

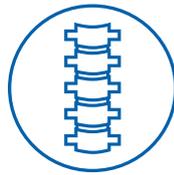
# Understanding Friedreich's Ataxia

## About Friedreich's Ataxia (FA)

FA is named after the physician Nikolaus Friedreich, who first described the condition in the 1860s<sup>1</sup>



“Ataxia” refers to coordination problems and unsteadiness caused by nervous system dysfunction; it occurs in many neurological diseases<sup>1,2</sup>



FA is marked by **degeneration in the spinal cord**, particularly the nerve fibers controlling arm and leg movement<sup>1,2</sup>



This leads to a **deficiency of sensory signals to the cerebellum**, a part of the brain that coordinates balance and voluntary movements, resulting in unsteady movements<sup>1,2</sup>

## The Genetic Basis of Friedreich's Ataxia

FA is a “**trinucleotide repeat disorder**” in which mutation of the *FXN* gene, which encodes the frataxin protein, leads to expansion of the repeating three-nucleotide sequence GAA<sup>2,3</sup>



**Nucleotides** are the “letters” that make up a strand of DNA<sup>4</sup>



In healthy people, GAA is repeated between **5-33 times**<sup>5</sup>



In people with FA, GAA is repeated between **66-1000 times**<sup>5</sup>

More repeats are associated with earlier disease onset and **more severe symptoms**<sup>5</sup>



**Frataxin is a protein critical to the function of mitochondria**, the part of cells that produces energy. Without sufficient frataxin, mitochondrial function can suffer in nearly all cells, including in the nervous system.<sup>6</sup>

People with FA do not produce adequate amounts of frataxin compared to those with no *FXN* gene mutations<sup>2</sup>

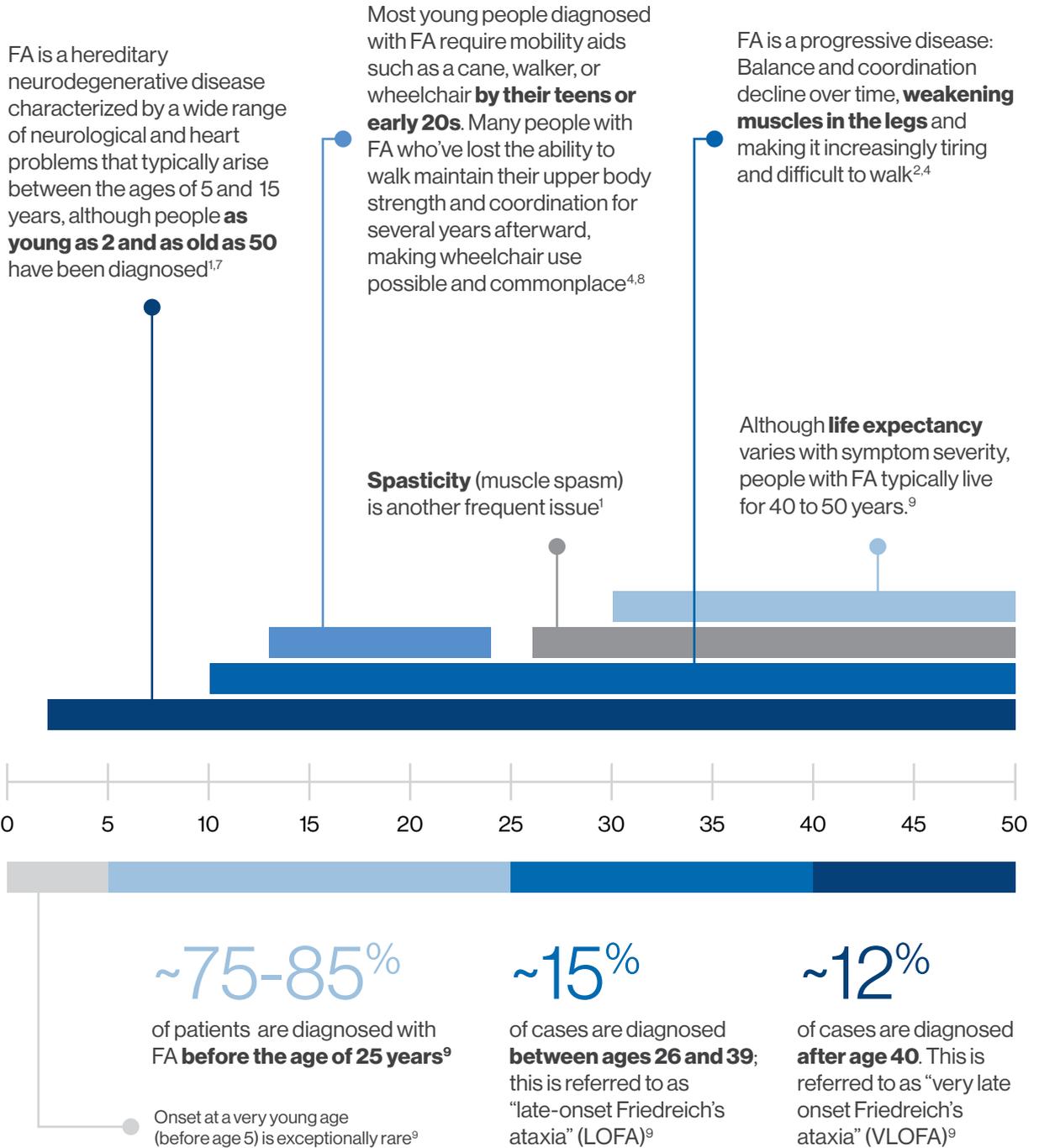
FA is the most commonly inherited ataxia, affecting **1 in 40,000** people in the US<sup>2</sup>

Worldwide, approximately **1 in 100** people are asymptomatic carriers of *FXN* mutations that cause FA<sup>4</sup>

A child whose parents are both carriers has an approximately **25% chance** of inheriting 2 mutated copies of the *FXN* gene and developing FA<sup>4</sup>



# FA Characteristics and Symptoms Timeline



**The age of onset of the disease varies substantially among patients<sup>9</sup>**

# Clinical Symptoms Associated With FA

FA does not affect the parts of the **brain** involved in thinking<sup>1</sup>

Some people with FA experience **hearing and vision problems**, including involuntary eye movements<sup>10,11</sup>

**Enlargement of the heart** can lead to abnormally fast heart rates that don't adjust efficiently to the body's demands, causing extreme fatigue, chest pain, shortness of breath, and lightheadedness<sup>10</sup>

FA can weaken the **tongue and facial muscles** used for speech, causing words to come out in a slow, jerky pattern (dysarthria)<sup>10</sup>

Cardiac disease is the leading cause of death in FA: **heart problems** due to FA can range from mild abnormalities to life-threatening dysfunctions<sup>10</sup>

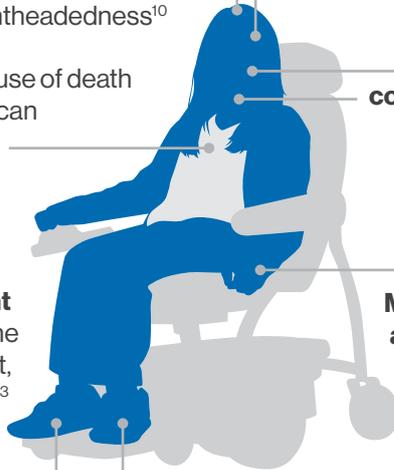
FA can also interfere with **muscle coordination in the throat area**, leading to swallowing difficulties (dysphagia), which can allow food to enter the airway and cause choking or respiratory infections<sup>12</sup>

The heart condition most often seen in FA is hypertrophic cardiomyopathy, an **enlargement of cardiac muscle** that shrinks the blood-filled chambers in the heart, decreasing its pumping capacity<sup>13</sup>

**Muscle weakness, poor coordination and loss of sensation in the arms and hands** can interfere with fine motor skills, such as writing or adjusting buttons and zippers<sup>1,10,14</sup>

In addition to problems with mobility and the heart, most people with FA **fatigue easily**, require more rest, and take a longer time to recover from common illnesses, such as colds and flu<sup>1</sup>

The effects of FA vary greatly from one person to another, but the first indication something is wrong is often **balance issues when walking or standing**<sup>1,10</sup>



## FA Comorbidities



of people with FA **develop heart abnormalities**, including hypertrophic cardiomyopathy<sup>13</sup>



of the people with FA **develop carbohydrate intolerance**<sup>1</sup>



of people **develop diabetes**<sup>1</sup>



of people with FA **develop scoliosis** (curvature of the spine) severe enough to require surgery<sup>1</sup>

**References:** **1.** Friedreich ataxia fact sheet. National Institute of Neurological Disorders and Stroke. June 2018. Accessed January 28, 2022. <https://www.ninds.nih.gov/disorders/patient-caregiver-education/fact-sheets/friedreichs-ataxia-fact-sheet> **2.** Friedreich's ataxia. National Organization for Rare Disorders. 2018. Accessed June 19, 2020. <https://rarediseases.org/rare-diseases/friedreichs-ataxia/> **3.** Ramakrishnan S, Gupta V. *Trinucleotide repeat disorders*. StatPearls Publishing LLC. 2022. Updated November 20, 2021. Accessed February 1, 2022. <https://www.ncbi.nlm.nih.gov/books/NBK559254/> **4.** What is FA? Friedreich's Ataxia Research Alliance. Accessed January 28, 2022. <https://curefa.org/whatis> **5.** Friedreich ataxia. MedlinePlus. July 2, 2021. Accessed February 1, 2022. <https://medlineplus.gov/genetics/condition/friedreich-ataxia/> **6.** Friedreich's ataxia (FA): causes/inheritance. Muscular Dystrophy Association. 2022. Accessed February 4, 2022. <https://www.mda.org/disease/friedreichs-ataxia/causes-inheritance> **7.** Friedreich's ataxia (FA): about Friedreich's ataxia (FA). Muscular Dystrophy Association. 2022. Accessed February 4, 2022. <https://www.mda.org/disease/friedreichs-ataxia> **8.** Friedreich's ataxia (FA): signs and symptoms. Muscular Dystrophy Association. 2022. Accessed February 4, 2022. <https://www.mda.org/disease/friedreichs-ataxia/signs-and-symptoms> **9.** Prognosis of Friedreich's ataxia. Friedreich's Ataxia News. 2013-2022. Accessed January 28, 2022. <https://friedreichsataxianews.com/prognosis-of-friedreichs-ataxia/> **10.** Symptoms of Friedreich's ataxia. Friedreich's Ataxia News. 2013-2022. Accessed January 28, 2022. <https://friedreichsataxianews.com/symptoms-of-friedreichs-ataxia/> **11.** Friedreich ataxia. MedlinePlus. Updated June 7, 2021. Accessed February 4, 2022. <https://medlineplus.gov/friedreichataxia.html> **12.** Dysphagia in Friedreich's ataxia. Friedreich's Ataxia News. 2013-2022. Accessed January 28, 2022. <https://friedreichsataxianews.com/dysphagia-in-friedreichs-ataxia/> **13.** Friedreich's ataxia and cardiomyopathy. Friedreich's Ataxia News. 2013-2022. Accessed January 28, 2022. <https://friedreichsataxianews.com/friedreichs-ataxia-and-cardiomyopathy/> **14.** Living with Friedreich's ataxia. Friedreich's Ataxia News. 2013-2022. Accessed January 28, 2022. <https://friedreichsataxianews.com/living-with-friedreichs-ataxia/>