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# An N of One: My Review of Management of Type 1 Diabetes, Myself as Patient

Jarred Daugherty

**Abstract:** As technology has advanced, so has the management of diabetes. Insulin, the essential medication for type 1 diabetes, is marketed in an array of formulations and devices. Continuous glucose monitors (CGM) can be inserted to measure blood glucose every 5 minutes. The rise of social media has given diabetics online support groups, where they can share their story and learn from others overcoming similar challenges. So, how well do the current diabetes management strategies work? My name is Jarred and I'm a type 1 diabetic. I have tried many of these products and this article is a review of my experiences with them.

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Many years of research has provided people living with diabetes a vast array of tools designed to improve quality of life and disease management. From glucometers that notice trends to continuous glucose monitors that can shut off an insulin pump after blood sugars fall below a certain threshold, diabetics today appear to have it quite easy. So does it all work as advertised?

## MY DIAGNOSIS

The last month of senior year of high school was supposed to be relaxing and fun. For the most part, I was enjoying my last days with my friends. By graduation, I was quickly feeling "off." I couldn't pinpoint exactly why, but I knew I wasn't feeling like my normal self.

Initially, I felt perfectly fine and had my annual physical before summer break. Everything about that physical was typical, except the finger stick. Normally, they would leave after the finger stick without saying the result. This time, my doctor requested to see me again in 7 days and asked to me refrain from eating for 8 hours prior. He said he did not want to jump to conclusions, but he didn't like the abnormal glucose result. The following week, I had another finger stick done and my blood sugar was over 200 mg/dL; a reading of 126 mg/dL is considered diabetic.<sup>1</sup> The nurse stated this was not normal and my doctor referred me to an endocrinologist. I attempted to get further explanations, but he didn't say anything precise or conclusive. Not getting answers from my doctor combined with increasingly severe symptoms had me frightened and convinced something was wrong. Symptoms such as frequent urination, constant thirst and hunger, and serious fatigue rapidly developed during the weeks following my physical. I am a worrying person by nature, and reasonably, I decided to go to Google to search my symptoms. I instantly regretted that search, as nearly every result was diabetes. Waves of fear swept over me as I thought of the possibility of having diabetes. I already had moderate congenital hearing loss and didn't want another lifelong health issue.

June 20, 2012, was the date of my endocrinologist appointment. The endocrinologist, Dr Ali, took blood samples and then ushered me to an exam room. Dr Ali returned a short while later and delivered the verdict; I had type 1 diabetes. Initially, shock and disbelief hit me like a tidal wave. But like all storms, dark and chaotic gave way to calm and quiet. It was a surreal moment, like a weight being lifted off my shoulders. Yes, my life was about to change in many ways, but it was an answer—an answer to why I was frequently urinating and constantly rehydrating. I had an answer to the fatigue and weight loss I had experienced for the past month. Admittedly, both my parents and I were scared of the future because I was headed for college at Butler University. How would I cope with living away from home while adjusting to this new lifestyle? What about dining hall food? How would I see my doctors in Ohio with my school in another state? What is insulin, and how do I use it? Thankfully, The Ohio State University's Diabetes Research Center had countless resources to address this type of scenario. From my first insulin shot, to hours of personalized education with a certified diabetes educator and nutritionist, I was covered every step of the way.

That was three and a half years ago, and a lot has changed since then! I learned that having diabetes doesn't define me. It certainly causes me stress, anger, fatigue, and some pain, but it will never control me. I've studied, conversed, and attempted many different management strategies throughout my constant supervision of my blood sugars. In the following information, I will attempt to explain some of these management techniques. I will be using myself as the patient and the outcomes I experienced as the results.

## DIABETES TREATMENT GOALS

The American Diabetes Association (ADA) published updated guidelines at the beginning of 2015 for the management of type 1 diabetes. Their recommendations include an A1C, a reading that tracks the blood sugar levels in your body over 3 months, of less than 7%, along with multiple doses of insulin daily through several insulin injections or through an insulin

pump infusion.<sup>1</sup> The ADA also recommends increasing self-blood glucose monitoring, as each additional blood glucose test per day decreases A1C by 0.2%.<sup>1</sup> They also recommend a fasting blood glucose of 80-130 mg/dL and a postprandial (ie, after meals) blood glucose of less than 180 mg/dL.<sup>2</sup> However, my personal goals are more strict than the ADA's recommendations.

## INSULIN INJECTIONS: MY INITIAL THERAPY

Insulin therapy is the mainstay of type 1 diabetes treatment, with a variety of dispensing methods. It can be infused through an insulin pump or injected from prefilled pens and syringes. I started on Humalog Kwikpens<sup>®</sup> (insulin lispro) and Lantus Solostar<sup>®</sup> (insulin glargine) pens the day of my diagnosis. Major benefits of using pens are safety and convenience. The use of syringes allows more accurate dosing, but it requires one to carry around a vial of insulin. A pen has a prefilled cartridge, or container, inside the casing and requires only a simple twist of the top to prime a dose. Doses are measured in units, which is much easier to read versus milliliter (mL) markings on a syringe. Pens are easier to store in bags, purses, and backpacks and generally do not require refrigeration after opening.<sup>3</sup> Initially, I thoroughly enjoyed the convenience that the pens provided me. I could throw a pen in my backpack and pull it out when I needed to without the hassle of a syringe and vial. I did not, however, enjoy the process of injecting insulin in public places such as dining halls and restaurants. While I have never been one to worry what others think, it was embarrassing to have people stare at me while I was injecting insulin. Part of me saw it as simple curiosity, yet the other part remembers the dirty looks and finger pointing. I was also concerned with the long-term effects of 5 to 6 injections a day into my abdomen. Over time, scar tissue develops and it does not absorb insulin very well. Although I rotated injection sites across my entire abdomen, I was repeating injection sites again within two weeks.

After 3 months, I was physically and mentally ready for an insulin pump. Avoiding public displays of injections, PDI, was the biggest factor that pushed me towards starting insulin pump use. No amount of education, practice or counseling could have prepared me for feeling like I was on display every time I had to inject in public. What I saw as lifesaving and necessary others saw as gruesome and inappropriate. A pump was needleless, concealable and quickly became an attractive option. While I was told it is unusual for such newly diagnosed patients to receive a pump recommendation, I believe it was the combination of my background in science and pharmacy that allowed the medical staff to feel I would be immediately adherent with a pump.

## THE INSULIN PUMP: MY SECOND AND CURRENT THERAPY

Continuous subcutaneous insulin infusion (CSII) consists of an infusion site, insulin pump, and insulin cartridge.<sup>4</sup> The insulin pump pushes insulin through a tube towards the infusion site. It then enters the subcutaneous tissue through a catheter at

the end of the infusion site. I am often asked why I chose the pump, and while there are a hundred reasons, below are some of the pros and cons I evaluated when choosing to begin pump therapy:

### Pros

- Incredibly accurate infusion (basal) rates down to 0.05 – 0.025 units/hr<sup>4,5</sup>
- One needle insertion every three days to change sites
- Discreet
- Active insulin calculation
- Bluetooth technology pairs to continuous glucose monitor (CGM)

### Cons

- Infusion site on stomach can make one feel self-conscious
- Bulky in pocket
- Tubing gets tangled
- Expensive
- Requires training classes and routine maintenance

A typical insulin pump costs around \$6,500.<sup>5</sup> Thankfully, my insurance covered a massive portion of that.<sup>6</sup> My insulin pump attempts to mimic the insulin levels of a non-diabetic through a small basal rate dose given continuously and larger boluses on top given for meals or to correct glucose levels.<sup>7</sup> Boluses can be given all at once or split up and delayed for meals that may take longer to digest and enter the bloodstream, like Chinese or Italian foods. Based on my own experience, the high-carbohydrate load of most Italian and Chinese meals seem to push my blood sugar higher for longer than low-carb meals. Basal rates can be reduced or increased quickly for workouts and illness. Alarms alert the user to low insulin levels in the cartridge, to low battery, and can warn of hypoglycemia and suspend basal rates automatically when paired to a continuous glucose monitor (CGM).<sup>8</sup>

Insulin pump therapy is not without drawbacks. The pump is something that is always connected to me. This means I had to find creative ways of sleeping without laying directly on the pump. A simple doorway is now a major hazard when there's 42 inches of tubing hanging at your side. I have closed my car door on my tubing, caught it in a zipper, had others pull on it, and had my cats at home chew on it while I was asleep. Infusion sites are not perfect either. They fail to stick for greater than 48 hours in summer weather and rarely survive any sort of forceful pulling on the tubing by doorways, car doors, etc.

Even with these issues, I wouldn't consider trading my pump for pens or syringes. The pump has allowed me to get back much of my life before diabetes in a way injections never could. Gone are the days of blank stares and disgusted looks. The worst look I've gotten was while I was on a date. She thought I was texting during dinner!

## CONTINUOUS GLUCOSE MONITORING

After diagnosis, I fully embraced my new lifestyle. I managed to reduce my A1C from 12.4% to 4.6% only 3 months after diagnosis. That's an average blood glucose of 79 mg/dL and almost on the side of too low. I kept hearing about CGMs and finally explored them during the summer of 2015. A CGM is a small device that measures blood glucose continuously throughout the day.<sup>9</sup> It measures the fluid between cells through a small sensor inserted into the abdomen that is changed every 7 to 10 days.<sup>11</sup> My CGM takes a measurement every 5 minutes and all of the data is transmitted to a receiver. This receiver plots the points in a graph and gives trend arrows indicating if blood glucose is rising, falling, or stable. My new insulin pump also talks to my CGM, and some pumps will stop delivering insulin if it senses a blood sugar too low.

One reason I love my CGM is its ability to quickly obtain a rough estimate and trend of my blood glucose at any given time. If I am busy at work and feel dizzy and low, I can quickly look at my CGM receiver and know if I am trending down and need to eat something. It can show me when I go low while asleep, which is potentially fatal and a common fear among diabetics.<sup>10</sup> I love having a full day's worth of data instead of readings from only 8 finger sticks. I can also upload and send my graphs electronically to my doctors to get adjustments to my insulin dosing.

Unfortunately, I have encountered a select number of issues with my CGM. Firstly, it is yet another item to stab myself with. I was already concerned about scar tissue forming with my insulin pens and here is another needle going into me, albeit every 7 to 10 days. Secondly, it's another bulky thing to sleep on. Technology has improved dramatically in the past decade, but they are still bulky enough to be uncomfortable. But the biggest issue I have with my CGM is the information overload.

The CGM system is designed to give the user access to far more data than the traditional finger sticks.<sup>10</sup> This led me to start something I call "chasing the numbers." I became obsessed with seeing perfect numbers every minute of every day. I would get very upset with myself when I went high after a meal. I would spend more time chasing the numbers I saw and getting mad at the past instead of actively correcting for future readings. There were a couple times I wanted to rip the thing out of my stomach and pretend the numbers weren't bad. I actually took a week off. When I resumed use, I forced myself to think ahead and treat the high without getting mad and checking every 5 minutes to see if it was down yet. I had to force myself to remember it takes up to two hours for my insulin to peak and that my blood glucose wouldn't change in 5 minutes. I would compare it with a finger stick reading to confirm measurements before meals and bed. I learned to utilize the trend graphs to identify foods, activities, and even emotions that affected my blood sugar. I wear the Dexcom G4 Platinum, which a 2014 study found to be the most accurate CGM among current options.<sup>11</sup> I definitely see my CGM as a valuable tool in managing my diabetes, but counseling and instructions for use are a must. Without instruction on how to use and interpret the data, it is far too easy to fall victim to chasing numbers. Having an insulin pump communicate with my

CGM allows me to better adjust my insulin needs, which leads to tighter control of my blood sugars.<sup>12</sup>

## DIABETES BURNOUT

Diabetes is a lifelong disease. It is a disease that requires care every day, every hour, and every minute. It doesn't take holidays or summer vacations, even when I do. Upon diagnosis, I found dealing with diabetes to be exciting. It was a new challenge to conquer, and I loved succeeding. Yes, I disliked the shots from day one, but the pharmacy student in me was intrigued. I was learning so much about this disease and I was determined to control it. For the first two years, I succeeded with relative ease. My initial carb ratio and insulin sensitivities were working beautifully. I had yet to see an A1C above 6.0%. But slowly, I started getting fed up with it. I found myself dreading the next finger stick. I was avoiding changing my pump site for as long as possible. I began to question why I was eating and started eating only foods with minimal carbs and high in protein. Researchers call this fatigue, but most diabetics I know call this burnout.<sup>13</sup> It is genuinely hard to describe the stress diabetes causes. It seems logical that knowing the complications of diabetes makes it easy to take an active role in controlling it, but it is far from that simple.

Physically, diabetes can make you incredibly tired one moment and sweating the next. Mentally, it is exhausting. It has ruined my workouts when I had to stop early to correct a low blood sugar level. It has left me with migraine-like headaches when I miscounted my carbs and ended up over 300 mg/dL. Missing part of a lecture to test and correct a low level means extra work that night to catch up on what I missed. Checking my blood sugar and seeing a poor number usually leaves me upset with myself, and there is nothing more annoying than trying to fall asleep and going low. Not only does this require getting up to correct it, but it also means waiting 15 minutes to check your blood sugar to make sure it is rising then brushing your teeth again before going back to bed. Stressing out about blood sugars is a daily occurrence, with every meal another chance to mess up. Even when I'm doing something completely unrelated to school or diabetes, it is always in the back of my mind. There is never a moment where I am not thinking, "What if I go low?" or "Am I shaking from being cold or from going low?" Dating is a whole new game when you have to explain that you're not texting but injecting yourself. Intimacy issues arise when you're afraid to take your shirt off because you don't want to explain your pump for the umpteenth time. All of this adds up over time to where dealing with it is no longer fun. I no longer want to think about this every second of every day. I want to think about going out with friends, eating what I want without doing math, and lifting weights without a juice box in my pocket.

However, I feel lucky to be a pharmacy student with diabetes. To this day, I still find lectures about diabetes complications incredibly motivating and I utilize it as my way of overcoming this fatigue. Nothing motivates me more than knowing I could easily lose my feet, eyes, and kidneys. Not everyone is in pharmacy school, and for those people, I

encourage them to get involved in the some of the many organizations designed to bring diabetics together. Whether it's in person or online, talking about your experiences with others who understand exactly what you're going through is incredibly beneficial. I developed lasting friendships with other diabetics and learned countless tips from other diabetic college students. Having someone to show me the ropes through personal experience was far more beneficial than handouts and books on diabetes treatment.

## SO DOES IT ALL WORK AS ADVERTISED?

Diabetes is a complicated disease with a myriad of treatment options. I have experienced many, both medicinal and social. I have tried insulin shots, pumps, and combined pump/CGM systems. I have spoken with fellow diabetics and attended lectures from leading researchers. For me, the insulin pump is the winner. Despite its drawbacks, it's far more flexible than insulin pens. When used in tandem with a CGM, it's the closest thing to a "real" pancreas aside from clinical trials.<sup>14</sup> I think pens are a great starting choice, but overall it was not the best suited for my needs. But just how diabetes has no one correct answer, my review doesn't either. Insulin therapy alone is not effective treatment for diabetes. Therapeutically, it's the gold standard, but overall it is a small piece in a very big puzzle. Nutrition, exercise, and stress management have all played a vital role in helping me achieve control. Talking with other diabetics, in person and virtually, has reminded me I'm not alone. I have been provided with a vast array of viewpoints and tips. Using my own experience, I can safely say yes, it all works as advertised. It does not, however, all work for me. Each type 1 diabetic has the same disease, yet each one of us faces unique challenges on the road towards better control, and, ultimately, wellness.

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