Telling the Story:

Diabetes Prevention and Management

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Spring 2022

Telling the Story:

Diabetes Prevention and Managment:

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Submitted in Partial Fulfillment of the Requirements for the Degree of
Master of Fine Arts in Studio and Digital Arts at Liberty University

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Acknowledgements

This book is dedicated to all those whose lives have forever been changed by diabetes.

To my family - Thank you for your amazing support.

In memory of my father - You have made a tremendous impact on my life and I will forever be grateful. You taught me to be fearless, to do what is right, try my best, and to never give up.

In memory of my Nanny - You always believed in me and encouraged me to embrace my creativity.

To my husband - Thank you for supporting me in pursuing my dreams and encouraging me every step of the way.

To my thesis committee - Thank you for all of your advice and encouragement to succeed in this project.

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Abstract

Diabetes has been studied for thousands of years, however the root cause of this disease is still unknown. Although there are have been many disoveries for treatment options for this disease, there has yet to be a discovery of a cure. Diabetes is a worldwide epidemic that currently affects millions of people and is expected to affect millions more in the future. This disease often results in fatal health complications which contribute to years of life lost and mortality rates. The project proposes a solution for individuals affected by diabetes and those that are currently undiagnosed. The expected outcome of this project is that individuals will be able to recognize underlying symptoms associated with diabetes and understand their risks for developing this disease. An additional anticipated outcome is the increase in self-management techniques which may help prevent or delay this disease from occurring or progressing. Furthermore, an anticipated outcome is the reduction in the amount of individuals that are affected by diabetes and a reduction in diabetes mortality rates.

Chapter 1: Introduction

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Many diagnosed and undiagnosed diabetic individuals fail to manage their diabetes which may lead them to developing severe or fatal health conditions. Many individuals are unaware of the underlying symptoms associated with diabetes. There is a critical need to raise awareness in these individuals because many are unaware that they currently have this disease or understand the risks this disease poses to their heath. Currently, 451 million people worldwide have this disease. The International Diabetes Foundation (IDF) believes there will be 693 million people affected by diabetes in 2045. Diabetes is a chronic condition that is caused by the pancreas not creating enough insulin or not using insulin effectively to regulate blood sugar levels. It has a direct impact on an individual's health. There are several types of diabetes including type 1, type 2, prediabetes, pregestational diabetes, and gestational diabetes. There are many other factors that contribute to the risk of diabetes such as genetics, hormonal disorders, and gestational diabetes during pregnancy. By raising awareness of this disease, major lifestyle choices can be made that could benefit and prolong lives.

Not only is there a critical need to raise awareness of this topic in individuals because many are unaware, but also because of the substantial number of lives lost to this disease. Currently, diabetes is the seventh most leading cause of death in the United States. The purpose of this research topic is to educate individuals so that they may understand underlying symptoms, risk factors, and treatment options associated with diabetes. Raising awareness can result in early diagnosis and treatment which will prevent or delay many serious health complications. This could result in fewer people being affected by this disease and reduce the amount of people lost to diabetes.

In order to better understand this topic and create the deliverables a few questions need to be answered such as: What are the types and definitions of diabetes? What are the common health risks associated with diabetes? How can this disease be prevented or delayed? How can storytelling or sharing one's experiences with diabetes impact individuals who are at risk for this disease? What does the future look like for those with diabetes? The thesis would benefit from quantitative research, in order to understand the devastating effect diabetes has on individuals and the world. The purpose of this research is to gather information and statistics on diabetes which will inform the deliverables created. This thesis strives to raise awareness of this disease and the life-threatening risks it poses to the health of individuals. The thesis would also benefit from user testing of the deliverables with those individuals affected by diabetes. Furthermore, the thesis requires case studies which demonstrate art as a prevention method.

The main inspiration for this project comes from my own personal experience with diabetes and the overall impact it has made in my life. Although I have not been diagnosed with this disease, myself, I grew up surrounded by several members in my immediate family who have been diagnosed with diabetes, specifically type 2 diabetes. I have spent much time watching my family members battle this disease and seen how it has impacted their daily life, including how it affects what they eat and how they sleep.

Although many members in my family have struggled with diabetes, my main experience comes from my father and his battle with this disease. During my childhood I watched as he measured his blood glucose levels, took his insulin injections, and attended doctor's appointments in order to manage his diabetes. In 2014, my life was forever changed when my loving father passed away unexpectedly at 41 years old as a result of devastating diabetes complications. Like many individuals with this disease, he suffered from many of the fatal health conditions that arise from diabetes. During his battle, he bravely faced double leg amputations, multiple heart issues, and severe kidney problems.

My hope with this project is to raise awareness on of the dangers of this disease in order to inspire life style changes that can ultimately save a life. This will greatly impact individuals who are currently unaware they have this disease to understand their risks while also assisting diagnosed individuals in managing their diabetes. The hope with this project is to prevent others from going through the heart-wrenching loss of a loved one and to help spark more research into the cause of this disease and the progression toward a cure.

Chapter 2: Research

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The following initial research defines the various types of diabetes, their associated complications, and what the future may hold for this disease. This gives insight into how raising awareness of this disease may prevent or delay the progression of diabetes and its related complications from developing in those at risk for this disease.

Diagnosed and undiagnosed individuals fail to manage their diabetes which may lead them to developing fatal health conditions. Through this initial research, it will be better understood what diabetes is and how to distinguish the different types. In addition, how diabetes impacts the health of individuals. Furthermore, how factors such as genetics relate to this issue. By understanding how this disease impacts individuals and the world, it will help inform individuals that are at risk for this disease in understanding underlying symptoms and management techniques they can incorporate into their daily lives in order to prevent or delay this disease from occurring.

Many people fail to realize they may be prediabetic or diabetic because they are unaware of the underlying symptoms associated with diabetes. There is a critical need to raise awareness in these individuals because many are unaware that they currently have this disease or understand the risks this disease poses to their heath. Diabetes is a chronic condition that affects millions of people worldwide. It is caused by the pancreas not creating enough insulin or not using insulin effectively to regulate blood sugar levels which has a direct impact on an individual's health. There are several types of diabetes including type 1, type 2, prediabetes, pregestational, and gestational diabetes. There are many other factors that contribute to the risk of diabetes such as genetics, hormonal disorders, and gestational diabetes during pregnancy. Not only is there a critical need to raise awareness of this topic in individuals because many are unaware, but also because of the substantial number of lives lost to this disease. Raising awareness can result in early diagnosis and treatment which will prevent or delay many life-threatening health complications and prolong an individual's life. In the future, a decrease could be seen in diabetes mortality rates and years of life lost.

Definition of Diabetes

Diabetes is caused by a complex group of disorders or conditions that have a variety of causes. For many people with diabetes, their blood shows high levels of glucose or sugar. This is also known as high blood glucose or hyperglycemia. For various reasons, their body's cells are unable to correctly absorb excess glucose from their blood. The result of this is an overabundance of glucose in their body. Another cause of diabetes is that a diabetic's pancreas is unable to naturally produce or use insulin sufficiently. It produces little to no insulin, or the cells do not correctly respond to insulin that is produced. These conditions cause a buildup of glucose in the bloodstream which overflows into the urine. People with diabetes are also affected by hypoglycemia or low blood glucose levels. In the United States, this disease affects 1 in 11 people, and it is believed most people will have some connection to this disease. For those individuals born in the year 2000 in the United States, they have a 1 in 3 chance of developing diabetes (Reusch).

There are several types of diabetes including type 1 diabetes, prediabetes, type 2 diabetes, pregestational diabetes, and gestational diabetes. However, the two primary forms are type 1 and type 2 which originate from autoimmune destruction of pancreatic beta cells (Barnes-Svarney). Type 1 is considered an autoimmune disease and occurs when the pancreas does not secrete insulin. This type has also been referred to as insulin-dependent or juvenile-onset diabetes mellitus because it is common in children and adolescents. It is a chronic disease in which the pancreas does not produce sufficient insulin. It causes high levels of glucose in the bloodstream which is life-threatening. "Type 1 diabetes has risen dramatically in the last 50 years. In the United States, the risk of childhood diabetes is one per every 300 children" (Moini).

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> Mioni

Prediabetes is a national and worldwide health problem. It is estimated that 86 million adults at least 20 years of age or older have prediabetes according to the Center for Disease Control and Prevention. Prediabetes is defined as having high blood glucose levels above normal levels, but not high enough to be defined as diabetes. Those with prediabetes have a 4 to 9 percent risk of progress to type 2 diabetes. However, progression to type 2 can be prevented or delayed through early identification and managing weight loss, physical activity, and diet which play an important part in reducing an individual's risk. "Prediabetes is a modifiable and largely preventable precursor to T2DM. Prediabetes and T2DM are global health concerns, affecting children, adolescents, and adults. Preventing prediabetes requires a comprehensive life course approach that includes healthy eating, physical activity, and policy approaches that support active living in safe environments and access to affordable healthy foods" (Rariden).

Type 2 diabetes is also known as noninsulin-dependent or adult-onset diabetes. It makes up between 90 to 95 percent of diabetic cases. It occurs as a result of relative insulin deficiency unlike type 1. It has also been linked to weight gain or obesity. When a person's body mass index (BMI) increases, their risk of developing type 2 diabetes also increases. However, there are genetic factors and other conditions which may lead an individual to developing type 2 diabetes. The prevalence of type 2 diabetes has doubled within the last 20 years and is becoming more common in

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>
> Christina Rariden"

Diabetes in younger people is one of the greatest concerns for health professionals. "Owing to the early age of onset and longer duration of diabetes, children and adolescents are at risk of developing diabetes-related complications at early ages" (Mioni). Many of these major complications are the risk of heart attack, stroke, blindness, kidney failure, and amputations. The risk of developing type 2 diabetes is continuing to increase and with this increase, the development of diabetes-related compactions also increases. The longer an individual has diabetes the greater the risk is of developing these complications.

There are two types of diabetes that are linked to pregnancy. One type is pregestational diabetes. This form describes women who already have insulin-dependent diabetes and become pregnant. This type of diabetes may have consequences for the child, especially if the mother's blood glucose levels are not controlled. As a result of uncontrolled blood glucose levels, excess glucose may transfer to the child which in turn makes the child's system secrete increased amounts of insulin. This may cause increased tissue and fat deposits in the child. "According to Stanford Children's Health, these deposits can increase the risk of birth defects, especially during the development of the fetus's heart, brain, spinal cord, and gastrointestinal system. In many cases, too, the infant of a mother with pregestational diabetes is often larger than expected for the gestational age" (Barnes-Svarney). Because of pregestational diabetes, the child is at high risk of developing birth defects.

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>
> M. Joubert

> Gestatational Diabetes occurs in 4 to 9 percent of pregnant women
>
> Barnes-Svarney

Another form of diabetes is gestational diabetes which develops during pregnancy. It is believed to occur because of the hormones in the fetus's placenta which delivers nutrients to the fetus. However, it may block the mother's insulin throughout the body. It occurs as a result of excessive hormones that oppose insulin. During pregnancy, insulin resistance occurs which results in the mother obtaining high blood sugar which may be caused by defects in the insulin receptors. By using the O'Sullivan test, a glucose-tolerance test, which is usually performed between the 24th and 28th week of pregnancy, a pregnant woman can be screened for gestational diabetes. Although it is one of the less common forms of diabetes, it occurs in 4 to 9 percent of pregnant women and may develop in women who have not had diabetes before. Generally, it develops during the second or their trimester. After the child is born, this type of diabetes usually disappears. However, the American Diabetes Association believes this form of diabetes may raise the risk for type 2 diabetes to develop later in life for the mother and for the child (Barnes-Svarney).

Although pregestational diabetes has been associated with causing birth defects in the child, it is uncommon with gestational diabetes. This may be due to gestational diabetes developing later in the mother's pregnancy which means their blood glucose levels are normal during their first trimester while the fetus's organs are forming. It is believed that teenage pregnant women are at lower risk of developing gestational diabetes compared to pregnant women who are 35 years old or older. Some women have higher risks than others of developing gestational diabetes. For example, obese women, older women, women with a family history of diabetes, women who have large babies for their gestational age, and women who have had gestational diabetes during other pregnancies. Gestational diabetes, if left untreated, may cause very large babies and may require the baby to be delivered by caesarean (Barnes-Svarney).

There are common signs and symptoms of diabetes which relate to glycosuria and hyperglycemia. Three of them are polydipsia, polyphagia, and polyuria.

Jahangir Mioni

Diabetes mellitus can quickly develop because of symptoms that are vague and may not point to a certain disease or condition. Because of this, it is termed as having insidious onset because the symptoms do not immediately point to diabetes. Type 2 diabetes symptoms are considered to be more insidious. Diabetes is usually discovered during a patient's routine medical checkup or when the patient needs medical treatment for other conditions. There are common signs and symptoms of diabetes which relate to glycosuria and hyperglycemia. Three of them are polydipsia, polyphagia, and polyuria. Polydipsia is described as excessive thirst. It is caused by dehydration, which causes increased blood glucose levels and water to be removed from the body's cells. This symptom is an early indicator of type 2 diabetes. However, it often goes unnoticed and is most common in patients with blood glucose levels that are increasing gradually. Another common symptom for diabetes is polyphagia. This symptom is described as excessive hunger. It is usually associated with type 1 diabetes, and not type 2 diabetes. Because cells are depleted of their cellular proteins, fats, and carbohydrates, which causes starvation of the cells. Furthermore, polyuria is another symptom of diabetes. It is described as causing excessive urination. Elevated glucose levels exceed the amount able to be reabsorbed through the kidneys. Because of this, there is a significant loss of water through the urine. Other symptoms that occur from diabetes include red, swollen, and/or tender gums, high blood pressure, and gastrointestinal problems (Mioni).

Understanding the classification between the different types of diabetes is beneficial in determining the best therapeutic approach. However, the type of diabetes the patient has is not always evident during the time of diagnosis. The classic symptoms associated with type 1 diabetes may not be the same for adults as they are for children. Because of this, many adults may be misdiagnosed with type 2 diabetes. As a result, there may be more adult-onset type 1 diabetes cases that are unknown. The Centers for Disease Control and Prevention (CDC) funded the diabetes in young adults study, or the DiYA study, which strived to determine the incidence of type 1 diabetes and create a predictive model for young adults between 20 to 45. The study reviewed more than 2 million individuals that are at risk of developing diabetes. The individuals were identified through the Kaiser Permanente's healthcare system in California. These individuals were invited to participate in the study and were asked to complete a survey and have their blood drawn for diabetes autoantibody testing (DAA) which was completed at the National Institute of Diabetes and Digestive and Kidney Diseases North America Core Laboratory. The blood was used to determine if the participants were positive in four DAAs. The conclusions of the data showed that participants who tested positive for at least one DAA had either type 1, type 2 or another form of diabetes. The data also showed that type 1 diabetes "may account for up to 8 percent of incident diabetes cases among young adults" (Lawrence). This predictive model can be used in clinical settings to help determine individuals who might benefit from DAA testing and help identify type 1 diabetes in individuals that have been recently diagnosed with diabetes but have not been classified with a certain type.

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>
> M. Joubert

There are many complications that arise for individuals with diabetes that greatly impact their health and well-being. These complications include stroke, heart attack, amputation, heart failure, blindness, or kidney failure. One of the most worrying diabetes complications is heart failure, because it has been shown that it is continuing to increase especially in individuals with type 2 diabetes. Hyperglycemia has been shown to correlate with cardiovascular dysfunction and contribute to mortality rates in patients with type 2 diabetes. "In patients with T2D, two-thirds of deaths are related to CV disease that is partly driven by coronary artery disease (CAD) and hypertensive cardiomyopathy, given that hypertension is frequently associated to T2D. Heart failure (HF) is also particularly frequent in patients with T2D, with a 2.5-fold higher incidence than in patients without diabetes" (Joubert). Because of this, there is an increased need for interventions that prevent cardiovascular complications in patients with diabetes.

Depression and anxiety have been linked to poorer self-care among young adults with diabetes, especially for young adults in their 20s and 30s with type 2 diabetes. For example, young adults with diabetes are less likely to take insulin injections or medications as recommended. A study done on the effects of depression and anxiety on self-care in young adults with diabetes found that "Only 63 percent of young adults with Type 2 diabetes reported that they (almost) always took insulin as recommended, compared to 85 percent of Type 1 diabetes" (Browne). Not only are young adults with diabetes less likely to take insulin injections as recommended, but they are also less likely to eat a healthy diet and engage in physical activity. Young adults with diabetes "have more symptoms of depression than their older counterparts, are more likely to deviate from their recommended insulin therapy regimen than other groups, and are less likely to eat a healthy diet and engage in physical activity than older adults" (Browne). In order to reduce the effects of depression and anxiety on self-care among young adults with diabetes, healthcare providers need to understand how these conditions affect these individuals so they can determine how they can best support individuals with diabetes.

One way that individuals can test their risk for developing diabetes is through the Diabetes Risk Calculator, a simple tool which was developed for the population of the United States to determine the probability an individual may have for undiagnosed diabetes or prediabetes. It was created by the American Diabetes Association and is currently the only noninvasive screening tool that has been designed and validated.

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>
> J. L. Browne

It is a self-administered and paper-based test which may help individuals determine if they should see a physician for further evaluation. Although there are many people with diabetes, 30 percent of the population is undiagnosed because of the cost and inconvenience of testing. "One way to address this problem is to develop a simple, inexpensive tool that can identify people who are at high risk of having prediabetes or undiagnosed diabetes and motivate them to be screened" (Heikes). The tool that was developed asks the individual a variety of questions without requiring them to do any calculations. Physicians can also use this screening tool to assess the risks their patients might have for undiagnosed or prediabetes and whether their patients would benefit from further confirmatory tests and treatments which may prevent or delay the onset of type 2 diabetes and its associated complications (Heikes).

Medical Advances and Current Treatments

Diabetes has been studied for over 3,500 years in many different parts of the world, including India, Egypt, China, and various others. One of the first records of diabetes is from India in the 5th century. Symptoms of the disease included emaciation, excessive urination with a sweet odor, and thirst. Some of the earliest treatments for diabetes were quite dangerous. They included bleeding the patient, fasting (often to near starvation), eating excessive amounts of sugar, certain meats and fats of animals, and herbs that were believed to cleanse the body of diabetes. Demetrius of Apameia during the 1st or 2nd century named diabetes using the Greek language which means "to siphon" or "to empty". It has also been known as diabainein, in Greek, dia meaning "to pass through" and bainein meaning "to go". This refers to the excessive urination that is associated with diabetes (Barnes-Svarney).

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>
> Patricia Barnes-Svarney"

In approximately 81-138 AD, Aretaeus of Cappadocia gave the first clinical description of diabetes in his book, Therapeutics of Chronic Diseases. Aretaeus and Galen of Pergamum believed diabetes to be a rare form of kidney disease because they believed the kidneys were the source of urine. One of the first ways to test for diabetes was by tasting a patient's urine for sweetness. Around 630 AD, Theodore Protospatharios considered that diabetes could be diagnosed by examining heated urine.

Paracelsus, a Swiss physician, observed an unknown, white-colored substance which was left after urine evaporated. He believed the sweet taste in urine was caused by salt deposits in the kidneys. Because of this, the patients showed symptoms of polydipsia and polyuria. The medical term diabetes mellitus or "honey diabetes" was termed around the year 1670 by Thomas Willis, an English physician. Willis also describes the differences between diabetes mellitus and diabetes insipidus in his book, Pharmaceutice Rationalis. In 1775, Robert Wyatt and Mathew Dobson, English physician and experimental physiologist, was the first to prove that sugar was the substance of sweetness in the patient's urine. He also discovered traces of sugar in their blood. He mentions this in his work, Experiments and Observations on the Urine in Diabetics (Barnes-Svarney).

During the 19th and 20th centuries, tests were developed for elevated sugar in the urine (glycosuria) and elevated sugar in the blood (hyperglycemia). Apollinaire Bouchardat, a diabetologist, during the 1800s found that food rationing influenced glucosuria. He treated his patients with low carbohydrate diets and fasting and found that exercise and weight reduction helped improve metabolism. He also believed in educating his patients about self-management in order to prevent diabetes (Moini). From 1895, Edward Albert Sharpey-Schafer, an English physiologist, believed that glucose came from the pancreas and developed as islets of Langerhans.

In 1910, he was the scientist that linked the pancreas to blood sugar levels. He believed the pancreas secreted a substance which he referred to as "insuline" now called insulin and believed it to be an enzyme that the body uses to metabolize glucose. He believed diabetes was linked to a lack or insufficiency of insulin. In 1919, Frederick Allen developed a therapy of strict dieting, or what could be considered a starvation treatment, which successfully managed diabetes. An American physician and pathologist Eugene Lindsay Opie connected the islets of Langerhans, which were found by Edward Albert Sharpey-Schafer, and their relationship to diabetes. He discovered degenerative changes in the tissues that make up the pancreas caused diabetes after examining postmortem diabetic patients (Barnes-Svarney).

The significant discovery of insulin occured in Canada in 1921, by Canadian physician Frederick Grant Banting, Canadian medical scientist Charles Best, Canadian biochemist James Collip, and Scottish biochemist John James Rickard Macleod. They experimented on dogs and eventually used cattle pancreas to create their insulin and proved that the pancreas secretes a substance that controls the metabolism of a person's blood sugar. They developed an extract from cattle pancreases. A 14-year-old boy named Leonard Thompson, who suffered from type 1 diabetes, was the first person to receive their cattle-extracted insulin in January of 1921. Their insulin was a success and because of this they won the Nobel Prize in Physiology or Medicine. Macleod, Banting, Best, and Collip, realized they could not commercially produce their insulin in large quantities, so they collaborated with Eli Lilly, the company responsible for producing the first commercial insulin. The company tested the drug over 100,000 times. By using cattle and porcine pancreas glands, 180,000 units of insulin were produced by the company in April of 1923. Their discovery allowed type 1 diabetes to be survivable and enabled them to save many lives (Barnes-Svarney).

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Patricia Barnes-Svarney

In 1926, the first crystallized insulin was created by an American biochemist named, John Jacob Abel. He was also the first to invent a primitive artificial kidney. In the 1930s, Elliot Joslin, a physician that specialized in diabetes, was credited with associating diabetes with hypertension, and arterial disease. He also discovered the link between obesity and diabetes. He founded the Joslin Institute which specializes in researching diabetes. In 1936, type 1 diabetes and type 2 diabetes were differentiated by Sir Harold Percival Himsworth. He is believed to be the first person to describe diabetes as a syndrome, which he discusses in his Lancet paper, "The syndrome of diabetes mellitus and its causes" in 1949.

The American Diabetes Association (ADA) was founded in 1940. It addresses the increase in rates and related complications due to diabetes. Their mission is to prevent and cure diabetes and improve the lives of those affected by diabetes. The first "Clinitest" also known as "stick" or "strip" tests were developed in 1941. They were based on copper sulfate reduction.

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Following these tests were "Clinistix" tests, which were based on enzymatic reaction of glucose oxidase. Tests have been further developed to measure blood glucose levels. One in five type 1 diabetics died within 20 years of their diagnosis during the 1950s. In 1979, an oral glucose tolerance test (OGTT) was produced. The patient swallows 75 grams of glucose and their blood glucose levels are measured after two hours. This test helped establish the criteria for diabetes diagnosis (Barnes-Svarney).

Insulin was the first protein to chemically synthesized in a laboratory, in 1963. Insulin became the first human protein manufactured with biotechnology in 1978. E. Coli bacteria was used by American geneticist Arthur Riggs and Japanese molecular biologist and chemist Keiichi Itakura to create the insulin with recombinant DNA technology which inserts human genetic instructions into the bacterium to produce a drug. The City of Hope National Medical Center and Genetech, a biotechnology company, worked together to synthesize the first human insulin and mass produce it. Synthesized human insulin is more stable than the animal insulins used in the past. The first synthesized human insulin, called Humulin, was manufactured by recombinant DNA. In 1982, it was approved by the Food and Drug Administration (FDA). However, it was not marketed and was not widely available until 1983. It acted similarly to human insulin that is naturally produced by the pancreas. It was considered a rapid-acting insulin that takes a short amount of time to activate in the bloodstream. (Barnes-Svarney).

Humalog, like Humulin, was also produced using recombinant DNA technology. It is a modified human insulin, which was approved by the FDA in 1996. It was designed to be a rapid-acting insulin which quickly lowers blood glucose levels. Insulin was thought to be a cure for many years and the research into diabetes seemed to almost be forgotten about (Barnes-Svarney). Dr. Paolo Di Bartolo and Dr. Robert H. Eckel are diabetologists who have lived with type 1 diabetes for over 50 years. In their journal article, Living with Insulin: The story of insulin from people with diabetes, they describe how the discovery of insulin has impacted people's lives. They state, "The history of insulin is rightly considered one of the most beautiful stories in medicine which goes even further than the extraordinary result of tens of millions of lives saved" (Di Bartolo). They believe it is one of the major achievements in medical science which has led to new and successful treatment opportunities for those that suffer from diabetes and because of it, many lives have been saved.

They also believe that research into insulin in the past 50 years has greatly impacted the therapies that are available to treat diabetes today. In the beginning of the new millennium, incredible developments in research and innovative technologies have greatly impacted patients with diabetes. For example, the invention of the pen injector for insulin, systems for glucose monitoring, and insulin pumps. One of the greatest impacts on insulin administration was the production of the first pen injector for insulin. It was created in 1985 by Novo Nordisk. This injector allowed patients to not have to carry a syringe or a bottle of insulin with them wherever they went. It also did not have to be refrigerated. Another great impact was the development of continuous glucose monitoring systems which showcased the fluctuations in blood glucose levels in relationship to food intake and exercise. "Our treatment options and quality of life today, after 50 years of living with insulin, seem downright incredible" (Di Bartolo). The research and development of technologies for diabetes has greatly impacted the treatment options available. As a result, the lives of many people with diabetes have been changed.

> "The history of insulin is rightly considered one of the most beautiful stories in medicine which goes even further than the extraordinary result of tens of millions of lives saved"
>
> Paolo Di Bartolo

Currently, there are no pharmacologic agents approved by the FDA for prediabetes management, however, there have been results seen in antihyperglycemic medications such as Metformin. Pharmacotherapy can play an integral part in prediabetes management. One study showed that patients using antihyperglycemic medications, such as metformin have seen positive results. "These medications are well tolerated, safe, and effective at reducing the risk of developing diabetes by up to 30 percent with a potential to reduce cardiovascular risk. Metformin use in prediabetes is backed by strong evidence, demonstrating cost savings over a 10-year span compared with placebo" (Rariden). Antihyperglycemic medications can help treat prediabetes and help prevent or delay the progression to type 2 diabetes.

"These medications are well tolerated, safe, and effective at reducing the risk of developing diabetes by up to 30 percent with a potential to reduce cardiovascular risk"

Christina Rariden

According to the American Diabetes Association, metformin should be used to treat individuals with prediabetes. Although metformin has shown results in preventing the onset of type 2 diabetes, Dr. Davidson believes it should not be used to prevent type 2 diabetes. Dr. Mayer Davidson uses direct information from the Diabetes Prevention Program to study how metformin can be used on the development of diabetes. He lists three general reasons as to why this treatment should not be used. "First, approximately two-thirds of people with prediabetes do not develop diabetes, even after many years. Second, approximately one-third of people with prediabetes return to normal glucose regulation. Third, people who meet the glycemic criteria for prediabetes are not at risk for the microvascular complications of diabetes and thus metformin treatment will not affect this important outcome" (Davidson). Although Dr. Davidson has discussed reasons patients should not use metformin to treat prediabetes, the American Diabetes Association states, "In conclusion, we believe that metformin should be used to treat prediabetes selectively. The efficacy, safety, and cost-effectiveness of metformin therapy were demonstrated among very high-risk individuals. Assurance of achieving the same beneficial effects is most secure when metformin therapy is prescribed to individuals who meet eligibility criteria for the DPP" (Herman). There are benefits of using antihyperglycemic medications, such as metformin, in preventing or delaying prediabetes and diabetes in select individuals.

Effects of Family History

Genetics play an important role in the development of diabetes. Patients with family members who have type 1 diabetes have an increased lifetime risk of developing this disease. "Type 1 diabetes mellitus appears to be a heterogeneous disease. Pathology of the pancreas causes various changes in autoantibodies that are related to genetics" (Moini). It is most likely to be transmitted from fathers to their offspring than from mothers to offspring. The risk of transmission from fathers is between six and eight percent compared to one and three percent from mothers. Genetics may increase the risk factor for developing type 1 diabetes. However, genetics may be more related to developing type 2 diabetes. Of the individuals with type 1 diabetes, 80 to 90 percent do not have a family history associated with the disease. However, with type 2 diabetes the majority of people do have a family history associated with the disease. Studies have shown that there are more than 40 genetic variants which can increase the risk of type 2 diabetes.

> "Family history is a major predictor of developing type 2 diabetes. Risks are doubled if a parent or sibling has diabetes and increased by four times if two or more first-degree relatives have diabetes"
>
> Jahangir Mioni

Because of the genetic predisposition of type 2 diabetes, it can lead to people of all body types to develop this disease. Major risk factors for this type include age, family history, ethnicity, obesity, and prediabetes. Other factors included in family history are environmental, cultural, and behavioral factors. "Family history is a major predictor of developing type 2 diabetes. Risks are doubled if a parent or sibling has diabetes, and increased by four times if two or more first-degree relatives have diabetes" (Moini). Because of family history many individuals have a higher risk of developing type 1 or type 2 diabetes. Understanding family history and how it affects the development of diabetes is crucial in determining preventative measures and treatment options that are available for this disease.

One study demonstrated how family history is a risk factor and the impact it has on diagnosed diabetes (DD), undiagnosed diabetes (UD) and prediabetes (PD) in the United States. The study utilized 8,796 non pregnant adults which consisted of 2,149 DD cases, 612 UD cases, and 2,719 PD cases. The study found that family history is associated with diabetes and has a major public health impact in the United States. Because of the numbers reported for family history and the numbers recorded for diabetes and prediabetes their findings suggested that millions of individuals in the United States who have diagnosed diabetes, undiagnoed diabetes, or prediabetes could be identified using family history from one of their first-degree relatives. "Among people 20 years and older in the United States, 9.3 percent had DD, almost half of whom have their diabetes attributable to family history. Around 3.4 percent of adults who were not diagnosed with diabetes had UD with more than 20 percent PAF for family history of diabetes (burden of more than 1.4 million people). Finally, 40 percent of the population without diabetes had PD with 5 percent attributable to family history (burden of nearly 3.9 million people)" (Moonesinghe). These results show how using family history in diabetes screening algorithms can be beneficial in identifying those individuals which may have diabetes attributable to family history. This may also help determine individuals who do have diabetes that were previously undiagnosed.

Not only does the genetic factor influence family history in relationship to diabetes, but behavioral family history also impacts those that develop diabetes. A second study which consisted of interviews found that behavioral family history does impact their experience with diabetes. Many individuals who have diabetes express inevitability about their diagnosis because people in their families also have or have had the disease. "Many participants reported a history of family members with diabetes. Those with a family history of diabetes often expressed a sense of inevitability about developing the condition. One particiant states, "It runs on my mother's side and my father's side, so I had no other choice but to catch it too" (Cunningham). Many participants felt it was related to genetics because of their grandparents, parents, aunts, uncles, and siblings that have all been diagnosed with diabetes. Other participants in the study believed it was a combination of genetics and behavior, which is impacted by their family's physical activity and eating habits.

Many of the individuals reported the consequences their family members experienced from developing diabetes. For example, leg amputations, heart and kidney issues, loss of sight, and death. Although many individuals have experienced hardship because of their family member's diagnosis, it has motivated them into creating self-care behaviors in their diet and physical activity. One of the participants stated, "It's real and diabetes runs in my family. And I have quite a few family members that have passed from diabetes and had amputations from diabetes. It skipped my mother, but it got me. And so I'm very familiar with what—the dangers of it and what it can do to you if it's not managed" (Cunningham). Diabetes is associated with genetic and behavioral components of family history.

Effects of Food Insecurity

Food insecurity has adverse outcomes on children and adults. It contributes to increased odds in developing prediabetes and diabetes. A study on food insecurity in adults between the ages of 20 and 39 in the United States found that food insecurity in linked to prediabetes and diabetes. Food-insecure adults were found to eat more carbohydrates and less protein than food-secure adults. "Food insecurity has been observed to have adverse health associations that vary across population subgroups. In children, food insecurity is related to obesity and poorer cognitive/ developmental outcomes. In adults, food insecurity has been related to outcomes such as type 2 diabetes mellitus (T2DM) and depression" (Lee).

The study assessed the food assistance program known as the Supplemental Nutrition Assistance Program (SNAP). It compared food-insecure adults who used SNAP to food-secure adults who did not use SNAP. The study found that food-insecure adults who used SNAP had higher odds of have a metabolic syndrome. Food insecurity and the use of food assistance programs are linked to the development of prediabetes and diabetes (Lee).

> "In children, food insecurity is related to obesity and poorer cognitive/ developmental outcomes. In adults, food insecurity has been related to outcomes such as type 2 diabetes mellitus (T2DM) and depression"
>
> Arthur Lee

Effects of Disordered Eating Behaviors

Disordered eating behaviors consist of restricting food intake, binge eating, using laxatives, or performing intense physical exercise in order to reduce body weight. These disordered eating behaviors influence glycemic control, insulin sensitivity, and psychosocial function in youth and young adults with type 1 and type 2 diabetes. According to the American Diabetes Association, there is a higher risk of clinical eating disorders and other disordered eating behaviors in adults with diabetes than those who do not have diabetes. A study on disordered eating behaviors on youth and young adults with type 1 and type 2 diabetes found that 21.2 percent of participants with type 1 diabetes had disordered eating behaviors. The study also found that 50.3 percent of participants with type 2 diabetes had disordered eating behaviors.

> "For both types of diabetes, individuals with DEB had a significantly higher BMI z score, lower insulin sensitvity, more depressive symptoms, and poorer quality of life than those without DEB. Diabetic ketacidosis episodes occured more freqquently in youth with type 1 diabetes"
>
> Angel Nip

The participants also faced difficulties managing their diabetes and maintaining a healthy weight. "For both types of diabetes, individuals with DEB had a significantly higher BMI z score, lower insulin sensitivity, more depressive symptoms, and poorer quality of life than those without DEB. Diabetic ketoacidosis episodes occurred more frequently in youth with type 1 diabetes with DEB compared to those without DEB" (Nip). Raising awareness and early interventions are needed to reduce disordered eating behaviors in individuals with diabetes.

Financial Aspects of Diabetes

Diabetes has a personal and global financial burden. In 2015, 12 percent of global health expenditures were spent on diabetes, according to the International Diabetes Federation. Because of the increase in people with diabetes it is estimated that these global health expenditures will be around 802 billion dollars per year by 2040 (Barnes-Svarney). Diabetes currently costs 327 billion dollars in the United States. Of the 327 billion dollars 237 billion is in health care costs while 90 billion is in loss of productivity. "Put another way, 1 in 4 health care dollars is related to diabetes. No other disease with statistics and costs like these would be ignored. Considering these facts, it is reasonable to question why diabetes is not at the center of our health care agenda" (Reusch).

There is a significant economic burden for patients, their families, health systems, and national economies. One study strives to showcase how the economic burden is affected by elevated blood glucose levels in diagnosed, undiagnosed, gestational and prediabetes. The study was conducted to estimate the economic burden at state-level for elevated blood glucose levels. "The economic burden associated with diagnosed diabetes (all ages), undiagnosed diabetes and prediabetes (adults), and GDM (mothers and newborns) reached nearly $404 billion in 2017, consisting of $327.2 billion for diagnosed diabetes, $31.7 billion for undiagnosed diabetes, $43.4 billion for prediabetes, and nearly $1.6 billion for GDM. Combined, this amounted to an economic burden of $1,240 for each American in 2017. Annual burden per case averaged $13,240 for diagnosed diabetes, $5,800 for GDM, $4,250 for undiagnosed diabetes, and $500 for prediabetes" (Dall). The estimates determined in the study showcase the importance of detection, prevention, and treatment in reducing the burden of prediabetes and diabetes in the United States.

> "Put another way, 1 in 4 health care dollars is related to diabetes. No other disease with statistics and costs like these should be ignored. Considering these facts, it is reasonable to question why diabetes is not at the center of our health care agenda"
>
> Jane Reusch

Mortality Rates and Years of Life Lost

Diabetes attributes to mortality rates and is one of the leading causes of death in the United States and has been for more than ten years. It is currently the seventh leading cause of death in the United States. However, the data calculated by the Center for Disease Control and Prevention may be misrepresented because many do not properly record diabetes as the underlying cause of death on the death certificates. Also, the data may not consider risk factors for diabetes such as cardiovascular disease (CVD).

Alva states, "diabetes may be underreported as a cause of death. Studies have found that only about 35 to 40 percent of people with diabetes who died had diabetes listed anywhere on the death certificate. Of those with diabetes mentioned in the death certificates, about 10 to 15 percent had it listed as the underlying cause of death. Most mortality statistics, including those published by the Centers for Disease Control and Prevention (CDC), are based solely on the underlying cause of death (UCD) as recorded on death certificates" (Alva). This suggests there may be a significantly higher number of individuals who pass on as a direct result of diabetes. The mortality rates related to diabetes and the health factors associated with diabetes may be misrepresented and underestimated.

"Diabetes may be underreported as a cause of death. Studies have found that only about 35 to 40 percent of people with diabetes who died had diabetes listed anywhere on the death certificate"

Maria Alva

In continuation, the mortality rates are also underestimated because they do not consider other health factors that are associated with diabetes. For example, diabetes is a serious chronic condition for which a contributing risk factor is cardiovascular disease. Cardiovascular disease is ranked as the third leading cause of death in the United States. "The numbers—seventh or third—are true, but they are dependent on whether people who die from related cardiovascular disease are included. In other words, just diabetes alone accounts for the listing as seventh, whereas diabetes and the often-resulting cardiovascular disease (heart problems in particular) would make diabetes third on the list" (Barnes-Svarney). This suggests that diabetes should be higher on the list for leading cause of death in the United States because diabetes is linked to cardiovascular disease. One study aimed to provide a realistic estimate of the number of deaths and cardiovascular-related deaths across the United States. A table was created which factored in age and sex. This study also strived to estimate the years of life lost nationally because of premature mortality. The study found that the excess number of deaths as a result of diabetes from all causes and those linked to cardiovascular disease was 156, 098 for males and 137, 126 for females. The rate of excess deaths was highest in those 75 and older and lowest in those 45 and younger (Alva).

> "Diabetes alone accounts for the listing as seventh, wheras diabetes and the often-resulting cardiovascular disease (heart problems in particular) would make diabetes third on the list"
>
> Patricia Barnes-Svarney

Not only does diabetes affect morality rates, but individuals with diabetes have lost years of their life because of this disease. The previous study mentioned strived to determine the life expectancy for people with and without diabetes across the United States. The years of life lost are estimated by the average number of years a person would have lived had they not die prematurely. This was calculated by multiplying the number of people with diabetes by the difference in life expectancy between people with and without diabetes. A table was used which factored in age and sex. The study found that a total of 109,707,000 years of life were lost as a result of diabetes. Also, each person with diabetes lost an average of 4.4 years of their life. Furthermore, the study showed that type 2 diabetes is more common in males than females and that in those diagnosed before age 40, males lost an average of 12 years of their life while females lost an average of 19 years (Alva). Life expectancy is lower in individuals with diabetes.

Prevention Methods

There are many individuals in the U.S and globally that are impacted by diabetes. There are many interventions that can improve diabetes outcomes, however, many individuals with diabetes do not achieve their goals when it comes to prevention and treatment. This is especially true in less educated individuals. One study strived to showcase how evidence-based interventions and resources in healthcare setting can dramatically impact outcomes for individuals with diabetes. "To improve diabetes disparities and outcomes, resources for implementing evidence-based interventions are needed in the settings where patients with diabetes receive healthcare. This study provides national estimates of the distribution of outpatient visits for US adults with diabetes across care settings to inform the delivery of resources for diabetes interventions" (Pilla).

> "To improve diabetes disparities and outcomes, resources for implementing evidence-based interventions are needed in the settings where patients with diabetes recieve healthcare"
>
> Scott J. Pilla

The study found that it is critical for patients with diabetes to interact with their physicians because most diabetes management resources occur in healthcare settings such as primary care offices. These interactions present opportunities to improve diabetic care. Individuals that are affected by diabetes need to be empowered with support and education on diet, physical activity, medications, mental health, and prevention of complications over their entire lifetime. The American Diabetes Association and other partner organizations can help individuals with diabetes find the support that they need in these areas. "Our failure in education and prevention is evident. According to the Centers for Disease Control and Prevention statistics, in 1975, 4.79 million people in the U.S. had diabetes—a little over 2 percent of the entire U.S. population. The increase from 2 percent to 9 percent in less than 50 years is unacceptable and represents a failure to focus on wellness and prevention" (Reusch). Diabetes can be prevented through the process of evidence-based interventions and resources that support individuals that are affected by this disease.

Diabetes has a significant impact on the lives of individuals in the United States and globally. The American Diabetes Association (ADA) discusses one strategy they believe can impact the story of diabetes. "Storytelling is a potent strategy for conveying both information and inspiration about a topic. By weaving together the individual reality and the global health burden of the inadequately addressed diabetes epidemic, we can frame the urgent and misunderstood diabetes epidemic as a story: a story that will create the impetus for action" (Reusch). Storytelling is one strategy that can convey information and inspiration about diabetes. It can not only raise awareness of diabetes and the harm it poses to individuals and to the world, but also inspire action to prevent and cure those affected by diabetes. It can have a direct impact on the story of diabetes in individuals and the globe. Storytelling can not only raise awareness of the diabetes epidemic, but also help diabetic individuals with self-management support. A study was done on individuals to determine if storytelling affected diabetes self-management. This study strived to demonstrate how to prevent diabetes complications and promote disease self-management through diabetes self-management education (DSME). One of the ways this is achieved is through group-storytelling. A study was conducted on individuals with type 2 diabetes. Knowledge exchange occurred when participants shared or sought out information from the group.

> "The increase from 2 percent to 9 percent in less than 50 years is unacceptable and represents a failure to focus on wellness and prevention"
>
> Jane Reusch

The participants felt more empowered with the knowledge they had gained through the storytelling interventions. They believed they were more in control of their diabetes. Participants were also inspired by those that had been living with diabetes for a long time. They gained a sense of community and inspired them to make changes and set goals (Gucciardi). Group storytelling is importnat for individuals with diabetes because it can promote disease self-management among people with type 2 diabetes. Storytelling can facilitate knowledge exchange, collaborative learning, reflection, and making meaning of one's disease. It promotes peer support and active engagement in disease self-management.

Everday Reality Campaign

There are many campaigns that strive to raise awareness of diabetes. For example, the American Diabetes Association (ADA) is one organization that uses campaigns to raise awareness of this disease. It was established in 1940, and is the nation's leading voluntary health organization for diabetes. Their mission is to prevent and cure diabetes and also improve the life of those that are affected by this disease. They are striving to fund research to prevent, cure, and manage diabetes and their vision is a life that is free from diabetes and its burdens. "For nearly 80 years, the ADA has driven discovery by funding research to treat, manage and prevent all types of diabetes, while working relentlessly for a cure" (MultiVu).

> "For nearly 80 years, the ADA has driven discovery by funding research to treat, manage and prevent all types of diabetes while working relentlessly for a cure
>
> MultiVu"

Magnifying the urgency of this epidemic the ADA works to safeguard policies and programs that protect people with the illness, those at risk of developing diabetes and the health care professionals who serve them by initiating programs, advocacy and education efforts that can lead to improved health outcomes and quality of life (MultiVu). The ADA has produced many campaigns for American Diabetes Month which in November. One of their campaigns, titled Everday Reality, was created and produced in November of 2018. The ADA partnered with national sponsors National Oral Care Strategic Partner Colgate Total and CVS Pharmacy to create this campaign. This campaign specifically utilized personal accounts by gathering stories from individuals affected by diabetes. The purpose of this research was to demonstrate how diabetes impacts the life of individuals by highlighting real experiences and perspectives from individuals that deal with this disease in their everyday life. This includes those living with diabetes and those that care for someone with diabetes. In this campaign, "recognition of American Diabetes Month and World Diabetes Day, the American Diabetes Association (ADA) aims to create urgency about diabetes, help educate others, break down stereotypes, and to correct myths and misunderstandings surrounding the disease" (MultiVu). Diabetes impacts the everyday choices of individuals including what they will eat and wear. These stories were shared during the month of November to raise awareness of diabetes and the impact it has on individuals.

The audience for the Everyday Reality campaign are the millions of Americans that are currently affected by diabetes or are potentially at risk for this disease. This campaign uses real stories of individuals affected by diabetes to connect to the audience. Photos of each person were taken and incorporated into the visual solutions. The photos are of the individual's side profile is portrayed in the visual solutions. The front half of their face is on a gray colored background while the back half is covered in a see-through layer of red. The color palette grabs the viewer's attention and demonstrates the urgency of spreading diabetes awareness. The imagery allows the viewer to connect to real individuals that are impacted by this disease. The visual solutions also use text to inform the viewer of the individual's name and diabetic type. It also tells their story with diabetes. In each visual solution, the text is separated by the individual's head in the center of the image. At the left bottom corner of each image is the American Diabetes Association Logo.

Fig. 1 American Diabetes Association. "Everyday Reality". 2018. https://www.multivu.com/players/English/8272631-ada-american-diabetes-month-everyday-reality/

Figure 1 depicts Winston Duke, a celebrity known for his role as M'Baju in the Black Panter Marvel movie. He partnered with the ADA to raise awareness of diabetes and the impact it has on families. He has lost several members of his family to this disease. He is striving to change the future for his family and millions more. His side-profile photo is positioned in the center of the visual solution. The text states, "When you lose someone to diabetes" in red is on the left side of the image and "you carry their story forward" continues in white on the right side of the image. The text creates an emotional response for the viewer because it relates the hardship that comes from losing a loved one due to diabetes. The subject's name and "Diabetes Advocate" is depicted in the bottom right corner.

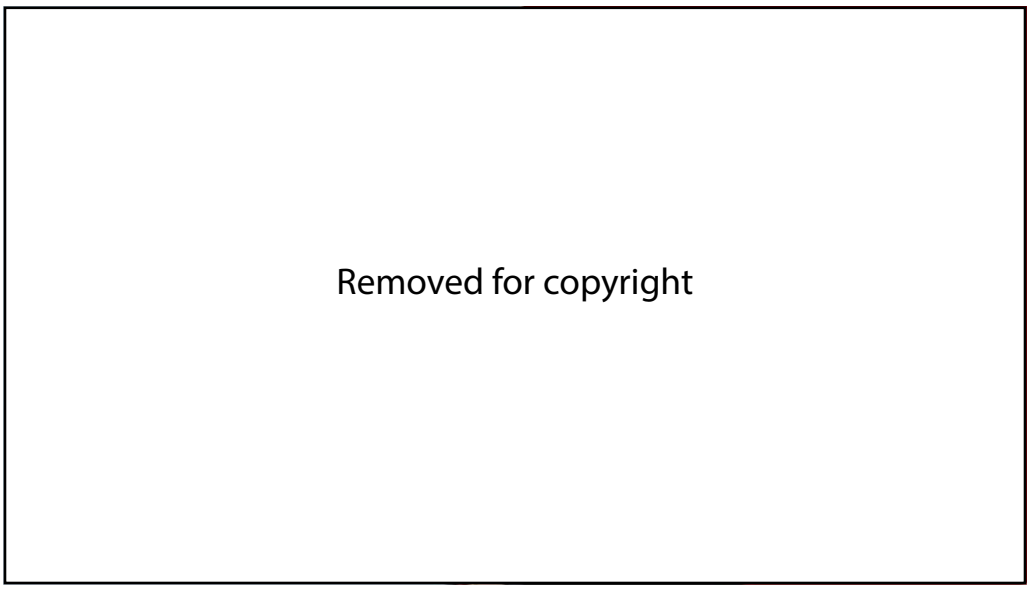


Fig. 2 American Diabetes Association. "Everyday Reality". 2018. https://www.multivu.com/players/English/8272631-ada-american-diabetes-month-everyday-reality/

Figure 2 tells another story of an individual impacted by diabetes. This image displays the chief executive officer (CEO) for the American Diabetes Association, Tracey Brown. She was diagnosed with gestational diabetes and then later developed type 2 diabetes. Her face is also depicted in a side profile. The words "When you have diabetes," is written in red and "you become as relentless as the disease you're fighting" is in white on the right side of the image. The subject's name and diabetes type are located on the bottom right side of the image. The text demonstrates how the individual has to react in order to manage their diabetes in order to save their life. Furthermore, Mike and Oliva Nelson. Mike is a 40-year-old father from Salt Lake City Utah. He was diagnosed with type 1 diabetes and now his 4-year-old daughter was also diagnosed with type 1 diabetes. Oliva Nelson is depicted in Figure 3. In the image, she is portrayed with a bow on her head. The text states, "When you have diabetes as a kid," on the left side in red and "you have to grow up quickly" on the right side in white. This demonstrates that anyone no matter their age can be impacted by diabetes and that diabetes puts a strain on the lives of children in the United States.

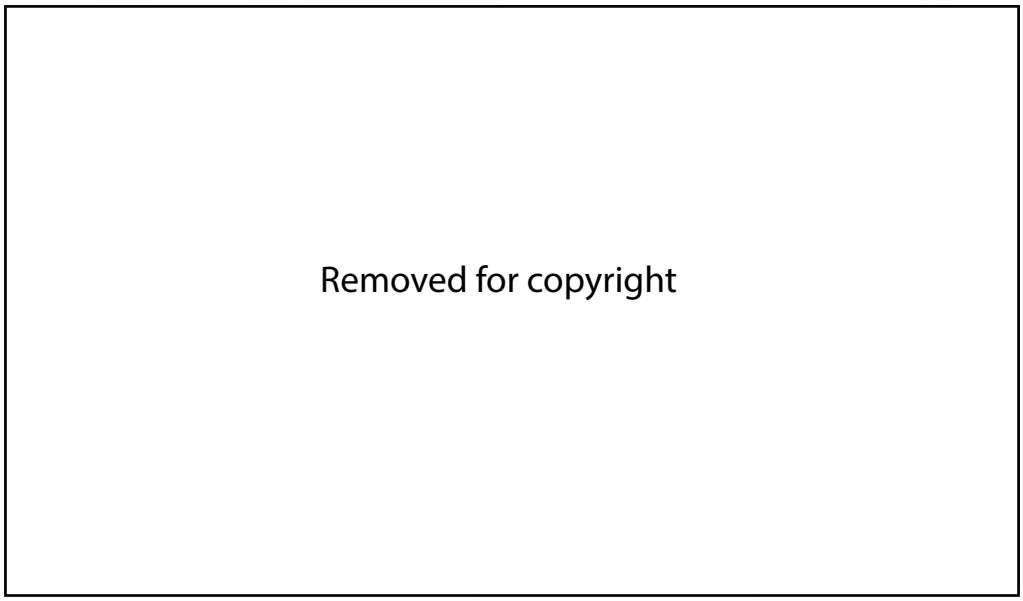


Fig. 3 American Diabetes Association. "Everyday Reality". 2018. https://www.multivu.com/players/English/8272631-ada-american-diabetes-month-everyday-reality/

Through the Everday Reality campaign, the American Diabetes Association generated 4.4 million media impressions and 3.5 million more on social media. This campaign also promotes people to take the ADA risk test on their website so people will understand their risk level for this disease. This campaign, relates to my thesis problem and theoretical solution because it strives to raise awareness of the diabetes epidemic in America by telling the stories and experiences of individuals and their everyday life that is affected by this disease. It succeeds in spreading knowledge of this disease by connecting individuals to real life people that are impacted by diabetes which is what I am striving to do with my thesis project. The campaign succeeds because it raises awareness of diabetes by connecting the viewer to real people that are affected by diabetes. This campaign connects to my identified problem because it strives to raise awareness of diabetes to the American population. This campaign uses portraiture to connect the viewer with the individuals that are impacted by diabetes. The Everyday Reality Campaign relates to my identified thesis problem because it strives to raise awareness of diabetes to prevent individuals from obtaining this disease.

Center for Disease Control and Prevention

Another campaign which strives to raise awareness of diabetes is the National Diabetes Prevention Program (National DPP) which was established in 2010 by the Center for Disease Control (CDC). The National DPP is a public and private partnership of organizations that was authorized by congress to build a nationwide delivery system for a lifestyle change program that is proven to prevent or delay the development of type 2 diabetes in adults who currently are prediabetic. They are striving to raise awareness of prediabetes, share information about the National DPP, and encourage participation in their lifestyle change program. They also strive "to address the increasing burden of prediabetes and type 2 diabetes in the United States. This national effort created partnerships between public and private organizations to offer evidence-based, cost-effective interventions that help prevent type 2 diabetes in communities across the United States" (Center for Disease and Control).

The identified problem depicted in this case study corresponds to the identified problem for my thesis project because it stives to raise awareness of diabetes and prevent individuals from obtaining this disease. However, this study specifically focuses on prediabetes and the prevention of type 2 diabetes. The CDC created a lifestyle change program which is a "research-based program focusing on healthy eating and physical activity which showed that people with prediabetes who take part in a structured lifestyle change program can cut their risk of developing type 2 diabetes by 58 percent (71 percent for people over 60 years old)" (Center for Disease Control and Prevention). The purpose of the research is to encourage health professionals to talk to their patients about lifestyle change and encourage individuals to participate in the program in order to prevent or delay the onset of type 2 diabetes in individuals who are currently prediabetic. This case study strives to resolve the problem of the progression of type 2 diabetes is similar to my thesis problem which stives to raise awareness of diabetes because it can have a major impact on cutting the risks this disease poses to an individual's health.

Infographics were created to raise awareness of this campaign. They use imagery and text to inform health professionals and individuals about the risks of diabetes and how to implement lifestyle changes in order to prevent or delay the onset of type 2 diabetes. The color palette for the infographics are calm colors including gray, blue, and green. Although these colors make the visual solutions easier to read, they do not demonstrate the urgency of raising awareness of this disease so individuals are provoked to make lifestyle changes.

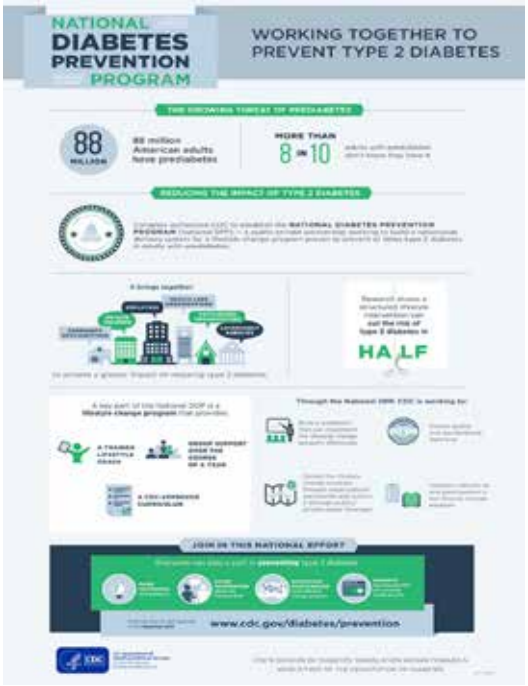


Fig. 4 Center for Disease Control and Prevention. "National Diabetes Prevention Program". https://www.cdc.gov/diabetes/library/socialmedia/infographics.html

The use of imagery and text is used in a way that the viewer can understand the information. "People process visual information much faster than text. These infographics make diabetes and prediabetes data easy to understand and visually appealing" (Centers for Disease Control and Prevention). This program targets American adults that currently have prediabetes and are at risk of developing type 2 diabetes and individuals that may not know they have this disease. Figure 4 demonstrates one infographic that was created for the National Diabetes Prevention Program. At the top of the visual solution it states, "Working Together to Prevent Type 2 Diabetes". This infographic uses text statistics to inform the viewer of the amount of people that do not currently know they are prediabetic. The text states 88 million American adults have prediabetes" and "8 in 10 adults with prediabetes don't know they have it". This demonstrates the enormous amount of people that are affected by diabetes and those that currently are unaware that they have prediabetes and the urgency to understand the threat diabetes poses to individuals. This infographic also informs the viewer of the benefits of joining the lifestyle change program established by the National DPP because they can help individuals affected by diabetes by providing them with a trained lifestyle coach, group support, and an approved CDC curriculum to manage their diabetes.

Fig. 5 Center for Disease Control and Prevention. "National Diabetes Prevention Program". https://www.cdc.gov/diabetes/library/socialmedia/infographics.html

The imagery and text used in figure 5 informs the viewer of the risks prediabetes poses to individual health including the onset of type 2 diabetes, heart attack, and stroke. It also informs the viewer of the effectiveness healthy eating habits and physical activity can increase weight loss which has been proven to prevent or delay the onset of type 2 diabetes. The statistics demonstrate the amount of people that are positively impacted by the National Diabetes Prevention Program led by the CDC. The text states, "Weight loss of 5 to 7 percent of body weight achieved by reducing calories and increasing physical activity to at least 150 minutes per week resulted in 58 percent lower incidence of type 2 diabetes". This information tells the viewer that weight loss can be achieved by increasing the amount of exercise they partake in and eating less which can reduce their risk of developing type 2 diabetes.

This case study is successful because it raises awareness of prediabetes and promotes prevention methods for individuals by establishing a lifestyle change program that encourages healthy eating habits and physical activity. This program provides prediabetic individuals with a lifestyle coach, group support, and a curriculum created by the CDC which can help prevent these individuals with prediabetes from progressing to type 2 diabetes. This case study utilizes quantitative research including statistics and information on diabetes risk as their prevention for individuals who currently have prediabetes, and individuals who are currently unaware they have prediabetes, in order to prevent the threat of type 2 diabetes progression.

The use of quantitative research used in their project relates to the research conducted for my thesis project because it helps to demonstrate the severity of the diabetes epidemic and how many individuals that are currently impacted by diabetes including individuals who may be impacted by this disease in the future. This project is successful in raising awareness by encouraging health professionals to talk to their patients who have prediabetes about preventing their risk of developing type 2 diabetes by using quantitative research of statistics and information on prediabetes to promote the CDC's lifestyle change program. However, my thesis project stives to raise awareness of all types of diabetes including type 1 diabetes, prediabetes, type 2 diabetes, pregestational diabetes, and gestational diabetes and their associated complications. Like this campaign, I will also be incorporating quantitative research into my thesis project to inform the viewer about diabetes.

This case study also informs the visual solutions because I will also be creating an infographic. The visual solutions demonstrate how to display data and statistics on diabetes to inform the viewer on the risks this disease has to individuals and how to prevent or delay type 2 diabetes from occurring in individuals with prediabetes. The visual solutions created for the National DPP are similar to the visual solutions I will create for my thesis project because they demonstrate the dangers of developing diabetes and how diabetes can be delayed or prevented by showcasing the statistics that lifestyle changes make in an individual's life. It also demonstrates the severity of diabetes by including the amount of people who are affected by diabetes, and the risks diabetes poses to their health. I will also incorporate these aspects into my visual solutions to raise awareness of these risks to the viewer so the information is understandable and visually appealing.

Diabetes Association of Thailand

Another organization that strives to raise awareness of diabetes is the Diabetes Association of Thailand which is a part of the International Diabetes Federation (IDF). The IDF "is an umbrella organization which has over 230 national diabetes associations in 170 countries and territories. It represents the interests of the growing number of people with diabetes and those at risk. The Federation has been leading the global diabetes community since 1950" (International Diabetes Federation). The Western Pacific Region (WPR) of the IDF currently has 26 diabetes organizations in 20 countries and territories. "Thailand is one of the 39 countries and territories of the IDF WP region. 463 million people have diabetes in the world and 163 million people in the WP Region, by 2045 this will rise to 212 million" (International Diabetes Federation). Currently in Thailand, there is a total population of 51,475,200 adults. Of this population, there are 4,284,900 total cases of diabetes in adults.

> "Thailand is one of 39 countries and territories of the IDF WP region. 463 million people have diabetes in the world and 163 million people in the WP Region, by 2045 this will rise to 212 million
>
> International Diabetes Federation"

The Diabetes Association of Thailand was established in 1965. Their main focuses are to "serve as an up to date and trustworthy source of knowledge for healthcare professionals and a conduit for disseminating information to the general public, to support development of knowledge and innovations related to the management of diabetes. To promote healthcare professional's knowledge and skills for improving standards of diabetes prevention and care, to improve patient's access to diabetes treatment, to publicize the work of the association to public and gain public trust, to co-operate with the relevant national and international bodies in organization of activities related to diabetes awareness and care" (International Diabetes Federation). This association has participated in six diabetes survey studies.

Fig. 6 Jaengsem, Nattakong. "Sweet Kills". https://www.theguardian.com/commentisfree/2016/mar/30/gruesome-adverts-capture-attention-thai-

The Diabetes Association of Thailand commissioned the designer, Nattakong Jaengsem, who works for Ogilvy and Mather an advertising agency in Bangkok, Thailand to create a series of print posters titled "Sweet Kills" in order to demonstrate the dangers of sugar consumption in relationship to diabetes. Research has proven that sugar negatively prevents the healing system in the human body from working correctly, especially for individuals with diabetes. As a result, too much sugar which is usually consumed by eating sweet treats, causes serious infections and complications which may result in amputation of a limb in diabetic patients. This case study focuses on the population of Thailand. The purpose of the research is to demonstrate how sugar can pose great risk for individuals specifically diabetic individuals because it can cause wounds such as ulcers, gangrene, blood poisoning, bone infection, and limb amputations. This case study strives to inform the audience of the harmfulness of sugar consumption and the impacts it has on the body. The identified problem for this case study informs my thesis problem because it demonstrates the risks associated with diabetes including the complications that arise as a result of having diabetes. However, this case study solely focuses on sugar intake in relationship to the healing system for diabetic individuals and does not consider how genetic components relate to the development of diabetes or other complications that arise because of diabetes.

Fig. 7 Jaengsem, Nattakong. "Sweet Kills". https://www.theguardian.com/commentisfree/2016/mar/30/gruesome-adverts-capture-attention-thai-sugar

Each print displays grotesque wounds on various body parts which are created using various food ingredients that have a high sugar content such as icing. The prints show "grisly close-ups of gaping wounds – the twist being that the blood and cuts are made out of confectionery. The ads, headlined "Sweet Kills", aren't designed just to gross people out; they're raising awareness of the complications of type 2 diabetes, which can be triggered by too much sugar. Uncontrolled diabetes causes slow wound healing, which can eventually cost the sufferer an arm or a leg" (Mahdawi). A complication related to diabetes is amputation, especially in lower-limbs. The small text at the top of each poster states, "Sweet Kills uncontrolled diabetes cause wound to heal slower. For more information www.diabassotal.org". In each visual solution, there is a close-up of the wound, and the subject is shown holding the affected area. Figure 6 displays a hand holding an elbow that is covered with brown colored sugary foods that resemble a grotesque wound. The imagery is used to promote fear in the viewer. However, this may not be effective in promoting lifestyle change. "The study, titled "Shock Advertising: Not So Shocking Anymore", found that while people remembered graphic imagery in ads, they didn't remember anything else. While gore may get views; changing people's views requires a little more work" (Mahdawi). Figure 7 displays a person holding onto their knee. The knee is covered with yellow sugary foods that resemble a wound. Figure 8 also displays a grotesque wound made with sugary foods. However, it is placed on the foot and uses pink sugary foods. The position of the wounds in figures 7 and 8 relate more to the amputations of the lower limbs of diabetic patients.

Fig. 8 Jaengsem, Nattakong. "Sweet Kills". https://www.theguardian.com/commentisfree/2016/mar/30/gruesome-adverts-capture-attention-thai-sugar

Although the imagery and text inform the viewer about the risks sugar poses to the healing process of diabetic individuals, it may not be effective in raising awareness and promoting change in the viewer. For example, it is believed that shock tactics may be effective in the beginning but may burn out over time. "But while shock tactics can be effective to begin with, they tend to burn out. They quickly stop being nauseating, and start to look normal. At this point, advertisers change their tactics...focus[ing] on reinforcing positive behavior rather than drumming home dire consequences. There's less of an emphasis on getting people to flinch; and more on gently nudging people to think" (Mahdawi). The visual solutions created by this organization uses grotesque imagery. However, I will be not be implementing this technique when creating my visual solutions because it may not be as effective in promoting awareness of the disease or promoting lifestyle changes in individuals with diabetes. Instead, I will be using quantitative research on diabetes statistics to inform the visual solutions for my thesis project. This will inform the viewer on aspects that relate to diabetes other than sugar consumption. Although this organization strives to raise awareness of diabetes and its related complications, the visual solutions I will create will incorporate other elements incorporated in the other case studies to invite the viewer in and provide information on the subject rather than instilling fear into the viewer with grotesque imagery.

The Future of Diabetes

Diabetes is expected to continue to increase in the future. Currently, 451 million people worldwide have this disease. The International Diabetes Foundation (IDF) estimates "By 2045, this number is expected to increase to 693 million" (Moini). This number predicts those that will be affected by diabetes and its related complications. Because of this, more research needs to be done to find better treatment options and support for individuals affected by diabetes. Through research there is increased understanding of current unknowns. Currently, the causes of type 1 and type 2 diabetes, and the complications that arise because of them, are still unknown. The contributions of genetics, cell biology, and integrative physiology that contribute to diabetes risk and progression are also unknown.

Through research, these knowledge gaps can be filled, which will foster a complete understanding of diabetes. Not only will this be extremely beneficial in developing a better understanding of diabetes and the individuals it affects, but it will also develop better treatment options for individuals affected by this disease. Dr. Paolo Di Bartolo and Dr. Robert H. Eckel are diabetologists who have lived with type 1 diabetes for over 50 years. In their journal article, Living with Insulin: The story of insulin from people with diabetes, they state, "Just 10 years ago, no one could have imagined where we would stand in 2021. So what can we expect, what improvements will the future hold? Inhaled insulins, oral insulins, smart insulins, weekly basal insulins appear as possible further extraordinary insulin treatment proposals for people with type 1 diabetes and some with type 2 diabetes" (Di Bartolo).

> "What can you do? Know the facts. Tell the story. Change the world for people with and at risk of diabetes"
>
> Jane Reusch

The future can hold endless possibilities for new and innovative treatment options for individuals with diabetes. Research is the key to understanding diabetes and developing new treatment options for individuals that are affected by this disease. One organization that is striving to research diabetes is the American Diabetes Association. The ADA has a vision and a hope for a life free of diabetes and the burdens associated with it. They state, "We are fighting the good fight, and we are not there yet. We are the mission workforce that needs to be engaged to achieve this vision. What can you do? Know the facts. Tell the story. Change the world for people with and at risk for diabetes" (Reusch). A cure for diabetes cannot be found unless more people are aware of this disease and its complications and are willing to stand up to help change the world.

Conclusion

In conclusion, the research greatly impacts the deliverables that will be created because it helps understand the many factors that effect those with diabetes. It is a complicated disease whose cause is still unknown. There are various types including type 1, prediabetes, type 2, pregestational diabetes, and gestational diabetes. Health complications arise from this disease which can be life-threatening. Evidence-based interventions can improve diabetic outcomes. Storytelling has been proven to foster knowledge and awareness on the subject and increase self-management techniques in individuals affected by this disease. Furthermore, it can help prevent or delay the progression of diabetes and its related complications.

By examining the solutions created by organizations such as the American Diabetes Association and the Center for Disease Control and Prevention which strive to raise awareness of this disease helps to understand how to display information on diabetes in a creative way for the viewer to understand their risks and preventitive measures in order to manage or delay this disease from occuring. This research also informs how best to engage the viewer by presenting them with stories and experiences that will spark them into action to be proactive in fighting diabetes and possibly change the future outcomes for individuals that are currently battling this disease.

Chapter 3: Visual Process

Chapter 3: Visual Process

Brainstorming

The main objective of my thesis project is to inform the viewer of the diverse types of diabetes in order to prevent or delay this disease from occurring. To accomplish this, I would need to inform the viewer on the definitions of each type, the symptoms of diabetes they shoul look for to help diagnosis this disease, health complications that those with diabetes are at risk for, and management techniques that can help prevent this disease. I believed the best way to distribute this information was by creating an infographic for the history of diabetes to demonstrate the medical advances that have attributed to this diabetic health as well as infographics for each diabetic type. Furthermore, a website design which viewer could easily access information on diabetes.

To create my infographics on diabetes, I first needed to study and learn how other infographics that related to my topic were created so I could gain a better overview and understanding of the best methods to connect the viewer with the information. I began by creating a Pinterest mood board which contains 100 images of infographics related to diabetes for inspiration. While creating the mood board, I paid close attention to the type, imagery, layout, and color schemes that were used. This enabled me to generate ideas for symbols I could use, how to best display the information so the viewer could understand it, and which color schemes were best for the design to create interest in the veiwer.

Many of the infographics demonstrate the diverse types of diabetes and their associated definitions, symptoms, health risks and management techniques. These were importnat aspects that I would need to include to make my infographic informative and effective in preventing or delaying diabetes from occurring. One of the main infographics that stood out to me was by the International Diabetes Federation which can be seen in figure 9. One of the reasons it stood out to me is its use of color and its ability to immediately grab the attention of the audience. This infographic had a profound influence in the development of my color scheme for my infographics.

Fig. 9 International Diabetes Federation. Pinterest Mood board.

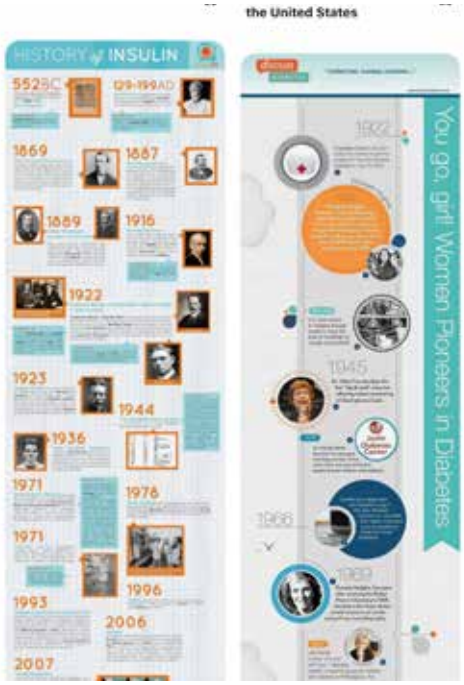


Fig. 10 and 11 Infographics aquired from Pinterest mood board

Another infographic that stood out to me also utlizes color to grab the attention of the audience. It can be seen in figure 10. Athough this infographic displays the definition of type 1 diabetes and key facts about this type, the imagery gives a false perspective of why this disease occurs and relates the root cause of diabetes to the consumption of donuts. Although I can utilize the way it captures the attention of the audience in the development of my work, incorporating imagery which directly relates to diabetes and does not include false pretense is important in the creation of my project. Furthermore, the infographic seen in figure 11 displays the history of diabetes and the many individuals who have initiated many of the medical discoveries which have instigated understanding of this disease. and how to manage it. Although this infographic incorporates important milestones in the history of diabetes, it contains an enormous amount of text which may overwhelm the viewer, especially those who are unfamiliar with this disease. To prevent the viewer from being overwhelmed, I will minimize the amount of text that will be included in my infographics and web design.

Determining Relevant Information and Imagery

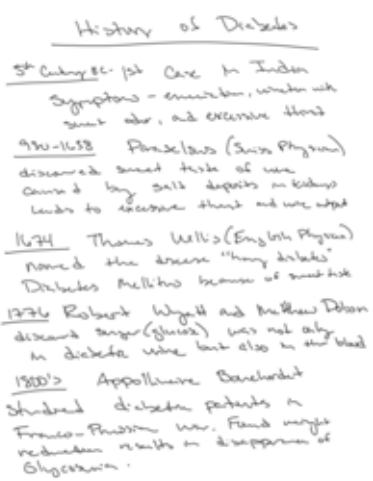


Fig. 12, 13, and 14 Lists of history of diabetes and type 1 diabetes.

After creating and studying the mood board, it was vital to know which information was most important to highlight on each infographic. To determine this, I reread through my sources and wrote lists for each diabetic type detailing vital information related to each type which can be seen in figures 12-14. This would help to determine the sections that would be included in the infographics. The sections I developed included their definitions, symptoms of the disease, percentages, and statistics about the specific type. Furthermore, how diabetes affects one's health and ways to manage diabetes. This helped me organize not only what information was best to include, but also how much. By determining the relevant information to include in the infographics, I would be able to prevent the viewer from being overwhelmed, while also ensuring they would be well informed of diabetes.

Fig. 15, 16, 17 and 18 Initial brainstorming sketches

During this process, I also began sketching out different imagery which would help the viewer in understanding the information. Like the infographics created for the National Diabetes Prevention Program by the Center for Disease Control and Prevention, I developed simple imagery to help display the vital facts about diabetes so the viewer could easily identify what the information meant. I created imagery of medical devices such as the glucose monitor and insulin pump. I also created images for the different symptoms which included excessive thirst, excessive urination, and excessive hunger. I also created images that are specifically related to each diabetic type. For example, in figures 15-18 I created sketches of the map of the United States to display the number of children with type 1 diabetes and the map of the world to demonstrate the number of people affected by prediabetes. I explored different symbols for males and females to demonstrate how type 1 diabetes is most likely passed from the father to the offspring. I developed a pregnancy chart to display the timeframe of when gestational diabetes is likely to develop, which is usually during the second or third trimester. Although these sections were important to distinguish the diverse types and allowed for some variety in imagery for each infographic, one of the main sections I wanted to include in the infographics was on health complications and birth defects that are associated with diabetes. This disease increases an individual's risk for a heart attack, stroke, kidney problems, leg amputations, blindness, and death. I also wanted to display the birth defects that are common with pregestational and gestational diabetes which may occur in the heart, brain, gastrointestinal system, and spine.

Rough Sketches - Type 1 Diabetes

I created the rough sketches of each infographic and the website design by using Adobe Photoshop on my iPad Pro. When creating the rough sketches, I considered the relevant information and imagery I would include on the infographics and website. During this phase, my main concern was determining the layout that provided the best flow for the viewer to understand the information about diabetes. I created 30 rough sketches for each of the five infographics as well as for the website design. Figures 19-21 demonstrate the rough sketches for type 1 diabetes.

Fig. 19, 20, and 21 Rough sketches for type 1 diabetes

Rough Sketches - Prediabetes and Type 2 Diabetes

Figures 22-24 demonstrate the rough sketches created for prediabetes and type 2 diabetes. This infographic utilized the world map to describe how many people are affected by prediabetes in the world. It also demonstrates related symptoms, health risks, and management techniques and related statistics to inform the viewer of how they can best understand their risk for this disease.

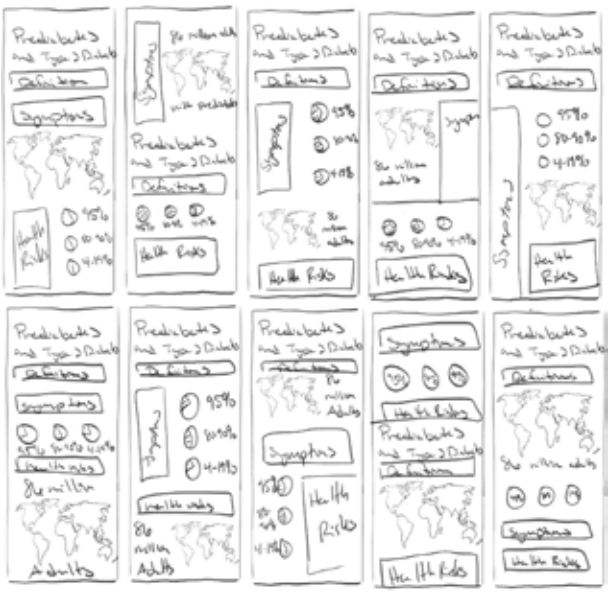
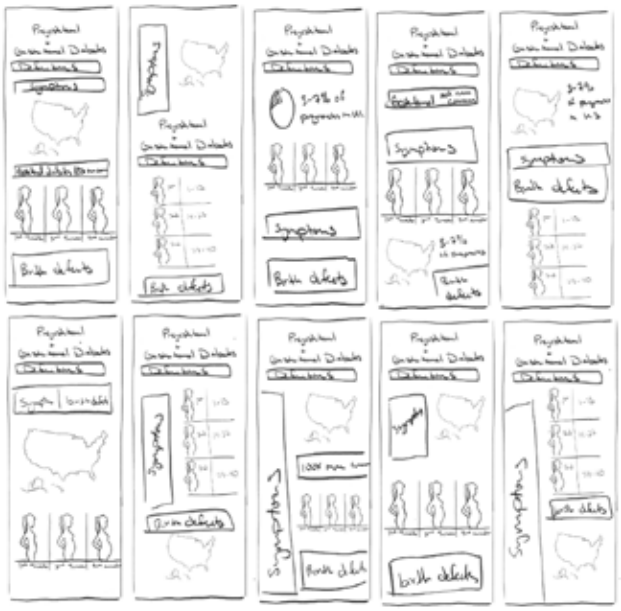


Fig. 22, 23, and 24 Rough sketches for Prediabetes and Type 2 Diabetes

Rough Sketches - Pregestational and Gestational Diabetes

Figures 25-27 demonstrate the rough sketches for the pregestational diabetees and gestational diabetes infogrphraphic. For this infographic, I incorporated a pregnancy chart that demonstrates when gestational diabetes is likely to develop. I also incorporated related statics for women with gestational diabetes. Furthermore, birth defects that occur as a result of these types. These include defects in the heart, brain, gastrolintestinal system, and spine.



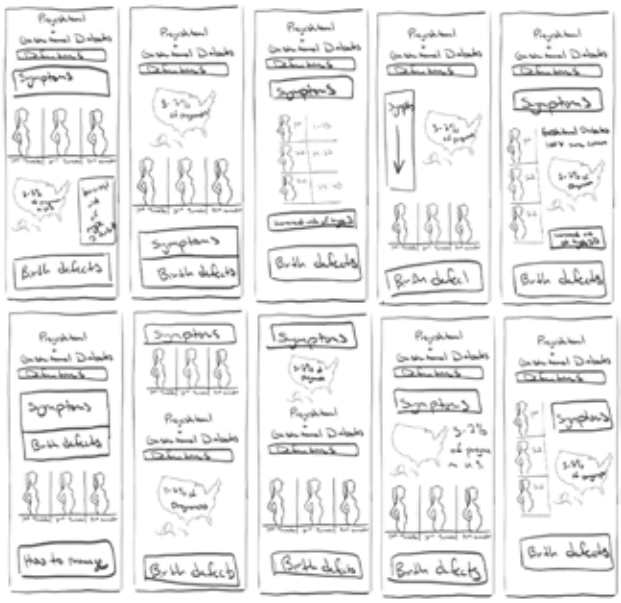


Fig. 25, 26, and 27

Rough sketches forPregestational and Gestational Diabets

Rough Sketches - History of Diabetes

For the history of diabetes infographic rought sketches, which can be seen in figures 28-30, I explored different ways in which to display the information. I found that the virtial layouts seemed to work best. The information included in this infographic dealt with medical discoveries and people that helped diabetes become survivable today.

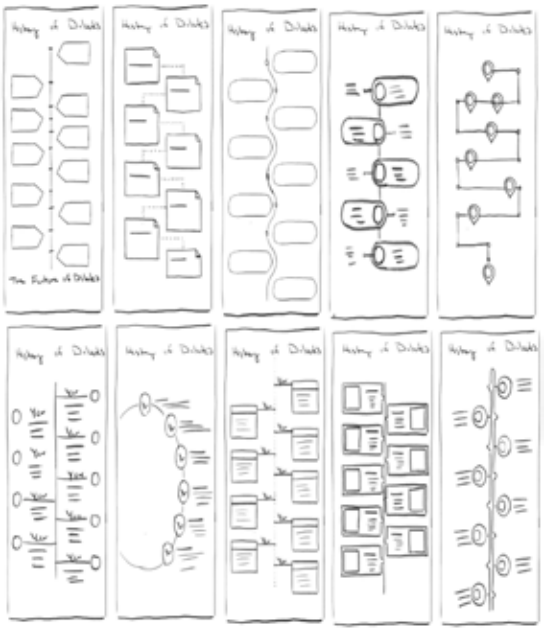
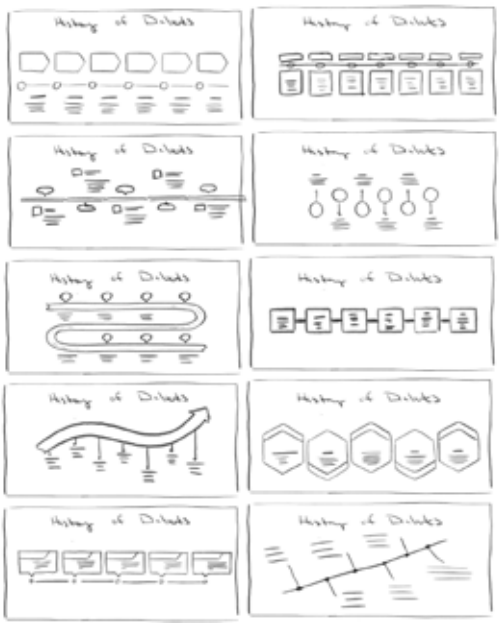
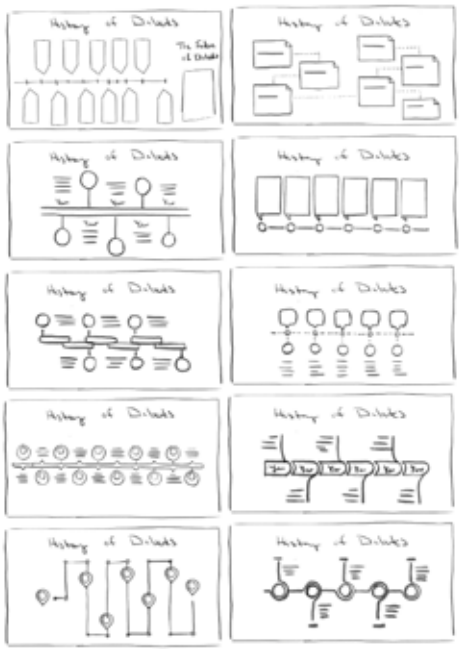


Fig. 28, 29, and 30

Rough sketches forPregestational and Gestational Diabetes



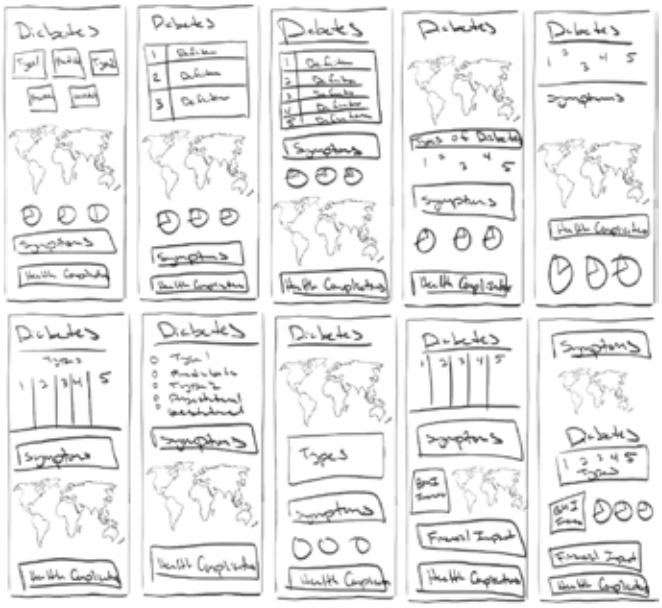


Rough Sketches - Large Infographic

The large inforgraphic rough sketches can be seen in figures 31-33 . This infographic displays all of the types of diabetes as well as their associated definitions and statistics. It starts by detailing the amount of people that have diabetes in the world and the predicted number for the future. I also incorporated the financial aspect of diabetes and a chart to display how many years of life are lost because of this disease.

Fig. 31, 32, and 33

Rough sketches for Large Infographic



Rough Sketches - Website Design

Figures 34-36 demonstrate the rough sketches for the website design. I explored numerous ways to display the separate sections which would be included. These consisted of the definition of the diabetic type, symptoms, statistics, health complications, and management techniques in various areas and reworked the amount of space each section required for the size of the imagery. The layouts that utilized a vertical view allowed the information to flow better than the layouts that utilized a horizontal approach. This phase was a crucial step because it helped give a reference for what the infographics would look like when completed. Although these initial sketches are not overly detailed, they allow room for change if needed and help clarify which solutions work best to solve the problem of diabetes.

Fig. 34, 35, and 36

Rough sketches for Large Infographic

Creating Final Sketches

After completing the initial rough sketches, I chose one layout for each infographic and the website design that incorporated the best structure and flow of information and imagery to create a final sketch of the final layout. Because this was the final phase before I would start creating my infographics in Adobe Illustrator and web design in Adobe XD, I needed to make sure that all the sections were included in the layout and that there was enough space for each section. The final sketches were also created in Adobe Photoshop on my iPad Pro. Figure 37 demonstrate the final sketch for the history of diabetes infographic.

Final Sketch - History of Diabetes

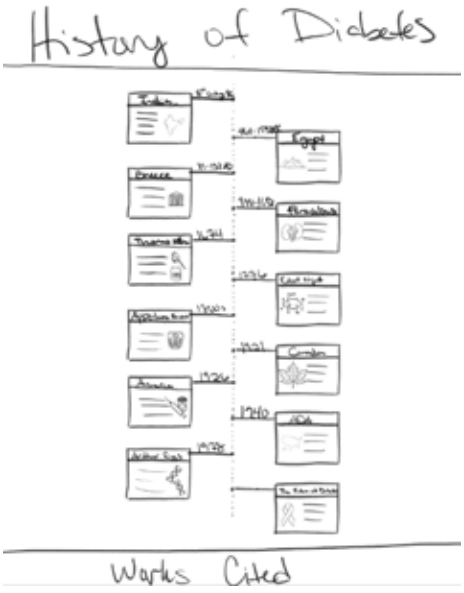


Fig. 37

Final sketch for History of Diabetes

Final Sketch - Type 1 Diabetes, Prediabetes, and Type 2

Fig. 38 and 39

Final sketch for Type 1 Diabetes as well as Prediabetes and Type 2 Diabetes

Figures 38 and 39 display the final sketches created for type 1 diabetes as well as the final sketch for prediabetes and type 2 diabetes. The final sketch for type 1 accounts for the number of children with this type in the United States. It also incorporates how this disease is likely passed down from father to offpsring. The final sketch for prediabetes and type 2 diabetes incorporates a world map. It demonstrates how many people are affected by prediabetes in the world and also states how many people in the United States have this disease. This infographic also demonstrates how greater body mass index (BMI) increases the risk of developing diabetes.

Final Sketch - Pregestational Diabetes, Gestational Diabetes and Large Infographic

Fig. 40 and 41

Final sketch for Pregestational Diabetes and Gestational Diabetes as well as Large Infographic

The final sketch for the pregestational diabetes and gestational diabetes infographic is displayed in figure 40. It incorporates a pregnancy chart to showcase when gestational diabetes is likely to develop. Figure 41 displays the large infographic which contains all of the diverse types of diabetes and their associated definitions, symptoms, health complications, and management techniques. It also showcases the financial aspect of diabetes as well as the mortality rates, and years of life lost due to this disease.

Final Sketch - Website Design

Fig. 42 and 43 Final Sketches for Website Design

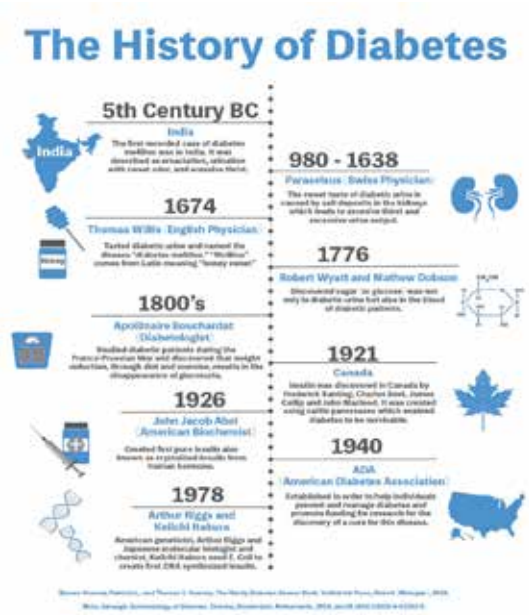
Figures 42 and 43 demonstrate the final sketches for the website design. This phase enabled me to visualize spacing for each of the different sections that would be included for each type of diabetes. I utilized the same layout for each infographic to make the design cohesive. To distinguish each infographic certain sections would contain specific information related to each individual type of diabetes. The final sketches would be used as a final guide or template for the infographic and website design and help identify how to begin the design process in Adobe Illustrator and Adobe XD.

Creating in Adobe Illustrator and Adobe XD

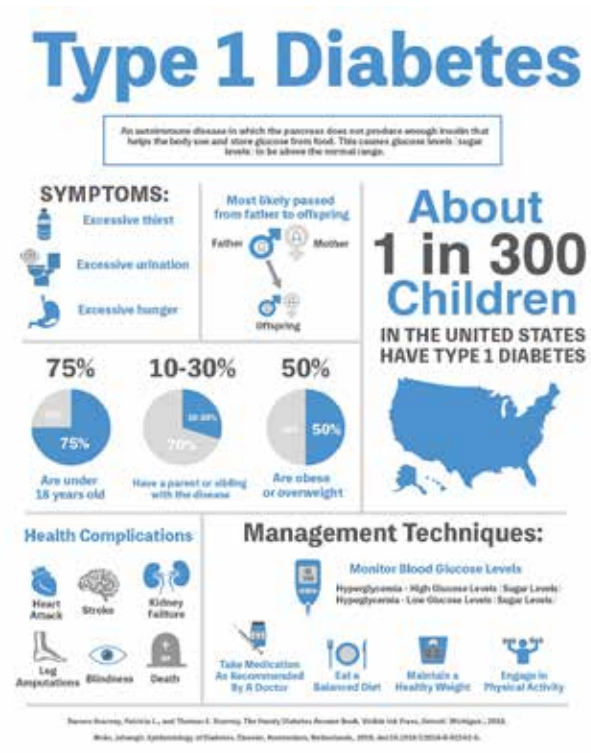
In this section, I describe the initial creations of the infographics in Adobe Illustrator and the website design created in Adobe XD. Once all the initial sketches were created, I began working on creating the infographics by placing my final sketches in Adobe Illustrator and reviewed my Pinterest mood board and imagery sketches. At this point in the process, the main color scheme utilized blue, gray, and white. Blue is the known color associated with diabetes. After creating the color scheme, I started creating the imagery and began arranging the completed pieces on the infographic. Some of the imagery was a little more difficult to create or did not look how I originally imagined so I found other ways to portray the information. The sections that were more difficult to create were health complications and management techniques.

I really enjoyed creating imagery for the health complications and birth defects sections although creating the gastrointestinal system and spine were some of the most difficult imageries to create. After creating the imagery pieces for each section, I placed them in their designated areas on the infographic. Although I created a final sketch of each layout, I found the spacing did not work as I had originally intended. I spent time rearranging a few of the sections to create a better flow for the information and imagery. After I had created all the infographics that displayed each type and the large infographic, I decided to create another small infographic that told the history of diabetes which can be seen in figure 44. It was important to show the medical discoveries, people, and organizations that helped diabetes be survivable today. This would help to tell the story of diabetes. The final sketch I created utilized a vertical layout similar to the other infographics. However, once I began placing the elements in their designated areas, I discovered the elements flowed better on a horizontal layout and I reduced the amount of information to prevent the viewer from being overwhelmed.

Fig. 44 History of Diabetes Infographic



Type 1 Diabetes, Prediabetes, and Type 2 Diabetes



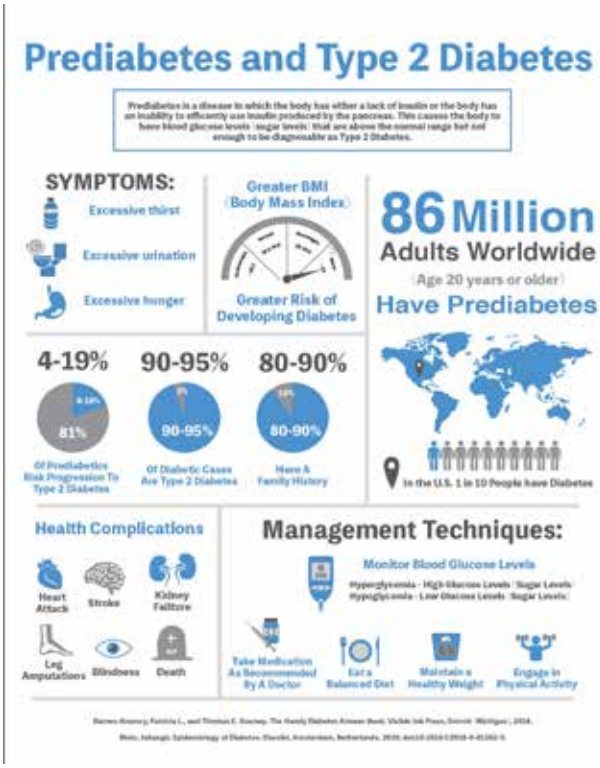


Fig. 45 and 46 Type 1 Diabetes Infogrphic and Prediabetes and Type 2 Diabetes Infogrpahic

Figure 45 displays the initial progress of creating the type 1 diabetes infographic. It incorporates the statistics for children in the United States with type 1 diabetes. It also displays the genetic component of type 1 diabetes. Furthermore, the associated statistics with this type. Figure 46 displays the intial progress of creating the prediabetes and type 2 diabetes infographic. It showcases the amount of people in the world that have prediabetes and how many in the United States that have diabetes. It also shows how increased body mass index (BMI) increases risk of developing diabetes. Finally, the statistics associated with these types. Both infogrphics also include their associated defintions, symptoms, health complications, and management techniques.

Pregestational and Gestational Diabetes

Fig. 47 Pregestational and Gestational Diabetes

Figure 47 displays the initial progress of creating the pregestational and gestational diabetes infographic. It incorporates a chart to display when gestational diabetes is likely to develop which is during the second or third trimester (between 24-28 weeks). It also displays information related to baby size and the likleyhood of having to have a c-section. Finally, the statistics associated with these types. Both infographics also include their associated defintions, symptoms, health complications, and management techniques.

Large Infographic

Figure 48 displays the large infographic which contains all of the information from each type of diabetes. At the top it describes the number of people who currently have this disease and the prediction for the future. It also incorporates the financial aspect of diabetes. Furthemore, the mortality rates and years of life lost for men and women due to this disease. Finally, this infographic includes all of the definitions, symptoms, health complications, and mangaement techniques that are associated with diabetes.

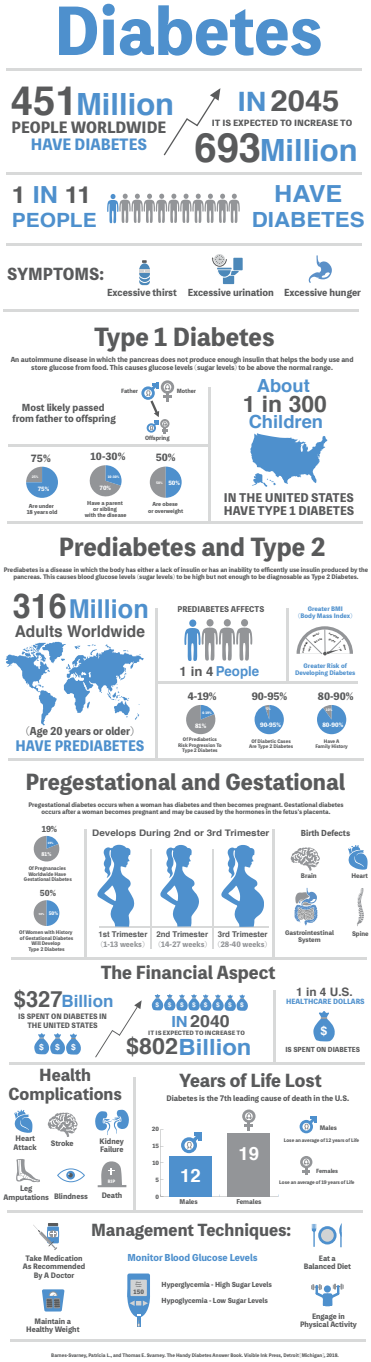


Fig. 48 Large Infographic

Website Design

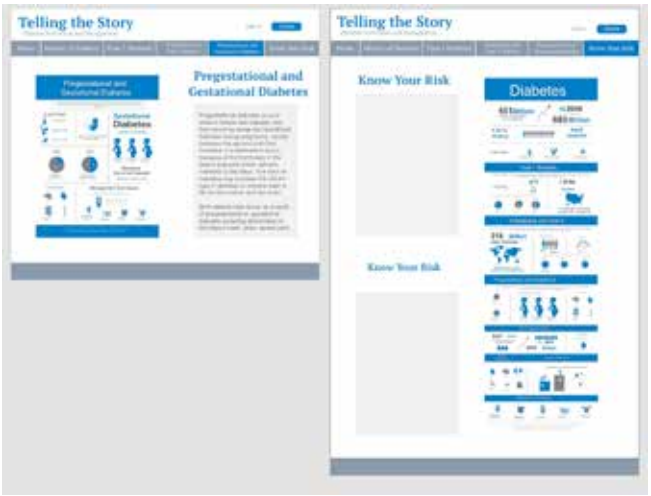
Fig. 49 Website Design

Once the infographics were complete, I began creating the website design. I started by developing the homepage. I wanted to include a world map to show that diabetes is a worldwide problem that needs addressing. I also included the current number of people that are affected by this disease and the amount that is predicted in the future. This does not only describe the daunting number of people that will have to live with this disease, but also describes those that could potentially die because there is not yet a cure. After completing the homepage, I began working on each individual page by placing a summary about each type and placing the associated infographic on each page. Finally, I began prototyping and connecting each page to the other pages. Although the original plan was to use the website to display the infographics, they were difficult to read on the website. Instead of displaying each infographic on their associated page, I took elements from the infographic and placed them on the page. Like the infographics, I wanted to utilize a similar layout for each webpage. However, each page is differentiated by the elements that are specific to each type. By incorporating the elements from the infographics instead of the actual infographic, it allowed the information to be more visible and better fulfill the purpose of the website.

One of the struggles I faced while creating these designs was finding a color palette that catches the attention of the viewer while also incorporating depth so the information would be visually interesting. I looked back at my mood board, the Everyday Reality campaign by the American Diabetes association, and the National Diabetes Prevention Program by the Center for Disease Control and Prevention to find new inspiration for my color scheme. One of the main colors the American Diabetes Association utilizes is red.

Fig. 50 and 51 Website Design

Figure 50 and 51 continue to demonstrate the initial creation of the website design for the pages dedicated to type 1 diabetes, prediabetes and type 2 diabetes, pregestational and gestational diabetes, and know your risk. Each page includes the defintion of each type as well as the infographic that corresponds to the defintion.



While reworking on my designs and added colors such as red and yellow to help break up the different sections and add variety. Red is a color that is associated with alerts or emergencies. Yellow is a color associated with caution. I kept blue as part of the color scheme because of its association with diabetes. However, I changed the original value in order to better coordinate with the other colors. By reworking the color scheme, I was able to create more visual interest than there was in the original designs. While working on the color scheme, I also changed the size of the sections. I needed to rework the layout again to make some of the more valuable information become the forefront of the infographic. To do this, I enlarged the section on health complications and added imagery of the human body. In the statistics section for each of the diverse types of diabetes, I originally designed the pie charts with the statistics above them. I later changed the design of the pie chart into a donut chart and put the statistic on the inside of the donut chart. This allowed the statistics to be more legible while also making them more visually interesting. Another area I struggled with was incorporating shadow to add depth. At first, the shadows I added seemed too dark around the type and objects and distracted from the imagery and information. After experimenting with shadow, I continued to work on adding this aspect in certain areas to add visual interest. I also experimented with adding texture and decided to incorporate a textured background to make the imagery less flat and make the information more appealing.

Although I struggled with some of the design aspects of this project including the color scheme and incorporating depth, my greatest challenge during this process was the emotional struggle I went through in remembering members of my family that are no longer here today because of this deadly disease. At times this made it difficult to continue to progress in the development of this project, but I continued to persevere and push my ideas toward completion. This project is a theoretical solution to the problem of diabetes. However, the creation of infographics and website design are critical in raising awareness of this disease and may help explain many of the main aspects about this disease that are unknown to individuals. In addition, they may help individuals who are currently struggling with this disease or those who may be affected by this disease in the future.

Chapter 4: Visual Solution

Chapter 4: Visual Solution

There have been many medical discoveries that have enabled diabetes to be manageable and survivable today. However, there has not been the discovery of a cure. Because of this, diabetes contributes to a substantial number of deaths throughout the world. There is still hope that promoting awareness of this deadly disease may deter the number of people that are affected by diabetes in the future. My final visual solution strives to solve the problem that diabetes presents to the world. The visual solution comprises of four small infographics, one large infographic, and a website design. The infographics detail the history of diabetes, type 1 diabetes, prediabetes, type 2 diabetes, pregestational diabetes, and gestational diabetes. The web design incorporates elements including information and imagery from each of the infographics in a location that can be easily accessed by the viewer.

One of the main factors that influenced my design choices was the American Diabetes Association in their Everyday Reality campaign. This campaign utilized color and imagery to capture the attention of the audience. Because of this campaign, I chose to incorporate a color scheme that would connect the urgency of the diabetes epidemic to the audience in order to promote action in raising awareness of this disease. Red, one of the main colors utilized in this campaign, demonstrates a sense of emergency. In this campaign, "recognition of American Diabetes Month and World Diabetes Day, the American Diabetes Association (ADA) aims to create urgency about diabetes, help educate others, break down stereotypes, and to correct myths and misunderstandings surrounding the disease" (MultiVu). Diabetes is predicted to affect more people in the future and there is an urgency to help prevent or delay this disease from occurring in as many people as possible.

This campaign focuses on all types of diabetes and does not exclude diabetic types. When I realized they were inclusive of all types of diabetes, I decided I did not solely want to focus on one type but wanted to be as diverse as possible when creating the infographics to reach as many people as possible. This also affected my choices of integrating information and graphics that not only pertained to the United States, but also the world. Although this campaign utilizes testimonies and imagery of those personally affected by the diverse types of diabetes, this campaign still influences my design choices by creating a design that utilizes color and type to spread the message of diabetes and the impact it has on people of all ages. Diabetes does not discriminate and anyone can be impacted by this disease.

Another campaign which greatly impacted my design choices was the National Diabetes Prevention Program (National DPP) created by the Center for Disease Control and Prevention. This program utilizes infographics to spread awareness about prediabetes and type 2 diabetes. These infographics inspired me to create my own set of infographics for my project. The infographics display statistics on how many people are affected by this disease, health risks, and management techniques. Although the infographics they created primarily focused on prediabetes and type 2 diabetes, I wanted to inform the audience about all the types of diabetes including what they are and how to manage them.

This campaign helped in understanding how to incorporate simple symbols into the design and how the design should be structured in order to create a natural flow of information. It also helped identify how to minimize text to prevent the viewer from being overwhelmed. The use of imagery and text is used in a way that the viewer can understand the information. "People process visual information much faster than text. These infographics make diabetes and prediabetes data easy to understand and visually appealing" (Centers for Disease Control and Prevention).

This campaign also promoted their program and encouraged people to join to help prevent or delay diabetes. Although my infographics were not promoting a program like the ones created for the National DPP, they still benefited in learning how to promote awareness of diabetes and encourage people to understand health complications that are associated with this disease and how to utilize management techniques to prevent or delay diabetes from occurring.

The use of quantitative research used in their project relates to the research I incorporated in my infographics to help demonstrate the severity of the diabetes epidemic and how many individuals that are currently impacted by diabetes including individuals who may be impacted by this disease in the future. Another way this campaign influenced my design choices is the color scheme. These infographics utilized a clam color scheme of blues and greens. However, this does not express the urgency of action needed for the diabetes epidemic. Because of this I decided to incorporate colors that grabbed the viewers' attention and expressed the importance of this problem. This campaign helped influence the imagery, amount of text, color scheme, and flow I would incorporate into my infographics and website design.

Another organization that strives to raise awareness of diabetes and helped influence my visual solutions is the Diabetes Association of Thailand which is a part of the International Diabetes Federation (IDF). The Diabetes Association of Thailand commissioned the designer, Nattakong Jaengsem, who works for Ogilvy and Mather an advertising agency in Bangkok, Thailand to create a series of print posters titled "Sweet Kills" in order to demonstrate the dangers of sugar consumption in relationship to diabetes. This campaign utilized grotesque imagery of body parts in order to scare the audience as a preventive measure for diabetes. It is believed that shock tactics may be effective in the beginning but may burn out over time. "But while shock tactics can be effective to begin with, they tend to burn out. They quickly stop being nauseating, and start to look normal. At this point, advertisers change their tactics... focus[ing] on reinforcing positive behavior rather than drumming home dire consequences. There's less of an emphasis on getting people to flinch; and more on gently nudging people to think" (Mahdawi). This form of imagery has been shown to be ineffective in promoting awareness of this disease.

The visual solutions created by this organization uses grotesque imagery. However, I did not implement this technique when creating my visual solutions because it may not be as effective in promoting awareness of the disease or promoting lifestyle changes in individuals with diabetes. Instead, I used quantitative research on diabetes statistics to inform the visual solutions for my thesis project. This campaign also relates the root cause of diabetes to sugar intake and does not highlight other factors that impact this disease, including family history, disordered eating behaviors, and food insecurity.

Unlike this campaign, I created simple imagery to inform the viewer about diabetes and their associated definitions, symptoms, health complications, and management techniques in order to raise awareness of this disease and did not focus on utilizing scare tactics to promote understanding of diabetes. By doing this, the viewer has a more complete understanding of diabetes and does not solely associate this disease with one factor, such as sugar intake, that may influence its progression. This campaign primarily focused on a large central image with open space around it. Rather than incorporate one image to describe diabetes, I incorporated various images to create interest. Furthermore, this campaign incorporated a small amount of type at the top of each image which was extremely difficult to read. This influenced my choices to incorporate a type that would be legible to the viewer. Because of this campaign I was influenced to utilize multiple images that did not scare the viewer, utilize the amount of space to its fullest extent, and choose a type that would be legible for the viewer.

History of Diabetes

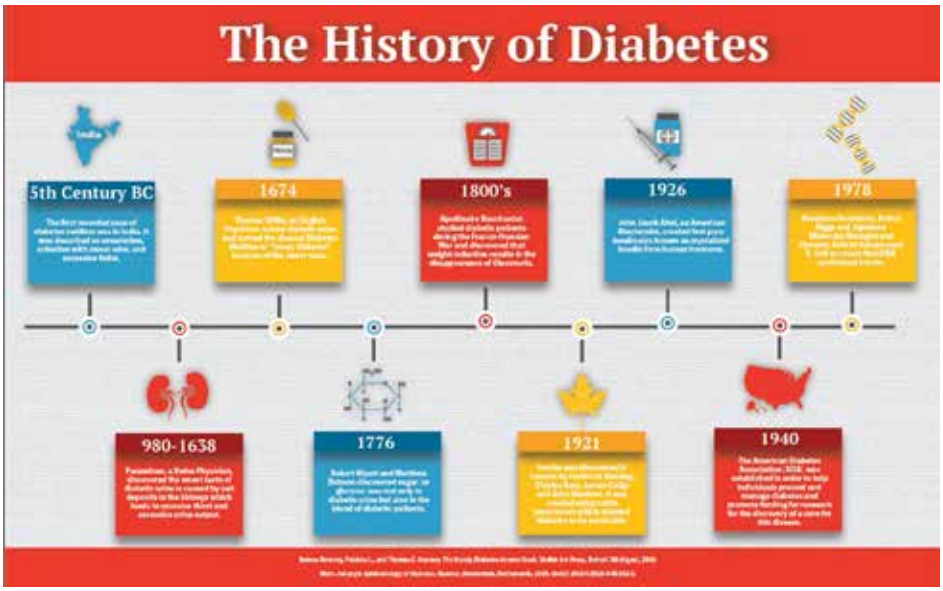


Fig. 52 History of Diabetes Infographic

Figure 52 demonstrates the history of diabetes infographic. This infographic describes important milestones that occurred in diabetes history. Although the root cause of this disease is still unknown, these discoveries allowed diabetes to be survivable. The timeline for this infographic starts with the first case of diabetes discovered in India in the 5th century BC. Between 980-1638 Paraselsus, a Swiss Physician, discovered salt deposits in kidneys which cause the sweet taste of diabetic urine. This results in excessive thirst and urination. It then progresses to the official naming of the disease by Thomas Willis, an English physician, in 1674 because of the sweet taste in diabetic urine. Furthermore, in 1776 Robert Wyatt and Matthew Dobson discovered sugar to be found not only in urine of a diabetic, but also in their blood. During the 1800's, Apollinaire Bouchardat during the Franco-Prussian war found that weight reduction in diabetic patients results in the disappearance of glucosuria. In 1921, the discovery of Insulin by Frederick Banting, Charles Best, James Collip, and John Macleod in Canada by using cattle pancreases. In 1926, John Jacob Abel, an American Biochemist, created the first pure insulin, also known as crystalized insulin from human hormones. In 1940, the American Diabetes Association was created to help individuals prevent or manage diabetes and promote funding for research for the discovery of a cure. Finally, in 1978 Arthur Riggs, an American geneticist, and Keichi Itakure, Japanese molecular biologist and chemist, used E. Coli to create the first DNA synthesized insulin.

Type 1 Diabetes

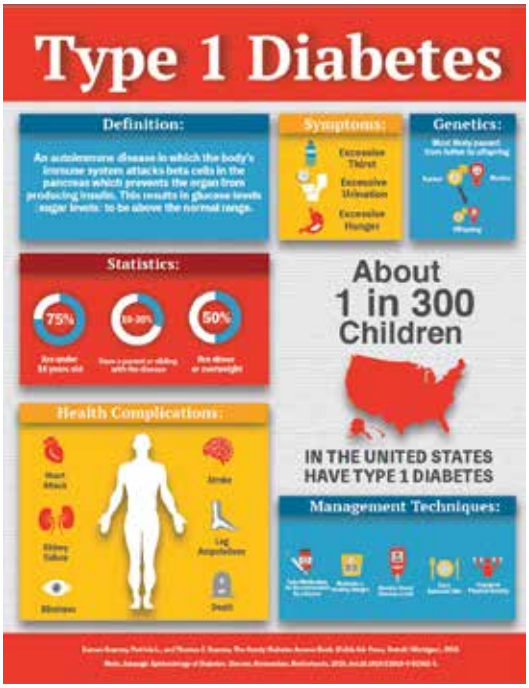


Fig. 53 Type 1 Diabetes Infographic

The other small infographics utilize the same layout. They describe each type of diabetes including their associated definitions and statistics and information that pertains to each type. These infographics also display symptoms, health complications, and management techniques for diabetes. The symptoms include excessive thirst, excessive urination, and excessive hunger. The health complications include heart attack, stroke, kidney problems, leg amputations, blindness, and death. The management techniques include taking medication as recommended by a doctor, maintaining a healthy weight, monitoring blood glucose levels, eating a balanced diet, and engaging in physical activity.

The infographic for type 1 diabetes can be seen in figure blank. It describes that it is an autoimmune disease in which the body's immune system attacks beta cells in the pancreas which prevent the organ from producing insulin. This results in glucose levels above the normal range. This infographic also includes how this type may be affected by genetics and is likely passed from father to offspring. Furthermore, how 1 in 300 children in the United States have type 1 diabetes. Finally, the statistics showcase how 75% are under 18 years old, 10-30% have a parent or sibling with this disease, and 50% are obese or overweight.

Prediabetes and Type 2 Diabetes

Fig. 54 Prediabetes and Type 2 Diabetes Infographic

The infographic for prediabetes and type 2 diabetes can be seen in figure 54. It describes prediabetes as a disease in which the body has either a lack of insulin or the body has an inability to efficiently use insulin produced by the pancreas. This results in the body's glucose levels (sugar levels) to be above the normal range but not enough to be defined as type 2 diabetes. This type also demonstrates how a greater body mass index (BMI) creates a greater risk of developing diabetes. The world map displays the number of adults (age 20 years or older) how have prediabetes. Also, the number of people who have diabetes in the United States. The statistics show 96% of prediabetics are unaware they have this disease. This demonstrates the number of undiagnosed individuals that are currently at risk of developing fatal health complications from this disease. In continuation, 90-95% of diabetic cases are type 2. This demonstrates how prominent this type is. Finally, 80-90% of diabetics have a family history. This shows that there is a genetic factor in the development of diabetes.

Pregestational and Gestational Diabetes

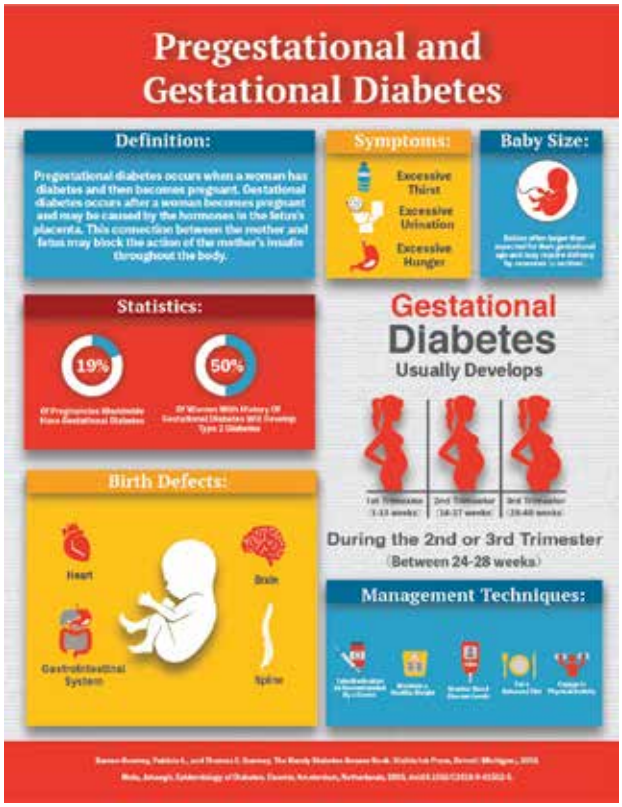


Fig. 55 Pregestational and Gestational Diabetes Infographic

Furthermore, the infographic for pregestational diabetes and gestational diabetes can be seen in figure 55. It describes it as pregestational diabetes occurs when a woman has diabetes and then becomes pregnant. Gestational diabetes occurs after a woman becomes pregnant and may be caused by the hormones in the fetus's placenta. This connection between the mother and fetus may block the action of the mother's insulin throughout the body. This infographic also includes how babies of pregestational, and gestational diabetic women are often larger than expected for their gestational age and may require delivery by cesarean (c-section). A chart describes when gestational diabetes is likely to develop, which is usually between the second and third trimester (between 24-28) weeks. The statistics display that 19% of pregnancies worldwide have gestational diabetes. Furthermore, 50% of women with history gestational diabetes will develop type 2 diabetes. The birth defects that may occur because of these types of diabetes include the heart, brain, gastrointestinal system, and spine.

Large Infographic

Fig. 56 Large Infographic

The large infographic, seen in figure 56, displays all the information contained on the smaller infographics. It also displays the financial aspect of diabetes. $327 billion is spent on diabetes in the United States. In 2040, it is expected to increase to $802 billion. This means that 1 in 4 healthcare dollars is spent on diabetes. This infographic also displays a chart to describe the years of life lost to this disease. It states that diabetes is the 7th leading cause of death in the United States. Males lose an average of 12 years of life. Females lose an average of 19 years of life.

Website Design

Fig. 57 Website Design

Finally, the website design can be seen in figure 57. This visual solution was designed so the viewer could engage with the content in a more effective way. On the homepage it incorporates statistics about how many people are currently affected by diabetes in the world and how many are predicted for the future. A large image of the world map is displayed underneath the statistics. Each webpage incorporates elements from the infographic to inform the viewer of the definition of each type, as well as symptoms, statistics, health complications, and management techniques that are associated with the disease. The final page is dedicated to informing the viewer of their risk for this disease and allows them to answer questions to help understand their own risk. It also shows how many people are affected by diabetes in the world. Furthermore, it displays the death rate for diabetes in the United States and a chart which displays the years of life lost for men and women because of this disease. Furthermore, it reiterates the prediction for diabetes in the future and includes a section for what the viewer can do. Know the facts. Tell the story. Change the world.

Website Design

Fig. 58 and 59 Website Design

Figures 58, 59, as well as 60 and 61 (seen on the next page) demonstrate the webpages dedicated to type 1 diabetes, prediabetes, and type 2 diabetes. At the top of each page is the defintion of each type. Underneath there is a central graphic related to that specific type. For type 1 diabetes it relates to the amount of children in the United States with this type. For prediabetes and type 2 diabetes, it describes the amount of people in the world with prediabetes and the amount of people in the United States with diabetes. For the pregestational diabetes and gestational diabetes webpage, it showcases the pregnancy chart which describes when gestational diabetes usually develops. Each of these webpages also include the symptoms, health complications, and management techniques for this disease. They each also incorporate their own statistics that relate to each type. For the final page of the website it details a page to know you risk for the disease.

Website Design

Fig. 60 and 61 Website Design

By creating these visual solutions, undiagnosed and diagnosed individuals can be educated on the definitions, symptoms, health complications, and management techniques, which will help reduce their individual risk for developing severe or fatal health conditions in the future. There is an urgency to raise awareness of this disease in order to prevent the substantial number of people that are predicted to be affected by this disease in the future. Diabetes education is vital in understanding an individual's risk for this disease. Raising diabetes awareness can also promote research and the discovery of a cure. My visual solutions are one way in which to spread diabetes awareness and promote education on this disease. By raising awareness of this disease, a life can be saved.

Chapter 5: Conclusion

Chapter 5: Conclusion

In summation, diabetes is an incurable disease whose root cause is still unknown. Many diagnosed and undiagnosed diabetic individuals fail to manage their diabetes which may lead them to develop fatal health complications. Understanding the diverse types of diabetes including type 1 diabetes, prediabetes, type 2 diabetes, pregestational diabetes, and gestational diabetes as well as their associated symptoms, health complications, and management techniques can help prevent or delay this disease from occurring. Diabetes is impacted by many factors such as family history, disordered eating behaviors, and food insecurity. Death rates due to diabetes may not accurately portray the devastating amount of people that are currently affected by this disease. To help resolve this problem, I have studied campaigns such as the Everyday Reality campaign by the American Diabetes Association, the National Diabetes Prevention Program by the Center for Disease Control and Prevention and the Sweets Kill campaign by the Diabetes Association of Thailand.

By studying these campaigns, I was able to develop my own theoretical solution of several infographics and a website design by promoting awareness of this disease. These visual solutions are one way to help solve the problem of diabetes epidemic in the world. One way to test the viability of these solution would be to record the response of focus groups that interact with the infographics and website design I have created to see if the information and visuals promote understanding of the disease and the effects it has on one's health. The visual solutions could be displayed in physician offices to help explain what diabetes is to those who are currently unaware of this disease. They could also be used to explain to newly diagnosed individuals about their current diagnosis.

Before coming to Liberty University, my artistic journey primarily consisted of acrylic painting and hand building ceramic sculptures. Through my time in the graphic design program and during this thesis process, my design skills have been immensely impacted. I have learned that researching a topic is a valuable step in developing a final solution that is effective in instigating curiosity and action. I have continued to grow in my understanding of design elements including shape, color, space, form, line, value, and texture and how to integrate these elements together to create the best possible solution. This thesis project has inspired me to continue to learn and grow in my understanding of graphic design elements so I can better communicate my topic and connect with the viewer.

Not only have I learned about graphic design elements, but my knowledge has grown deeper in my connecting and working on a topic that is deeply personal. Although it may be painful it can also produce rewarding outcomes. It has allowed me to connect diabetes as a disease that has not only hurt my family, but many others out in the world and given me the passion to help others in their battle with this disease. Furthermore, to immerse myself in projects I am passionate about in my future endeavors.

It is my hope that my thesis project can be used to help raise awareness of this disease and inspire others to make their health a priority and prolong their life. I also hope to inspire individuals to step up and help fight the battle against this deadly disease by promoting the discovery of a cure so future generations may know a world in which diabetes does not exist. Although the future may look bleak for those with diabetes, the story of diabetes is not over. There is still time to change the ending. You can support this cause by sharing the diabetes infographics on social media such as Facebook, Instagram, and Twitter to help spread awareness of this disease and change the outcome for the future.

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