

# The Laws of Small Numbers – Part 2

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## THE LAW OF INSULIN DOSE ABSORPTION

If you do not take insulin, you can skip this section.

Think again of traffic. You're driving down the road and your car drifts slightly toward the median. To bring it back into line, you make a slight adjustment of the steering wheel. No problem. But yank the steering wheel and it could carry you into another lane, or could send you careening off the road.

When you inject insulin, not all of it reaches your bloodstream. Research has shown that there's a level of uncertainty as to just how much absorption of insulin actually takes place. The more insulin you use, the greater the level of uncertainty.

When you inject insulin, you're putting beneath your skin a substance that isn't, according to your immune system's way of seeing things, supposed to be there. So a portion of it will be destroyed as a foreign substance before it can reach the bloodstream. The amount that the body can destroy depends on several factors. First is how big a dose you inject. The bigger the dose, the more inflammation and irritation you cause, and the more of a "red flag" you send up to your immune system. Other factors include the depth, speed, and location of your injection.

Your injections will naturally vary from one time to the next. Even the most fastidious person will unconsciously alter minor things in the injection process from day to day. So the amount of insulin that gets into your bloodstream is always going to have some variability. The bigger the dose, the bigger the variation.

A number of years ago, researchers at the University of Minnesota demonstrated that if you inject about 20 units of insulin into your arm, you'll get on average a 39 percent variation in the amount that makes it into the bloodstream from one day to the next. They found that abdominal injections had only a 29 percent average variation, and so recommended that we use only abdominal injections. On paper that seems fine, but in practice the effects on blood sugar are still intolerable. Say you do inject 20 units of insulin at one time. Each unit lowers the blood sugar of a typical 150-pound adult by 40 mg/dl. A 29 percent variability will create a 7-unit discrepancy in your 20-unit injection, which means a 280 mg/dl blood sugar uncertainty (40 mg/dl x 7 units). The result is totally haphazard blood sugars and complete unpredictability, just by virtue of the varying amounts of insulin absorbed. Research and my own experience demonstrate that the smaller your dose of insulin, the less variability you get. For type 1 diabetics who are not obese, we'd ideally like to see doses anywhere from ¼ unit to 6 units or at the most 7. Typically, you might take 3–5 units in a shot. At these lower doses, the

uncertainty of absorption approaches zero, so that there is no need to worry about whether you should inject in your arm or abdomen or elsewhere.

I have a very obese patient who requires 27 units of long-acting insulin at bedtime. He's so insulin-resistant that there's no way to keep his blood sugar under control without this massive dose. In order to ameliorate the unpredictability of large doses, he splits his bedtime insulin into four small shots given into four separate sites using the same disposable syringe. As a rule, I recommend that a single insulin injection never exceed 7 units.

#### THE LAW OF INSULIN TIMING

Again, it's very difficult to use any medication safely unless you can predict the effect it will have. With insulin, this is as true of when you inject as it is of how much you take. If you're a type 1 diabetic, fastacting (regular) insulin can be injected 40–45 minutes prior to a meal tailored to your diet plan to prevent the ensuing rise in blood sugar. Regular, "fast-acting" insulin, despite its designation, doesn't act very fast, and cannot come close to approximating the phase I insulin response of a nondiabetic. To a lesser degree this is also true of the new, faster-acting lispro (Humalog) or aspart (Novolog) insulins. Still, these are the fastest we have. Small doses of regular start to work in about 45 minutes and do not finish for at least 5 hours; lispro starts to work in about 20 minutes and also takes at least 5 hours to finish. This is considerably slower than the speed at which fast-acting carbohydrate raises blood sugar.

**Con't Next Week:: Part 3- The Laws of Small Numbers**