Medication Math Errors
and the Nursing Student

A shocking number of patients die every year in United States hospitals as the result of medication errors, and many more are harmed. One widely cited estimate (Institute of Medicine, 2000) places the toll at 44,000 to 98,000 deaths, making death by medication "misadventure" greater than all highway accidents, breast cancer, or AIDS. If this estimate is in the ballpark, then nurses (and patients) beware: Medication errors are the forth to sixth leading cause of death in America.

How many medication errors are miscalculation errors? No one really knows since by some estimates as little as one in ten errors are reported (Pepper, 2002). Of reported errors one FDA study (Thomas, et. al., 2001) found that 7% were due to "miscalculation of dosage or infusion rate." Combining this estimate with the estimate for total deaths, as many as 3,000 to 6,800 deaths are caused annually by medication math errors. This would mean that in the average hospital one patient dies every year or two because someone makes a miscalculation, and one or two patients are sub-lethally harmed each month. As future nurses, then, there is a distinct possibility that we will harm, or even cause the death of, a patient over the course of our career.

If we believe the adage "first do no harm" applies to us, then what can we possibly do to minimize miscalculation errors? If we only aim to pass Medication Math with an 80% or above, are we setting the bar high enough? It might be late some Saturday night, you're the only RN on the floor, the hospital pharmacy is closed, and it's up to you to calculate a needed dosage. Surely getting the right answer only 80% of the time is not acceptable. Perhaps the problem you need to solve is a little different than any you've seen before or recall seeing in the textbook. How confident will you be that your calculation is correct?

The time to build confidence is while we are students. I suggest that as conscientious students we should aim for 95% or better. We should, then, carefully study, learn from, and thereby avoid repeating what mistakes we do make, so that by the time we are working in the real world we can be confident that, if we are vigilant enough, we can approach 100% proficiency. Since "to err is human," we will always be at risk of not achieving a goal of 100% proficiency, but we cannot aim for less, and knowing that we are always at risk will make us extremely careful.

Neither effort, desire to avoid error, nor carefulness, however, is enough. We need the right tools and techniques that will help us avoid miscalculations. I believe that dimensional analysis is the most appropriate tool available to us. It is, by far, the best method of solving medication math problems with the least chance of making errors. As nurses we're not likely to ever use whatever algebra, trigonometry, calculus, or statistics we may know and (even better?) we need make no effort to learn these subjects, but we should strive for a deep understanding of, and proficiency in, dimensional analysis (DA).

The good news is that mastery of DA is not at all an unobtainable goal. While few could master a vast subject such as algebra in a lifetime, most students should be able to master DA in a few weeks of focused effort. Mastery would mean the ability to solve any problem that could crop up, no matter how it is presented, while avoiding pitfalls, and retaining proficiency in the years to come. Needless to say, if I thought that nursing students were mastering DA, I wouldn't be writing this paper.