

University of South Florida

Inclusivity by Design

A Diabetes Simulator

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Abstract

The purpose of this research is to serve as a basis for the algorithms I will create for a diabetes simulator. The research focuses on the intersecting identities of class, race, sex, and age and how they affect diabetes management. The algorithms created will then be used to determine the outcomes of a user's simulated blood glucose levels and simulated overall health based on the choices they make in the demographic form and throughout the simulator. The outcome is to help users understand the difficulties in managing diabetes while providing solutions in navigating around a healthcare system that exploits those with chronic conditions.

Defining Insulin

Insulin is a hormone that allows glucose to move from the bloodstream into the cells. This is critical because this is how we get the energy we need from food.

Defining Type 1 and Type 2 Diabetes

With type 1 diabetes, the pancreas does not produce insulin. It is unrelated to someone's weight and diet and there is no way to predict someone's chances of getting it. Anyone can get type 1 diabetes at any age. However, there are certain risk factors that can be passed down from parents that make some more likely to get type 1 diabetes. Moreover, there is nothing you can do to prevent it. Mainly because there is insufficient evidence to pinpoint exactly what causes it. Unlike type 1, with type 2 diabetes the body is still creating insulin but it is not using it effectively which causes your blood glucose levels to rise to an unhealthy level. To compensate, the pancreas creates extra insulin but over time it won't be able to create enough insulin to keep blood glucose levels healthy. For some, type 2 diabetes can be reversed while type 1 cannot.

Introduction

In 1923, Fredrick Banting discovered insulin that humans could use. He refused to put his name on the patent because he felt it was immoral for a doctor to profit over medicine that would save thousands of lives. The patent for insulin was sold to the University of Toronto for one dollar, with the intention that everyone who needed the medicine could afford it. Clearly, medical professionals do not share the same morals that Dr. Banting had when he discovered insulin. Today the average cost for one vial of insulin is around 300 dollars. Most patients need 2-3 vials per month. This cost per month does not include other medical supplies that are necessary for managing diabetes. For example, if a patient wants to improve diabetes

management, and therefore their lives, for daily comfort and easier management of diabetes the prices are even higher. Individuals with diabetes, specifically those with type 1 diabetes, need insulin to survive. No one should have to worry if they'll make enough money to buy the medicine that keeps them alive. This is exactly the injustice I wish to bring to light.

I am researching the effects of one's identity on those with diabetes. The identities I will focus on are class, race, sex, and age. Most of my research revolves around type 1 diabetes, but I will include a few studies that involve both type 1 and type 2. This is because most of the literature focuses on both. I will then use this research in the simulator I am programming in Visual Studios. The simulator will consist of two forms, the first being a demographic questioner and the second will generate random scenarios depending on how the questions are answered in form one. Each response will affect the user's simulated health on screen and will allow them to try and properly manage their simulated blood glucose levels. The research will serve as a basis for the algorithms I will use to model glucose levels and overall health within the simulator.

I am creating this simulator because I want people to understand how medical exploitation can harm those with chronic conditions that require medicine/medical supplies to survive. More often than not, we ignore problems that do not involve us. People are suffering and we need to change that. My hope is that this opens people's eyes to the injustices that are happening within the medical community.

Review of the Literature

Socioeconomic Status

Access to affordable health care is something that many Americans do not have. Most people do not rely on life-sustaining medical supplies or medicine. For those who do, affordable medical insurance is their best option for survival and high quality of living. According to the

American Diabetes Association, the cost of health care for those with diabetes is 2.3 times higher than those who do not. In that same study, they found that on average those with diabetes “spend an average of \$16,752 per year on medical costs.” The price of insulin per month can be as much as the price of rent. People living in poverty already struggle to pay rent or do not have anywhere to live because they could not afford it. How can we expect them to be able to take care of their heart if it is so expensive? It is impossible for someone living near poverty to afford necessary medical supplies unless they have affordable medical insurance that can cover most of this cost.

Many individuals who live near or below the poverty line experience long-term food insecurities. For an individual with diabetes experiencing food, insecurities is a monumental challenge, especially when trying to manage their diabetes. There is an assumption that healthier eating is harder because it is more expensive. This assumption is strengthened because of how cheap and quick it is to buy fast food. The cost of a burger from a fast food chain can be as low as one dollar. Living a fast-paced lifestyle often with jobs that take up most of the day, cheap and quick food is usually the preferred meal type. A study in *Journal of the Academy of Nutrition and Dietetics* concluded that “improved diet quality was not accompanied by greater cost for youth with type 1 diabetes and their parents participating in a randomized clinical trial.” (Nansel 1757). These findings clearly contradict the idea that healthy food is more expensive. However, it does not discuss how much time an individual uses to invest to cook a healthy meal or how much they need to spend on one trip. For those living paycheck to paycheck and working long hours, grocery shopping for healthy foods and cooking a healthy meal may not be the best use of their time.

If an individual with diabetes cannot afford or does not have medical insurance to properly care for their condition it can “lead to neuropathy, kidney failure, retinal damage, and

cardiovascular disease” (Whittle 182). It can even lead to amputations. The medical companies that drive the prices of insulin and other medical supplies necessary to monitor and manage diabetes are exploiting individuals who need their products to survive. Again, for those who cannot afford to manage their diabetes efficiently, their health continues to suffer; leading to poor quality of life and sometimes death.

Race

Studies have shown disparities on diabetes management among varying races. One study shows deterioration in hemoglobin A1c differed by race. Hemoglobin A1c (HbA1c) is a type of hemoglobin that shows the average level of blood glucose from about three months. It can only show the average for the previous two to three months because the lifespan of red blood cell is about 4 months. The study showed that “Black youth appear to experience disproportionate risks compared with White and Hispanic youth when income is statistically controlled. Neither Black nor Hispanic youth appears to benefit from living in higher-income neighborhoods” (Wang 574). Even though White youth benefited from living in higher income neighborhoods, the condition of HbA1c Black and Brown youth experienced rapid deterioration. In another study, it was found that “poor glycemic control was evident one year after diagnosis in some minority youth with T1D or T2D in an integrated managed healthcare setting” (Jacobsen 283). This may be from negative social factors that affect mental health which in turn affects the overall management of diabetes. Some negative social factors include racial tensions, discrimination, and prejudice. However, a defining factor big one is the amount of support they receive from their community; social isolation can deteriorate one’s overall health even more. The study found that individuals in low-income Hispanic communities were healthier than hypothesized despite their lack of resources. This may be due to the way these communities see each other as family

and put the well-being of the community over the well-being of an individual. Furthermore, “managing diabetes-related stress during adolescence involves dyadic as well as individual stress and coping processes and extends this work to the Latino context where family involvement is a central cultural value” (Mello 655). Family and community involvement increases the standard of living and decreases the obstacles involved in managing diabetes.

In a study that focused on cause of death of African American and white Americans diagnosed with diabetes, it was found that “renal failure and heart failure mortality were common, with rates of mortality from renal failure up to 15 and 50 times higher, respectively, among African Americans with young-adult onset and white Americans with childhood-onset type 1 diabetes than their non-diabetic counterparts” (Conway 734). This can be related back to the previous study that showed that the deterioration in hemoglobin happens faster in those who are Black and Latino. If White Americans who have diabetes longer than African Americans do and have the same rate of mortality for renal failure and heart failure at the same ages, maybe it’s connected to how rapidly black and brown individuals’ health can deteriorate.

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