg of Digoxin. Instead he was given 0.9 mg.

The story is detailed in an article by Lisa Belkin in the New York Times, 15 OCT 1997. Here are some details from the story.

> The first step in the sequence was the determination of the appropriate amount of Digoxin to be administered. The attending physician and resident did the calculations and determined that the correct dose was .09 milligrams. However, when the resident wrote the order on José 's chart, he made a slip of the pen and entered .9 milligrams -- a dose that was ten times too high. When the physician checked the chart, the mistake went unnoticed.
>
> The Digoxin order was faxed to the pharmacy. The pharmacist thought the amount too high, so he placed the order on the coffee pot -- the location of the unofficial important pile and then paged the resident to discuss the order. However, the resident had left for the day and did not receive the page. A back up copy of the order that had been sent by messenger arrived and was filled by a technician. The technician filled a vial with .9 milligrams of Digoxin and left it for the pharmacist to check. By the time the pharmacist checked the dosage, he had forgotten his original concerns. Since the order and the dosage in the vial matched, the pharmacist sent the prescription out.
>
> That was not the end of the opportunities to correct the error. The nurse who received the vial thought that the dosage was incorrect, so she approached the resident on call who was not the same resident who made the initial error. This resident redid the math and got the correct dosage of .09; but when he looked on the vial he failed to notice that the decimal point was in the wrong place and the dosage on the vial actually read 0.9.

Lisa Belkin explored this error further.

> The pharmacy was one person short the night the order was filled. A policy existed that the phone must be answered within four rings and that visitors should be greeted within five seconds–a policy that put pressure on an understaffed unit. The nurse who questioned the order was from a

> country in which women rarely confront men and in which women rarely confront doctors. Cultural practices and some well-intentioned policies played a role in the events that occurred.

Subsequent commentary has involved assessing blame and trying to institute solutions. The business ethicist Normal Bowie has tried to cast the problem into the framework of institutional ethics. Specifically, what is there about the structure of an institution that works to prevent serious errors?

A letter from H.B. Burchell to *The American Journal of Cardiology*, 15 OCT 1997, pp 1121-1122, had this comment:

> One item conducive to oversight and which needs reemphasis is the misplacement of the decimal point in the dosage unit.

Burchell is an expert on digitalis poisoning.

So . . . what's the message for us?

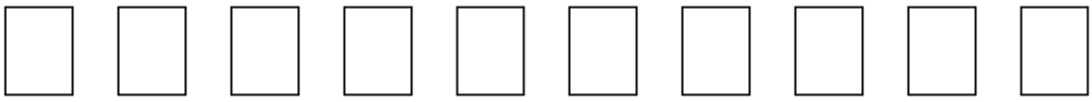
Please note the very casual use: .9 .09 0.9

It's hard to know from these accounts exactly how much of the confusion was created by our careless and inconsistent notation for numbers below 1.0.

Let us hereby endeavor to enforce uniform numerical notations for our organizations. This is important for prescription drugs, and it is also important for financial transactions. Here are some suggested steps:

(1) Numbers less than 1.0 should be written with a leading zero. Use 0.09 and *not* .09.

(2) Ask each person in the operation to supply written versions of the ten digits, possibly by filling in these boxes:



0 1 2 3 4 5 6 7 8 9

Many people write 7 in a style that others will interpret as 1. Other possible confusions will be revealed.

Merely distributing such a form will enforce the message that careful writing is important.

(3) Be aware that Americans, some Europeans, and some Asians use commas and decimal points differently. Americans write 12,345.67, while some Europeans write 12.345,67. Insist on local standards! In the United States, please be sure that everyone uses the 12,345.67 style. If you are working in a country that uses the 12.345,67 style, then *you* should change; do not expect others to cope with your peculiarities.

(4) There are also differences for very large numbers. In the United States, the big-number names change for every multiple of 1,000: one, thousand, million, billion, trillion, quadrillion, and so on. This gets the name "short scale." In some European countries, the names change for every multiple of 1,000,000, and this is called "long style." Here's a little table.

10^k	Number	Short scale	Long scale
10^0	1	one	one
10^3	1,000	thousand	thousand
10^6	1,000,000	million	million
10^9	1,000,000,000	billion	milliard
10^{12}	1,000,000,000,000	trillion	billion
10^{15}	1,000,000,000,000,000	quadrillion	billiard
10^{18}	1,000,000,000,000,000,000	quintillion	trillion

Note that billion and trillion are used inconsistently. The short scale style is winning out, but long scale numbers are still used. The exponential notation will help avoid confusion.

(5) Adopt a personal uniform style for your own materials. If you always write 1,234 with the comma, then your word processor, usually MS-WORD, can use edit-find or search-replace easily. You won't have to try both "1,234" and "1234" in the searching.

(6) Technological changes will provide us even more interesting ways to get confused. Be ready.

> Suppose that you depend on the spell-checking in MS-WORD to find errors. Consider this sentence:
>
> > They're was no way that there coats would have been left their.
>
> No one with pen and paper would write such a sentence. MS-WORD finds no spelling errors. (In fairness, it does note grammatical problems.)

Numbers matter. Let's make sure that they are handled with care.

It's too late for José. Let us not repeat the pain.