Science Fair Logbook

By: Jiya Sidhu

September 10, 2024:
Today I had my first science fair meeting. We talked about the three different types of projects, study, innovation, and experimental.

October 1, 2024:
Question and project type:
I will be doing a study project and my question(problem) is; What is celiac disease and how can it be treated?

October 4, 2024:
Problem:
“The numbers of people getting diagnosed with celiac are increasing, and it is extremely important that everybody is aware about what it is and how it affects individuals with this disease. Many people diagnosed with celiac could be struggling with staying on their diet or getting the right amount of nutrients, so knowing what causes it, the nutrients that they are low in, and which genetics affect the likelihood of developing celiac is important to figuring out a different medication or possibly an immunization. Thus, my project looks into what celiac disease is and how it can be treated.”

October 6, 2024:
Objective:
The objective of my project is to raise awareness about what celiac disease is and ensure that everybody knows how severe it can be if somebody with celiac disease eats gluten and why it is so severe. Knowing the difference between gluten intolerance and celiac disease is very important, so I will ensure that I include this topic in my research. I also want to try and figure out if there is any treatment for celiac disease other than going on a gluten free diet.

October 8, 2024
Key Terms:
- Villi
- Small intestine
- Gluten free diet
- Genetics
- Deoxyribonucleic Acid (DNA)
- T cells Lymphoma (EATL) [1]
- Non-Hodgkin’s lymphoma
- Cells

October 10, 2024

Research Questions:

- What is celiac disease?
- What causes celiac disease?
- Once the villi are damaged from celiac disease can they recover back to normal?
- How do genetics affect the likelihood of developing celiac disease?
- How does switching to a gluten-free diet affect the overall nutritional intake of individuals with celiac disease?
- Can you detect whether or not you are going to develop celiac disease in the future?
- Gluten Intolerance vs Celiac Disease
- Can you develop Celiac disease from being Gluten Intolerant?
- Why are the numbers of people getting diagnosed with celiac disease growing?
- Does nationality or age affect the number of people that are diagnosed with celiac disease?
- Is there any other treatment for celiac disease other than going on a gluten free diet?

October 12, 2024

Monthly plan:

October	☐ Forming my problem and finalizing a type of project ☐ Look at the rubric for a study project ☐ Plan my project ☐ Come up with research questions ☐ Come up with key terms related to celiac disease ☐ Create my method ☐ Objective ☐ Villi ☐ Small intestine ☐ Gluten free diet ☐ Genetics ☐ Complete Ethics with CYSF ☐ Deoxyribonucleic Acid (DNA) ☐ Cells
November	☐ T cells Lymphoma (EATL) ☐ Non-Hodgkin's lymphoma ☐ What is celiac disease? ☐ What causes celiac disease? ☐ Once the villi are damaged from celiac disease can they recover back to normal? ☐ How do genetics affect the likelihood of developing celiac disease?
December	☐ How does switching to a gluten-free diet affect the overall nutritional intake of individuals with celiac disease? ☐ Can you detect whether or not you are going to develop celiac disease in the future? ☐ Gluten Intolerance vs Celiac Disease ☐ Can you develop Celiac disease from being Gluten Intolerant? ☐ Why are the numbers of people getting diagnosed with celiac disease growing?
January	☐ Does nationality or age affect the number of people that are diagnosed with celiac disease? ☐ Is there any other treatment for celiac disease other than going on a gluten free diet? ☐ Make graphs and Diagrams ☐ Interview Dr. Iwona Wrobel ☐ Form Conclusion ☐ Future Spinoff

	☐ Receive tri fold from Ms.Bretner
February	☐ Work on showcasing my project ☐ Practice Presenting and answering questions

October 13, 2024

Method:

Defining scientific/key terms:

I will initiate my research by defining key terms correlated to my project. These include villi, small intestine, gluten free diet, cells, T cells lymphoma (EATL), genetics, deoxyribonucleic acid (DNA), non-hodgkin's lymphoma.

Research:

Secondly, I will research further into celiac disease, to learn what it is, what causes it, and what are the different ways that it can be treated. The questions that I will be researching are:

Data Collection:

Next I will use all of the data I have collected to make graphs and tables, so that the data is formatted clearly.

Now What?:

After concluding what celiac disease is and how it can be treated, it is important that I think about how it can be applied in the real-life world. It is extremely important that everybody is aware about what celiac disease is and the restricted diet that individuals with celiac disease have to follow.

Various Sources:

I am going to research various sources of text and media, to ensure the quality of my information. Throughout my project, I will research on trusted websites, online resources, and media sources which could include documentaries. I will also be interviewing Dr. Iwona Wrobel, who is a gastrointestinal doctor.

Objective:

The objective of my project is to raise awareness about what celiac disease is and ensure that everybody knows how severe it can be if somebody with celiac disease eats gluten and why it is so severe. Knowing the difference between being gluten intolerant or having celiac disease is very important, so I will ensure that I include that in my research. I also want to try and figure out if there is any treatment other than going on a gluten free diet.

October 15, 2024:

Villi:

Villi are tiny hair-like projections that line the inside of the small intestine. Villi contain blood vessels and help absorb nutrients, which are very important for our body to get. They absorb nutrients into capillaries which are in the circulatory system and lacteals which are a part of the lymphatic system. Villi contain capillary beds along with lacteals, acids that are absorbed from broken down chyme go into the lacteals. Other nutrients that are absorbed by the ville enter the bloodstream through the capillary beds and go directly to the liver.

October 18, 2024:

Small intestine:

The small intestine is part of the digestive system, it is an organ shaped like a tube that connects the stomach and the large intestine. The length of it is around 20 feet long and for it to fit inside your abdomen it folds many times. There are three different parts to the small intestine, which are the duodenum, jejunum, and ileum. The role the small intestine plays is digesting the food that comes through the stomach and absorbing nutrients and water from food, so that they can be used by the body.

Gluten-free diet:

A gluten free diet is when you follow a diet without eating foods containing gluten. Gluten is a protein found in wheat, barley, rye, and triticale. In many foods you may notice that these ingredients are listed as may contain. It is important that nobody with celiac disease eats something which may contain these ingredients because they were made in the same factory as foods that contain gluten. A gluten free diet is what somebody with gluten intolerance and celiac disease follows.

October 21, 2024:

Genetics:

Genetics is the study of genes and heredity. Genes are small sections of the chain of DNA. They vary in size and humans approximately have between 20,000 and 25,000 genes. People inherit two sets of chromosomes, one from each parent, which is why people have two copies of genes. Heredity is the passing of genetic information and traits, such as your physical appearance and increases the chance of you developing a certain disease.

October 23, 2024:

Basic Project Information:

Today I completed my Basic Project Information on the CYSF platform.

October 24, 2024:

Ethics Due Care 2A:

I completed my Ethics Due Care 2A and sent it to get reviewed.

Deoxyribonucleic acid(DNA):

Deoxyribonucleic acid is the molecule that carries genetic information for the functioning and development of an organism. It is made out of two linked strands that wrap around each other and resembles a double helix. Each of the strands has a backbone which is made out of alternating sugar and phosphate groups. Each of these sugars has one of these four bases attached to them: adenine(A), cytosine(C), guanine(G), or thymine(T). An A base always pairs with a T base and a C base always pairs with a G base. By reordering these four bases in long DNA sequences, multiple combinations are possible. This is why there is a unique DNA sequence for every protein in our bodies, including the sequences that determine our traits.

October 25, 2024:

Cells:

Cells are an extremely important part of our bodies. They provide structure for the body, form all of the tissues and organs of the body, take in nutrients from food and convert those nutrients into energy, contain the body's hereditary material, and most importantly are the structural, functional, and biological units of all organisms. The average adult male human has approximately 36 trillion cells, while adult females have 28 trillion and children have about 17 trillion. Each cell contains a fluid called the cytoplasm, which is enclosed by a membrane. Inside of the cytoplasm are several biomolecules, which include proteins, nucleic acids, and lipids. Cells can be classified into two types, prokaryotic cells and eukaryotic cells. Prokaryotes are cells that are lacking in nucleus and membrane organelles. They have a simpler structure and include bacteria. Eukaryotic cells do have nucleus and membrane bound organelles. The purpose of organelles in eukaryotic cells is to organize cellular functions. They are larger and have a more complex cell structure.

October 31, 2024:

Non-Hodgkin Lymphoma:

Non-Hodgkin's lymphoma is a cancer that starts in lymphocytes, which is a type of blood cell. It often starts in a group of lymph nodes, which could include the neck, above the collar bone, under the arms, in the abdomen, or in the groin. The different types of non-hodgkin's lymphoma are described by the type of lymphocyte of where the lymphoma starts. An example is that the B-cell lymphoma starts in the B cells and the T cell lymphoma starts in the T cells. T cell lymphoma is the lymphoma that is related to celiac disease.

T cells Lymphoma (EATL):

EATL is an extremely rare non-Hodgkin lymphoma, which is a disease that has a very small chance of recovering with approximately a five year survival. EATL can be associated with celiac disease because if celiac disease is untreated patients have a very high risk of developing EATL, especially if they are diagnosed with celiac disease at an earlier age. Managing celiac disease with a gluten free diet can decrease the chance of developing EATL. EATL is rare to develop, although it is more common in males rather than females.If 11,700 people are diagnosed with EATL, approximately 3,100 will die from it. EATL is most likely developed in people who do not treat their celiac disease, although it can also develop in other ways.

November 8, 2024:

Ethics Due Care 2A:

My Ethics Due Care 2A got approved.

November 14, 2024:

What is celiac disease?:

Celiac disease is an autoimmune disease where the ingestion of gluten will lead to damage in the small intestine. Eating gluten can lead to damage on the villi, which are extremely important for nutrient absorption. Celiac disease can also lead to other long term health conditions, although the younger age that you get diagnosed at lowers the chance of developing another condition. This disease is hereditary, as it runs in families. If you are a first degree relative with somebody that has celiac then you have a one in ten chance of developing it as well. There are two different ways currently used to identify whether you have celiac disease. These include blood work and biopsy. Blood work checks the level of infection fighting cells you have to gluten in your body. A person with celiac disease would have a higher number of these cells. A biopsy is one of the most accurate ways to check if you have celiac disease. A tissue sample, which is called a biopsy is taken from your small intestine to check for any damage to the villi. To do this, an endoscope is put in your mouth, down your stomach, and into the small intestine. The tissue sample passes through the endoscope. Celiac disease is an autoimmune disease that damages the villi on your small intestine and can be difficult to identify.

November 19, 2024:

What causes celiac disease?:

Celiac disease can be developed because of many reasons. You could have been eating gluten for a very long time before you got diagnosed. The body would have a reaction after eating gluten for a while and the small intestine could begin to become extremely sensitive towards gluten and no longer be able to intake nutrients from what is being digested. This is because celiac disease has a genetic predisposition to it. Another time you have a higher chance of developing this disease is after surgery, pregnancy, childbirth, a viral infection, or severe emotional stress. It is also more common if you have type 1 diabetes, down syndrome, william syndrome, or turner syndrome, thyroid disease, microscopic colitis, addison's disease, or if a family member has dermatitis herpetiformis, which is an itchy, blistering skin that will usually appear on the elbows, knees, buttocks, torso, spine, or scalp. There are many causes as to why you people are diagnosed with celiac disease. Some things can make the risk if developing it higher, although genetics plays the largest role in causing celiac disease.

November 28, 2024:

Once the villi are damaged can they return back to normal?:

Once you have removed gluten from your diet completely, symptoms will begin to get better within weeks, meanwhile the small intestine will take 4-6 months to heal. Although, if you are older then it can take up to 2 years. The amount of time it takes for the villi to heal completely can also differ according to how much they were harmed. It is extremely important that once you are diagnosed, a strict gluten free diet is followed, or else it will take longer for the villi and small intestine to heal. Therefore, once the villi are damaged they can return back to normal over a couple years.

December 8, 2024:

How do genetics affect the likelihood of developing celiac disease?:

Celiac disease affects the chances of getting diagnosed with celiac disease as it is hereditary. People with a first degree relative with celiac disease have an estimated 1 in 10 chance of developing the disease themselves. Approximately 1 in 100 people are affected worldwide, although only 30% get properly diagnosed. This disease will usually occur in people who have a gene called HLA-DQ2 or HLA-DQ8. Around 30% of people have one of these genes, although only 3% of people develop celiac disease. Many people who have celiac will also have at least one of these genes. There can be extremely rare cases when a person will not have these genes but still be diagnosed with celiac disease. All in all, celiac disease is hereditary and the genes that a person will most likely have are HLA-DQ2 or HLA-DQ8.

December 17, 2024:

How does switching to a gluten-free diet affect the overall nutritional intake of individuals with celiac disease?:

Once you have gone on a gluten free diet, the small intestine will begin to heal and the villi will begin to absorb nutrients again, although with this diet it is difficult to get aloof the nutrients you normally would. Normally, when eating a whole grain bread you would get nutrients such as, iron, calcium, and fibre. A gluten free diet will change the nutrients you are getting from food, as some foods might have less iron or higher sugar and fat contents. Removing gluten from your diet changes the overall intake of fibre, vitamin A and B, magnesium, calcium, and iron regardless of the reason as to why you are following this diet. Mediac; conditions that would need somebody to follow this diet would be celiac disease, gluten sensitivity, gluten ataxia, and a wheat allergy. It is important that somebody with celiac disease is getting their blood work done annually to monitor any changes in their nutritional intake and numbers of celiac. Once a gluten free diet is being followed, the villi will begin to grow and collect nutrients, although it is difficult to find the nutrients that are needed in gluten free foods.

December 22, 2024:

Email to Dr. Wrobel for an Interview:

Hi Dr. Wrobel,

I hope you are doing well.
I was one of your patients that got discharged this year.

I am doing a science fair project about celiac disease and would like to interview you and get some questions answered to support my research about celiac disease. Could you please let me know what the best way is to connect with you, either by an appointment, email, or call. Thank you for your time in advance.

Kind Regards
- Jiya Sidhu (January 2, 2013)

December 26, 2024:

Email to Canadian Celiac Association for an Interview:

Dear Canadian Celiac Association,

My name is Jiya Sidhu and I attend STEM Innovation Academy in Calgary and I am in grade 7. I am doing a science fair project about the genetics related to celiac disease and how your nutritional intake gets affected with a gluten free diet. I got inspired to look into it because I have celiac disease myself.

I would appreciate it if I could get some support on my research and get some questions I have answered. I am very passionate about learning more about the disease and genes that I carry, along with making my project as successful as I can. These are some of the questions that I have and if you have any other additional facts, I would love it if you could share them.

- What causes celiac disease?
- Once the villi are damaged from celiac disease can they recover back to normal?
- How do genetics affect the likelihood of developing celiac disease?
- How does switching to a gluten-free diet affect the overall nutritional intake of individuals with celiac disease?
- Can you detect whether or not you are going to develop celiac disease in the future?
- Gluten Intolerance vs Celiac Disease
- Can you develop Celiac disease from being Gluten Intolerant?
- Why are the numbers of people getting diagnosed with celiac growing?
- Does nationality or age affect the number of people that are diagnosed with celiac disease?
- Is there any other treatment for celiac disease other than going on a gluten free diet?

Thank you so much for taking out time to help me with this project.

Sincerely,

Jiya Sidhu
STEM Innovation Academy
jiyasidhu02@gmail.com
jiyas656@stemia.ca

December 29, 2024:

Message to Celiac Disease Foundation for an Interview:

I attend STEM Innovation Academy and I am doing a science fair project about the genetics related to celiac disease and how your nutritional intake gets affected with a gluten free diet. I got inspired to look into it because I have celiac disease myself.

I would appreciate it if I could get some support on my research and get some questions I have answered. I am very passionate about learning more about the disease and genes that I carry, along with making my project as successful as I can. These are some of the questions that I have and if you have any other additional facts, I would love it if you could share them.

- What causes celiac disease?
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Thank you so much for taking out time to help me with this project.

December 30, 2024:

Can you detect whether or not you are going to develop celiac disease in the future?:

One way you can see if you have celiac disease is by doing a genetic test. This test can also help with seeing if you have the possibility of developing celiac in the future. If you have a first degree relative with the disease then it is a good idea to get a genetic test every 2-3 years. If you have gotten negative on the genetic test multiple times, you can move onto a gene test. If the gene test is also negative, then the person can stop regular screening as they would have a small chance of developing celiac disease. Since celiac disease is an autoimmune disease you can still develop it at any time, so it is important that you still do screening for celiac, although you probably have a very small chance of developing it. 25-30% of people have HLA-DQ2 or HLA-DQ8, so if you get a genetic test and have one of these genes, it is not certain that you have celiac disease. Thus, it is possible to know partially if you will develop celiac in the future, although you can have the genes and still not have celiac disease or not have the genes, but still have celiac disease. It is extremely important that you are screened frequently if you have a first degree relative with this disease, even though it may not be positive the first time.

December 31, 2024:

Celiac Disease vs Gluten Intolerance:

Celiac disease is when eating gluten triggers an autoimmune reaction that causes damage to the villi on the small intestine.You will not feel any symptoms within minutes, although your stomach may begin to ache. Meanwhile, gluten intolerance is when you have sensitivity to gluten. There is no damage done to the inside of the body as it is an immediate reaction such as a headache, bloating, or hives. You can treat it as simply as cutting back on foods with gluten, rather than eliminating them completely. Somebody with celiac disease has to stop eating gluten for the rest of their life, although you can still eat gluten with gluten intolerance as it is only a sensitivity. There is no genetic component related to gluten intolerance and can disappear after a certain amount of time if you begin to slowly introduce gluten to your diet again. Celiac disease and gluten intolerance are extremely different because they affect the body in very different ways.

January 1, 2025:

Can you develop celiac disease from being gluten intolerant:

Celiac disease can develop at any age once you start consuming gluten, most likely if you have the genes. Having gluten sensitivity does not trigger the villi to no longer be gathering nutrients. This is because celiac disease and gluten intolerance are both very different. Celiac disease normally does not have any external symptoms, meanwhile gluten intolerance would have external symptoms, such as abdominal pain, bloating, constipation, diarrhea, headaches, or vomiting. You can get these symptoms depending on how much your body can tolerate. Many people do not have to watch how much gluten they are having because no symptoms occur when they digest it. Consuming gluten is what starts celiac, meaning that if you have already limited the amount that you are eating, then it is very rare that the villi will begin to shrink. All in all, celiac disease does not develop from being gluten intolerant because they do not have any connection to how the gluten is harming the body.

January 2, 2025:

Email from Dr. Wrobel:

Hello Jiya,

I would be very interested to hear more about your project. I don't know your timelines as I am away until Jan 13.
If it can wait until after please connect with Randolph, my administrative assistant to schedule time for us to talk.

All the best in the New Year and your project.

Iwona Wrobel

January 3, 2025:

Why are the numbers of people getting diagnosed with celiac disease growing?:

Celiac disease is growing as the results are showing that the average number of people diagnosed with celiac disease are growing by an average of 8 percent every year. Some of the reasons that celiac disease is becoming more common is because of improved awareness and more accurate diagnosing, for example blood testing and biopsy. If a baby is fed too much gluten earlier on in life, it may result in immune reactions later on. What we have been doing with gluten has also changed a lot, making celiac more common. The amount of gluten and fast food that people are eating has plummeted in large amounts over the past couple of decades which also affects the number of people getting diagnosed. The incidence of being diagnosed has started to go lower in some parts of the world because people begin to follow a gluten free diet before being diagnosed, making it harder to know if they have celiac disease. Ultimately, the main reasons as to why celiac disease is growing is because of people eating gluten that can harm the body, as it is being used differently from how it was before. Medical equipment has advanced in the past 15 years in a fair amount, making it easier to diagnose celiac disease.

January 4, 2025:

Does nationality or age affect the number of people that are diagnosed with celiac disease?:

As a person gets older and has untreated celiac disease, they have a very high chance of getting other medical conditions such as low bone density, GI issues, and possibly the development of cancer. Untreated celiac will not affect a child as much, with such terrible conditions, although the small intestine may not be able to get healed. The amount that the intestine gets affected does not vary through age. If you are diagnosed with celiac at an early age, there are less chances that you will develop another autoimmune condition. Therefore, age does not affect the number of people that are diagnosed with celiac disease, although the chances of developing other medical conditions at an older age are higher. North Africans, Europeans, northern and western Indians have a higher chance of developing celiac disease as it has been shown over years of data. In North India it had been reported that the overall prevalence of celiac disease was 1.44%, meanwhile the overall prevalence in the world was 1.04%. Celiac is extremely rare among East Asians, sub-Saharan Africans, and African Americans because they tend to carry the two genes less, meanwhile some nationalities tend to carry these genes and develop celiac disease. All nationalities still have a percentage of diagnosis with celiac disease although some are higher, and others are lower.

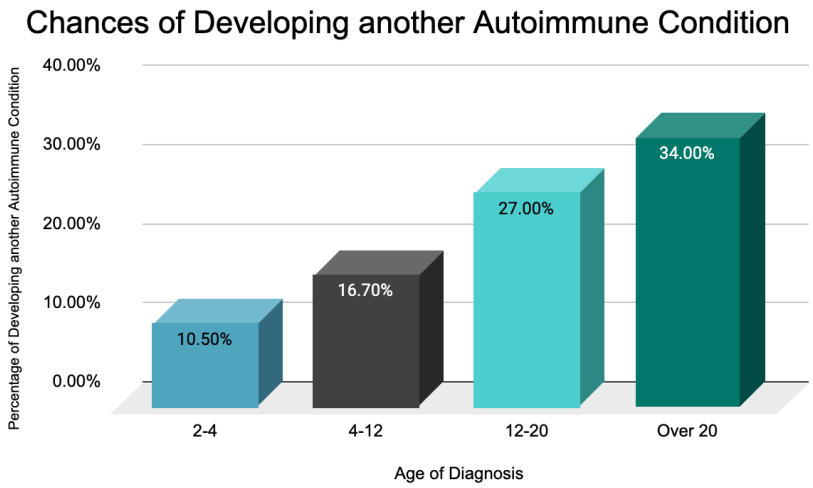
January 5, 2025:

Is there any other treatment for celiac disease other than going on a gluten free diet?:
The safest way to treat celiac disease that is currently available is a gluten free diet, although many are in the work to make other treatments. An enzyme therapy is one of those treatments. It is coadministration of prolyl endopeptidases, which are endoproteolytic enzymes expressed by both microorganisms and plants. IMU-856 is a small molecule modulator that targets a protein that acts as a transcriptional regulator in the intestinal barrier. Genetically modified gluten is also another solution, as they are trying to keep the same amount of nutrients in gluten free food, although it can be hard without having gluten in it. A peptide based therapeutic vaccine is being developed to modify the T-cell response. Currently it is only working with patients that have the HLA-DQ2 gene. Two treatments that are almost in full development are engineered gluten free grains and inducing oral tolerance to gluten with a therapeutic vaccine.

January 8, 2025:

Graphs and Tables:

2-4	4-12	12-20	Over 20
10.50%	16.70%	27.00%	34.00%

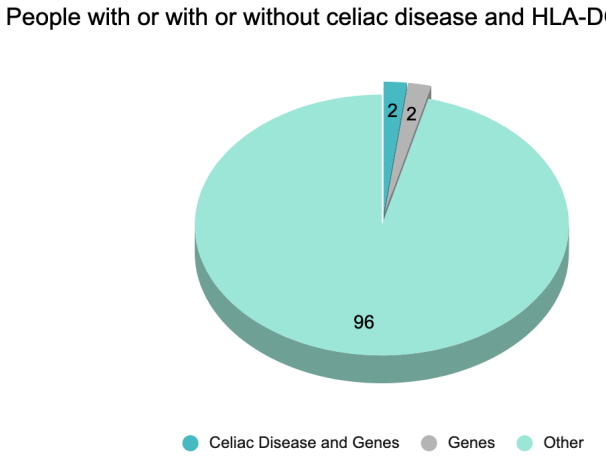


The graph above is showing how high the chances are of somebody with celiac disease developing another autoimmune disease. You can see that as the older you are when you are diagnosed there are more chances of developing another condition as it is 34%, meanwhile if you are between 2 and 4, then the chances are only 10.5%. This graph proves that the older you get diagnosed with celiac disease, the more likely you are to develop another autoimmune condition.

January 9, 2025:

Graphs and Tables:

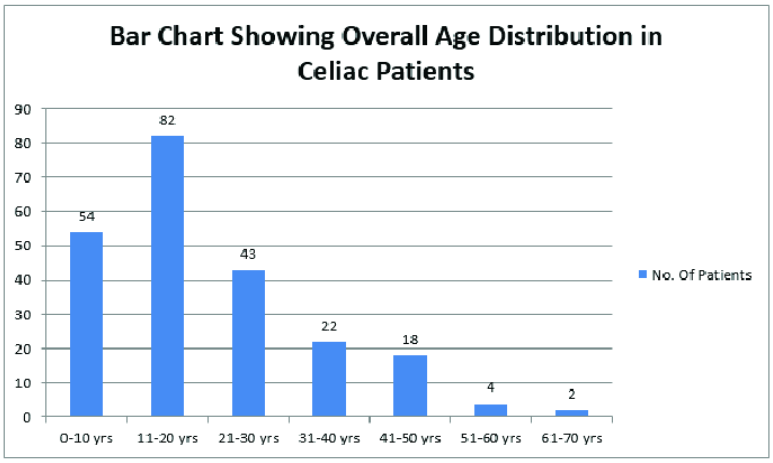
	People
Celiac Disease	2
Genes	2
Other	96



This pie chart is showing the amount of people with celiac disease or the two genes out of 100. 4/100 people have HLA-DQ2 or HLA-DQ8, although only 2/100 end up getting diagnosed with celiac disease. The other 96 people are not bothered at all and do not have the genes or celiac disease. It is shown that only 2% of people actually have celiac disease.

January 11, 2025:

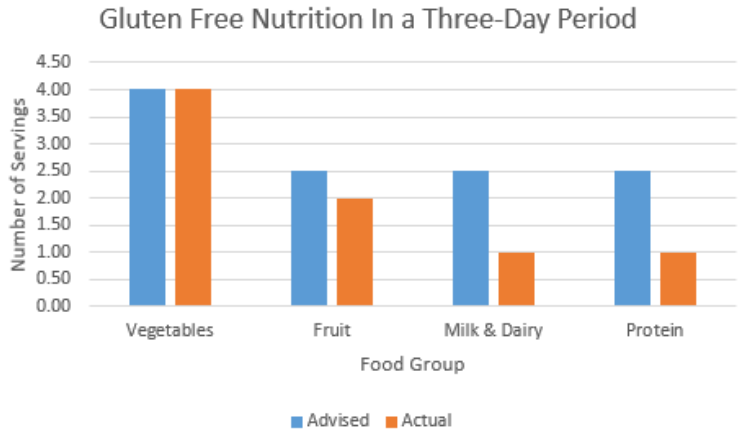
Graphs:



This bar chart is showing the number of patients throughout age distribution for when they were diagnosed with celiac disease. You can notice the pattern starting off from 11-20 years of age, as the diagnosis begins to become a lot lower in the later years of life. 0-10 is very similar in numbers compared to 21-30 as they are both close to the age range where it is highest, at 82 people. It is showing how the number of patients that get diagnosed with celiac disease can be very high, or even extremely low depending on the age range.

January 14, 2025:

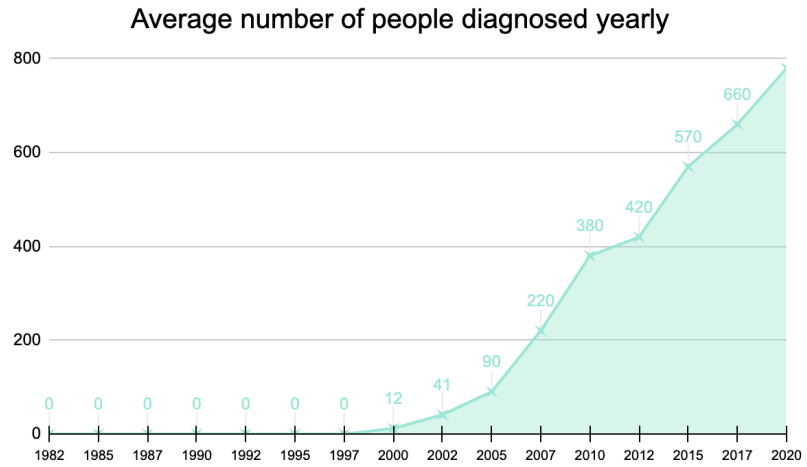
Graphs:



The graph is showing how the nutrients you are getting from a gluten free diet, are very different from what you should be intaking. Protein and dairy are extremely low when somebody is on a gluten free diet, meanwhile vegetables typically stay the same and fruit can vary a little bit, but is not extremely low. You can see that the nutrients from a gluten free diet are lower than what they should be.

January 15, 2025:

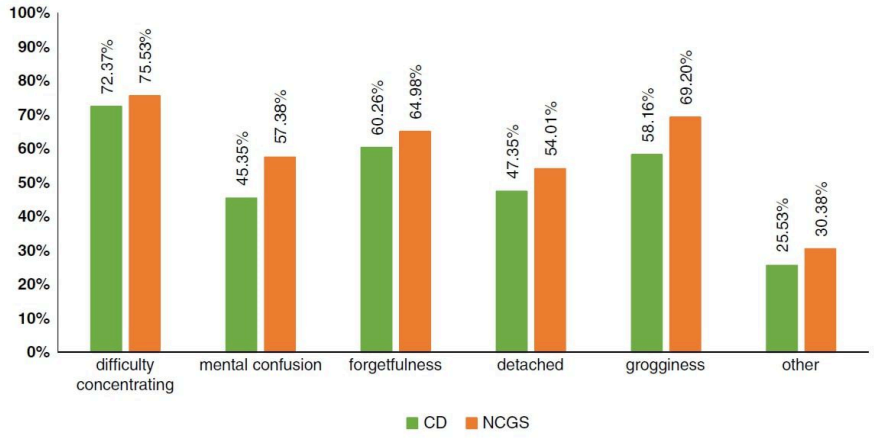
Graphs:



The graph above shows the average number of people diagnosed yearly. It shows data after a couple of years, although the main purpose of this graph is to see the pattern from before, compared to a few years ago. There are many components in healthcare that must have been needed to change the number by so much. The largest difference is the ability test if somebody has the disease, and knowing not to wait too long if they know they have the gene. The pattern continued to grow in the graph and is still growing up until today.

January 17, 2025:

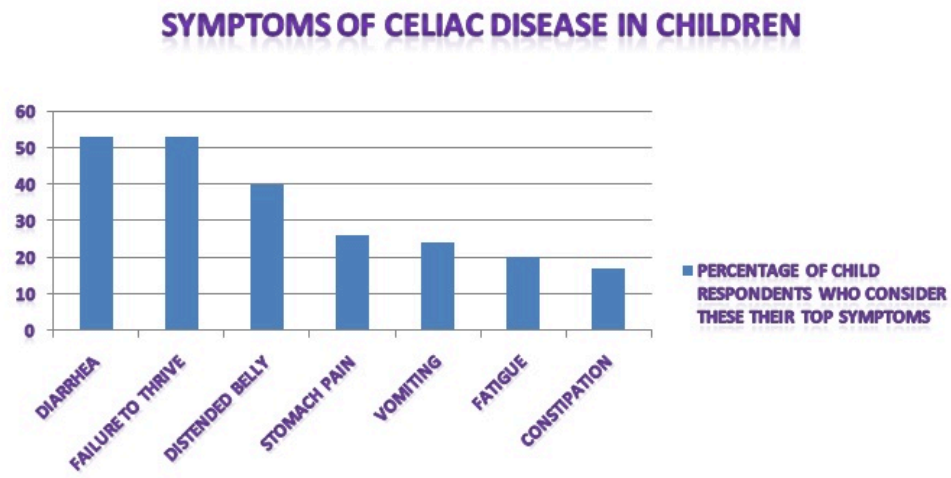
Graphs:



This graph looks at celiac disease and non celiac gluten sensitivity. It shows their symptoms and how it affects people. People with CD and NCGS both have difficulty concentrating, mental confusion, forgetfulness, get detached, and grogginess, but usually people with NCGS have a higher chance of having these symptoms compared to individuals with celiac disease.

January 21, 2025:

Graphs:



The graph is showing the symptoms that were most common in children. Diarrhea and a failure to thrive were the highest, meanwhile constipation was extremely low. These symptoms can vary depending on the person, although these six different symptoms are most common.

January 23, 2025:

Interview with Dr. Wrobel:

As of today, I gathered information from Dr. Iwona Wrobel who is a gastrointestinal doctor. I was able to gather a lot of research and expand my knowledge even more about this disease.

January 24, 2025:

Today I included the information that I gathered from Dr. Wrobel into my research.

What is celiac disease?:

Celiac disease is an autoimmune disease where the ingestion of gluten will lead to damage in the small intestine. Eating gluten can lead to damage on the villi, which are extremely important for nutrient absorption. Celiac disease can also lead to other long term health conditions, although the younger age that you get diagnosed at lowers the chance of developing another condition. This disease is hereditary, as it runs in families. If you are a first degree relative with somebody that has celiac then you have a one in ten chance of developing it as well. There are two different ways currently used to identify whether you have celiac disease. These include blood work and biopsy. Blood work checks the level of infection fighting cells you have to gluten in your body. A person with celiac disease would have a higher number of these cells. A biopsy is one of the most accurate ways to check if you have celiac disease. A tissue sample, which is called a biopsy is taken from your small intestine to check for any damage to the villi. To do this, an endoscope is put in your mouth, down your stomach, and into the small intestine. The tissue sample passes through the endoscope. Celiac disease is an autoimmune disease that damages the villi on your small intestine and can be difficult to identify.

What causes celiac disease?:
Celiac disease can be developed because of many reasons. You could have been eating gluten for a very long time before you got diagnosed. The body would have a reaction after eating gluten for a while and the small intestine could begin to become extremely sensitive towards gluten and no longer be able to intake nutrients from what is being digested. This is because celiac disease has a genetic predisposition to it. Another time you have a higher chance of developing this disease is after surgery, pregnancy, childbirth, a viral infection, or severe emotional stress. It is also more common if you have type 1 diabetes, down syndrome, william syndrome, or turner syndrome, thyroid disease, microscopic colitis, addison's disease, or if a family member has dermatitis herpetiformis, which is an itchy, blistering skin that will usually appear on the elbows, knees, buttocks, torso, spine, or scalp. There are many causes as to why you people are diagnosed with celiac disease. Some things can make the risk if developing it higher, although genetics plays the largest role in causing celiac disease.

Once the villi are damaged from celiac disease can they return back to normal?:
Once you have removed gluten from your diet completely, symptoms will begin to get better within weeks, meanwhile the small intestine will take 4-6 months to heal. Although, if you are older then it can take up to 2 years. The amount of time it takes for the villi to heal completely can also differ according to how much they were harmed. It is extremely important that once you are diagnosed, a strict gluten free diet is followed, or else it will take longer for the villi and small intestine to heal. The villi recover completely if you follow a strict gluten free diet. "Even if the villi are completely flat they can still recover over several months. Biopsies and endoscopies are used to check the health of villi." Therefore, once the villi are damaged they can return back to normal over a couple years.

How do genetics affect the likelihood of developing celiac disease?:
Genetics affect the chances of getting diagnosed with celiac disease as it is hereditary. People with a first degree relative with celiac disease have an estimated 1 in 10 chance of developing the disease themselves. Approximately 2 in 100 people are affected worldwide, although only 30% get properly diagnosed. This disease will usually occur in people who have a gene called HLA-DQ2 or HLA-DQ8. Around 30% of people have one of these genes, although only 3% of people develop celiac disease. “HLA - DQ2 and HLA - DQ8 can be subdivided into multiple different genes. Every person has a different part of the genetic where the gluten hits it and gives them an autoimmune reaction. The position of these genes determines if you have celiac disease or not. They must be positioned in a certain way for the gluten to trigger it.” Many people who have celiac will also have at least one of these genes. “4 in 100 people have the gene and only 2 in 100 have celiac disease”. There can be extremely rare cases when a person will not have these genes but still be diagnosed with celiac disease. All in all, celiac disease is hereditary and the genes that a person will have are HLA-DQ2 or HLA-DQ8.

How does switching to a gluten-free diet affect the overall nutritional intake of individuals with celiac disease?:
Once you have gone on a gluten free diet, the small intestine will begin to heal and the villi will begin to absorb nutrients again, although with this diet it is difficult to get a lot of the nutrients you normally would. Normally, when eating whole grain bread you would get nutrients such as iron, calcium, and fibre. A gluten free diet will change the nutrients you are getting from food, as some foods might have less iron or higher sugar and fat contents. Removing gluten from your diet changes the overall intake of fibre, vitamin A and B, magnesium, calcium, and iron regardless of the reason as to why you are following this diet. Medical conditions that would need somebody to follow this diet would be celiac disease, gluten sensitivity, gluten ataxia, and a wheat allergy. “Typically these people would be intaking less grains and would also be missing fibre in their diet. Vitamin B complex is very popular to be missing when being on a diet with no gluten. These are some of the reasons as to why people with celiac disease get recommended to take multivitamins.” It is important that somebody with celiac disease is getting their blood work done annually to monitor any changes in their nutritional intake and numbers of celiac. Once a gluten free diet is being followed, the villi will begin to grow and collect nutrients, although it is difficult to find the nutrients that are needed in gluten free foods.

Can you detect whether or not you are going to develop celiac disease in the future?:
One way you can see if you have celiac disease is by doing a genetic test. This test can also help with seeing if you have the possibility of developing celiac in the future. If you have a first degree relative with the disease then it is a good idea to get a genetic test every 2-3 years. If you have gotten negative on the genetic test multiple times, you can move onto a gene test. If the gene test is also negative, then the person can stop regular screening as they would have a small chance of developing celiac disease. Since celiac disease is an autoimmune disease, you can still develop it at any time, so it is important that you still do screening for celiac, although you probably have a very small chance of developing it. 25-30% of people have HLA-DQ2 or HLA-DQ8, so if you get a genetic test and have one of these genes, it is not certain that you have celiac disease. “If they have the two genes and they are in the position that could cause celiac disease, then you would have a chance of developing it, but if they do not have any of the two genes, or they are positioned differently then there is no chance you will develop celiac.” Thus, it is possible to know partially if you will develop celiac in the future, although you can have the genes and still not have celiac disease or not have the genes, but still have celiac disease. It is extremely important that you are screened frequently if you have a first degree relative with this disease, even though it may not be positive the first time.

Celiac Disease vs Gluten Intolerance:
Celiac disease is when eating gluten triggers an autoimmune reaction that causes damage to the villi on the small intestine.You will not feel any symptoms within minutes, although your stomach may begin to ache. Meanwhile, gluten intolerance is when you have sensitivity to gluten. There is no damage done to the inside of the body as it is an immediate reaction such as a headache, bloating, or hives. You can treat it as simply as cutting back on foods with gluten, rather than eliminating them completely. Somebody with celiac disease has to stop eating gluten for the rest of their life, although you can still eat gluten with gluten intolerance as it is only a sensitivity. There is no genetic component related to gluten intolerance and can disappear after a certain amount of time if you begin to slowly introduce gluten to your diet again. Celiac disease and gluten intolerance are extremely different because they affect the body in very different ways.

Can you develop celiac disease from being gluten intolerant?:
Celiac disease can develop at any age once you start consuming gluten, most likely if you have the genes. Having gluten sensitivity does not trigger the villi to no longer be gathering nutrients. This is because celiac disease and gluten intolerance are both very different. Celiac disease normally does not have any external symptoms, meanwhile gluten intolerance would have external symptoms, such as abdominal pain, bloating, constipation, diarrhea, headaches, or vomiting. You can get these symptoms depending on how much your body can tolerate. Many people do not have to watch how much gluten they are having because no symptoms occur when they digest it. Consuming gluten is what starts celiac, meaning that if you have already limited the amount that you are eating, then it is very rare that the villi will begin to shrink. All in all, celiac disease does not develop from being gluten intolerant because they do not have any connection to how the gluten is harming the body.

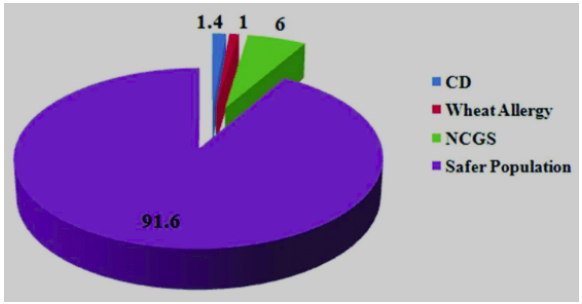
Why are the numbers of people getting diagnosed with celiac disease growing?:
Celiac disease is growing as the results are showing that the average number of people diagnosed with celiac disease are growing by an average of 8 percent every year. Some of the reasons that celiac disease is becoming more common is because of improved awareness and more accurate diagnosing, for example blood testing and biopsy. If a baby is fed too much gluten earlier on in life, it may result in immune reactions later on. What we have been doing with gluten has also changed a lot, making celiac more common. The amount of gluten and fast food that people are eating has plummeted in large amounts over the past couple of decades which also affects the number of people getting diagnosed. “The largest difference is the ability to diagnose and how it has advanced over time. A couple of decades ago, only 1 in 1000 would have celiac disease, as they would only test them if somebody said they need to get screened for celiac disease or want a test to check for different medical conditions. Now, the average number of people that are getting diagnosed is 2 in 100, because now the screening is usually included in bloodwork. The environment compared to now and before is very different, with higher pollution and other chemicals being used and emitted everyday. This is another reason that is causing more people to get diagnosed.” The incidence of being diagnosed has started to go lower in some parts of the world because people begin to follow a gluten free diet before being diagnosed, making it harder to know if they have celiac disease. Ultimately, the main reasons as to why celiac disease is growing is because of people eating gluten that can harm the body, as it is being used differently from how it was before. Medical equipment has also advanced in the past 15 years in a fair amount, making it easier to diagnose celiac disease.

Does nationality or age affect the number of people that are diagnosed with celiac disease?:
As a person gets older and has untreated celiac disease, they have a very high chance of getting other medical conditions such as low bone density, GI issues, and possibly the development of cancer. Untreated celiac will not affect a child as much, with such terrible conditions, although the small intestine may not be able to get healed. The amount that the intestine gets affected does not vary through age. If you are diagnosed with celiac at an early age, there are less chances that you will develop another autoimmune condition. Therefore, age does not affect the number of people that are diagnosed with celiac disease, although the chances of developing other medical conditions at an older age are higher. “Something that doctors had noticed is that people with European ancestry had a higher incidence than other nationalities, although they realized over time that other continents are getting just as high in incidence with celiac disease. It has been shown that kids are currently getting diagnosed more frequently than adults and seniors. Typically, girls get diagnosed at an earlier age compared to boys and it tends to be that slightly more females are diagnosed with celiac disease.” North Africans, northern and western Indians also have a higher chance of developing celiac disease as it has been shown over years of data. In North India it had been reported that the overall prevalence of celiac disease was 1.44%, meanwhile the overall prevalence in the world was 1.04%. Celiac is extremely rare among East Asians, sub-Saharan Africans, and African Americans because they tend to carry the two genes less, meanwhile some nationalities tend to carry these genes and develop celiac disease. All nationalities still have a percentage of diagnosis with celiac disease although some are higher, and others are lower.

Is there any other treatment for celiac disease other than going on a gluten free diet?:
The safest way to treat celiac disease that is currently available is a gluten free diet, although many are in the work to make other treatments. An enzyme therapy is one of those treatments. It is coadministration of prolyl endopeptidases, which are endoproteolytic enzymes expressed by both microorganisms and plants. IMU-856 is a small molecule modulator that targets a protein that acts as a transcriptional regulator in the intestinal barrier. “Researchers are currently trying to look into why the body responds to gluten in a way like how it does to a person with celiac. They figured out that gluten brings the immune cells to the bottom of the villi and these cells produce antibodies and chemicals, causing the villi to fall. They first looked into trying to modify gluten, so that it would be harder for the body to recognize. Secondly, they looked into, if there is a way that the body will be able to break down the gluten before it reaches the villi.” Genetically modified gluten is also another solution, as they are trying to keep the same amount of nutrients in gluten free food, although it can be hard without having gluten in it. A peptide based therapeutic vaccine is being developed to modify the T-cell response. Currently it is only working with patients that have the HLA-DQ2 gene. Two treatments that are almost in full development are engineered gluten free grains and inducing oral tolerance to gluten with a therapeutic vaccine. “Currently, there is no medication, but everyday they are getting closer to finding a permanent cure without going on a gluten free diet.”

January 25, 2025:

Graphs:



The pie chart shows the percentage of people with celiac disease, a wheat allergy, or non celiac gluten sensitivity. You can see that the smallest percentage is for a wheat allergy, meanwhile, six times the amount of people have non celiac gluten sensitivity. Celiac disease is also fairly low, as it is only 1.4%. The highest percentage is definitely the safer population with 91.6%. Overall, the percentage of people with celiac disease is low.

January 26, 2025:

Conclusion:

In conclusion, celiac disease is an autoimmune disease that affects how the villi absorb nutrients, as they begin to fall the villi are unable to gather any nutrients. A biopsy is the most common way to diagnose celiac disease after doing blood work. As celiac disease is hereditary, you must have the gene HLA-DQ2 or HLA-DQ8. You can have a higher chance of developing it after certain events, including pregnancy, surgery, type 1 diabetes, or thyroid disease. A strict gluten free diet needs to be followed in order for the villi to grow back completely, as it can even take up to 6 months for the small intestine to heal completely. The gene HLA-DQ2 or HLA-DQ8 have to be in a certain position in order for the gluten to hit it and give them an autoimmune reaction to gluten. Approximately 4 in 100 people have both of the genes, although only 2 in 100 have celiac disease. Foods without gluten do not give you the same nutrients that you should be intaking, which is why it is important you take multivitamins. A person following a gluten free diet will be low in fibre, vitamin A and B, magnesium, calcium, and iron. Genetic tests can be extremely helpful as you are partially able to tell if you have a chance of developing celiac disease. If you have any of the two genes, then the doctors know that you are one of the 4 people with the gene, but may not be able to narrow it down right away about whether or not you have celiac disease. If somebody does not have HLA-DQ2 or HLA-DQ8 then they have absolutely no chance of developing celiac. Celiac disease is very different from gluten intolerance because if you think you can tolerate gluten and you are only sensitive to gluten, then eating gluten is still an option that you have, but with celiac disease if you eat any gluten, the small intestine will be damaged and if you do not follow a strict gluten free diet, then you have the chance of developing another autoimmune reaction. The main reasons as to why celiac disease is growing is because of people eating gluten that can harm the body, as it is being used differently from how it was before. Medical equipment has also advanced in the past 15 years in a fair amount, making it easier to diagnose celiac disease. Along with this, there are also a lot of environmental factors that can harm the body. At first mainly only people with European ancestry had celiac disease, but over time every nationality began to be diagnosed with celiac disease. Recently more kids have been diagnosed than seniors and adults. Females are likely to get diagnosed earlier on in life. Researchers and doctors have been figuring out what triggers gluten to harm the body and they realized it is when it hits a specific part of the villi or genes. The first thing that they tried to do was modify gluten so that the body was unable to recognize what it was. Secondly, they looked into if there is a way they can break down the gluten before it reaches the villi. Currently, there is no medication, but everyday they are getting closer to finding a permanent cure without going on a gluten free diet.

January 27, 2025:

Future Spinoff:

I think the project I have completed is amazing, although if I were to do this project again I would change a couple of things to make it even better. I would have expanded my research even more by looking into more sources and possibly interviewing multiple doctors instead of only one. The other doctor that I could have talked to is a family doctor, so that they could answer my questions related to nutritional intake, as they check multiple patients' bloodwork. If I would have been able to email the canadian celiac association or celiac disease foundation earlier then I may have had the chance to connect with them. Along with this, I would add more to my problem and check the price difference between food that is gluten free compared to food with gluten. I could also check what ingredients are being used to make something gluten free. Other than this I would keep my project similar as it has turned out to show lots of information about celiac disease.

January 28, 2025:

Sources of Error:

When I was collecting information from different sources, one of those may not have been very trusted, although I tried to check every time. I also included multiple sources for each question and term to ensure that I was not getting incorrect information. Lastly, to make sure I was not including information from sources that were not reliable, I interviewed a gastrointestinal doctor, who knew a lot about celiac disease and if the information I already had was not matching up to what Dr. Wrobel said I was trying my best to remove anything from that source, as I knew it was incorrect. Although I tried to ensure that I was not getting information that did not match up, there could have been some that was completely correct.

February 1, 2025:

Showcasing:

As of today, I worked on putting my work into a template.

February 2, 2025:

Showcasing:

Today, I finished putting my work into a template.

February 7, 2025:

Showcasing:

I printed my work so that I will be able to put it onto my trifold soon.

February 9, 2025:

Showcasing:

I started cutting out my work so that I can start putting it on my trifold soon.

February 11, 2025:

Showcasing:

Today, I layed out everything on my trifold and finalized the layout.

February 13, 2025:

Showcasing:

As of today, I taped everything on my trifold and I can practice my presentation.