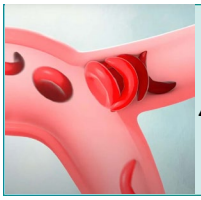

[NARRATOR:] Right after she was born, a routine blood test revealed that Ceniya Harris has the genetic mutation that causes sickle cell disease.

[CRYSTAL KELLEY:] It hit me hard. I cried. I was nervous, just because I have family members that actually have the disease. And I've seen them have lots of crises, and a lot of hospitalizations, so I was devastated.

[CLIFTON HARRIS:] I have to sit here and be like "Oh yeah, you know, you'll be all right, everything's okay." And then go inside and just like, oh, *[cries]*. Yeah, but…

[KELLEY:] Yeah, we kind of feel helpless.

[NARRATOR:] Approximately 100,000 Americans have sickle cell disease. Globally, it affects millions, from different countries and backgrounds.

[FREDA LEWIS-HALL:] A patient told me once… I said to her "You know, this is very rare. It only affects about 3% of people." And she patted me on my hand, and she said "Honey, if it affects me, it's 100%."

[NARRATOR:] The cause of sickle cell disease can be traced back to a single gene. The *HBB* gene encodes for a subunit of hemoglobin, an important protein in red blood cells. A change in the *HBB* gene results in a mutated hemoglobin that causes cells to become stiff and misshapen.

Ceniya's parents each have one copy of the mutation. Ceniya inherited two copies of the mutation, one from each parent. Individuals with two copies have mostly sickled blood cells, which often clog up small blood vessels, cutting off circulation from tissues and leading to what are called pain crises.

21-year-old Ingrid Ortiz has frequent pain crises.

[MATT HEENEY:] It's the type of pain that you get when you break a bone. Some patients do very well for several years and then have several years that are very difficult and challenging with complications or the accumulation of chronic organ damage. Ingrid's sort of an example of that. In the last year, she's had over 15 blood transfusions.

[NARRATOR:] For years, joint and muscle pain has taken a toll.

[INGRID ORTIZ:] 16 is when I started to get pain crises. Every couple of weeks, I'm sick with the pain. Constant sharp pain.

[NARRATOR:] It was pain in her hip that forced her to give up cheerleading. Eventually, it required surgery.

[ORTIZ:] I almost didn't graduate. I almost didn't go to my senior prom. I did plan on going to college. But the first semester in September, I couldn't go, because that's when I had to get another surgery for my hip.

[NARRATOR:] Some patients with sickle cell disease can be helped with a bone marrow transplant, but only if they can find a compatible donor. Ingrid doesn't have a match.

[HEENEY:] And if you don't have a match, which is the majority of patients, there really isn't a curative option currently.

[NARRATOR:] Unlike Ingrid, Ceniya has never had a single symptom.

[KELLEY:] A lot of times, honestly, we forget that she even has it, because she hasn't had any complications.

[NARRATOR:] Why is Ceniya's experience so different from Ingrid's? The answer can be traced back to when she was in her mother's womb.

With no air to breathe, fetuses must get oxygen from their mother's blood. To do that, they produce a special form of hemoglobin that can extract oxygen from the mother's bloodstream. After birth, babies start producing adult hemoglobin. By about six months of age, production of the fetal hemoglobin is switched off. A mutation in the adult form of hemoglobin causes sickle cell disease. Both Ingrid and Ceniya have this mutation.

The secret to Ceniya's surprising good health is that she has a second mutation. This mutation keeps Ceniya's fetal hemoglobin production switched on. Ceniya does not have a properly functioning adult hemoglobin, but because she continues to produce fetal hemoglobin, she does not have the same symptoms as Ingrid. Individuals like Ceniya suggest a new treatment approach.

[HEENEY:] So if we could somehow switch it back to making the fetal hemoglobin, then many of the complications, if not all of them, would be ameliorated.

[NARRATOR:] Scientists are now working to develop a treatment that can switch fetal hemoglobin back on. Testing it will need patient volunteers like Ingrid.

[HEENEY:] You know, it's a new therapy. It's gonna take someone courageous, maybe like yourself, who'll be interested in doing something like that.

[NARRATOR:] As of 2019, clinical trials are underway to determine if this strategy can be used to increase fetal hemoglobin expression and successfully treat the disease.

[LEWIS-HALL:] So what's happening now is just remarkable, because it does give hope to patients, to families, to whole communities that would never have had hope at all. So this is really an amazing turning point.

[music plays]