Diabetes: Doing the Math

Jim Hines

BEFORE YOU READ:

1. Do you or someone you know have diabetes? Share what you know about diabetes.

2. Scan the headings. What does the author mean by "Math 100," "Math 200," etc.?

3. Study the words at the bottom of the page.

People often make assumptions about what I can and can't eat as a type 1 diabetic. Here's the thing: I can eat anything I choose ... as long as I take the correct dose of insulin to go with it. Therein lies the trick.

Diabetes Math 100: Introduction

I try to keep my blood sugar goal between 70 and 140. I've discovered that one unit of insulin drops my blood sugar about 60 points, so if my blood sugar is 200, I'll program the insulin pump to give me 1.5 units.

With meals, you're worried about glucose. This means you primarily count carbohydrates. I need to take about 1 unit of insulin for every 8-9 grams of carbs.

POP QUIZ: My blood sugar is 160, and I'm sitting down to a meal with 90 grams of carbohydrates. How much insulin do I take?

I've also found that I need more insulin for my first meal of the day – closer to 1 unit for every seven grams of carbs. A 50 gram breakfast gets about seven units. So now there are two ratios to remember. So far, so good.



Diabetes Math 200: Graphing Over Time

Those ratios are nice, but some foods are digested and absorbed more quickly than others. Humalog insulin has a pretty stable absorption rate, peaking after about 90 minutes. This can be a problem.

A number of factors affect the absorption of that meal you just ate. Some things, like orange juice, get absorbed pretty darn fast. Others, like pasta, can take a long time to absorb, especially larger noodles. (Lasagna is a killer!)

The insulin pump is programmed to deal with this using a feature known as the square bolus. Basically, you program two doses of insulin: one to be delivered immediately, and a second to be delivered at a steady rate over several hours.

Pizza has a pretty high fat content, which also slows down absorption. So for pizza night, I've



Glucose: a type of sugar you get from foods you

eat. Your body uses it for energy. As it travels through your bloodstream to your cells, it's called blood sugar.



People with diabetes do not make enough insulin, so they inject insulin.

Carbohydrates:



Called "carbs" for short, they come in the form of

sugar, starch, and fiber. After you eat them, they convert to glucose in your body.



figured out the proper dose is 6.5 units now and a square bolus of 10 units over 6 hours. Lasagna is two units now, and 6-7 units over about 5 hours. A piece of fruit? One unit now, no square bolus.

Diabetes Math 300: Multivariable Equations

Now things get exciting. Remember those ratios we learned back in the 100-level class? They don't actually stay the same from day to day. Here are some of the factors that can mess with your numbers:

- A good aerobic workout speeds up my metabolism and decreases my insulin requirements by 10% or so for up to 24 hours.
- Getting sick throws everything off and usually raises my blood sugar, meaning I need 10-20% more insulin. (I can often tell I'm getting sick because my blood sugar starts to spike a day or so before any other symptoms.)
- Stress tends to raise blood sugar, though I'm told it can also lower it in some people with type 1 diabetes.
- When did I change my insulin pump? If it's the first 24 hours of a new set, the insulin absorbs better than it does on the second day.
- The insulin pump uses catheters that go into the belly fat, and occasionally those sites get irritated or build up scar tissue, which slows absorption. Increase all dosages 5-10%.
- Finally, there's the heck-if-I-know factor. Sometimes your blood sugar still ends up at 250, even though you ate the exact same thing for lunch, took the exactly right dosage of insulin, and did everything else you were supposed to.

Conclusion

It's not that diabetics can't eat certain food. But I've chosen to eliminate some things from my diet. I drink diet soda instead of regular; I don't usually drink milk; I'll eat ice cream, but rarely. Not because I can't, but because eliminating those things from my diet reduces the number of variables and makes it easier for me to calculate my dosage. Even so, those calculations are often a best-guess, and I'll usually check my sugar two hours after a meal and adjust for any errors. That's how it works for me as a type 1 diabetic.

AFTER YOU READ:

1. What is your answer to the "pop quiz"? How did you reason through the problem? Can you visualize or draw the situation to figure out the answer? Create your own word problems modeled on the pop quiz.

2. What kinds of math does the author have to know to calculate his insulin needs?

3. Name at least three factors that the author has to keep track of as he monitors his insulin intake.

4. Describe how you use math to manage your health.

5. What does the author mean by the "heck if I know" factor? Do you have anything in your life that requires careful monitoring but also includes a "heck if I know" factor? If so, describe it.

Jim C. Hines <www.jimchines.com> is the author of the Magic ex Libris series, the Princess series of fairy tale retellings, the humorous Goblin Quest trilogy, and the Fable Legends tie-in Blood of Heroes. His latest novel is Terminal Alliance, book one in the humorous science fiction Janitors of the Post-Apocalypse trilogy. He's an active blogger, and he won the 2012 Hugo Award for Best Fan Writer.

Ratios Show Relationship

A ratio is the relationship between two amounts. For example, when you cook rice, the ratio of *rice to water* is 1 to 2. (One mathematical way to write this is 1:2.) The ratio of *water to rice* is 2:1. How much water would you need if you were going to cook 2 cups of rice? Name some other ratios you use in your life.

Using mathematical notation for ratios, list the two ratios that the author mentions in "Diabetes Math 100."

