Module 2
How is myotonic dystrophy type 1 (DM1) diagnosed?

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Module summary

DM1 is associated with a diagnostic delay of 6–7 years[1,2]

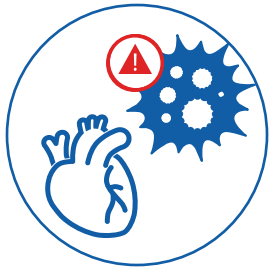
Delays are due to the diversity in age of onset, the wide range of body systems involved, and the variability in symptom severity[1–3]

A diagnosis of DM1 should be suspected in individuals with a family history of DM1 and/or associated features[4–6]

Features vary between individuals and by age, and include muscular and non-muscular manifestations[4–6]

Genetic testing detects abnormal CTG repeat expansion and confirms a DM1 diagnosis[4,7,8]

After diagnosis, the risk to family members should be explained, and a genetic study should be proposed to those aged >18 years[8]



Early diagnosis of DM1 is important to introduce appropriate management of disease-associated risk factors[1]

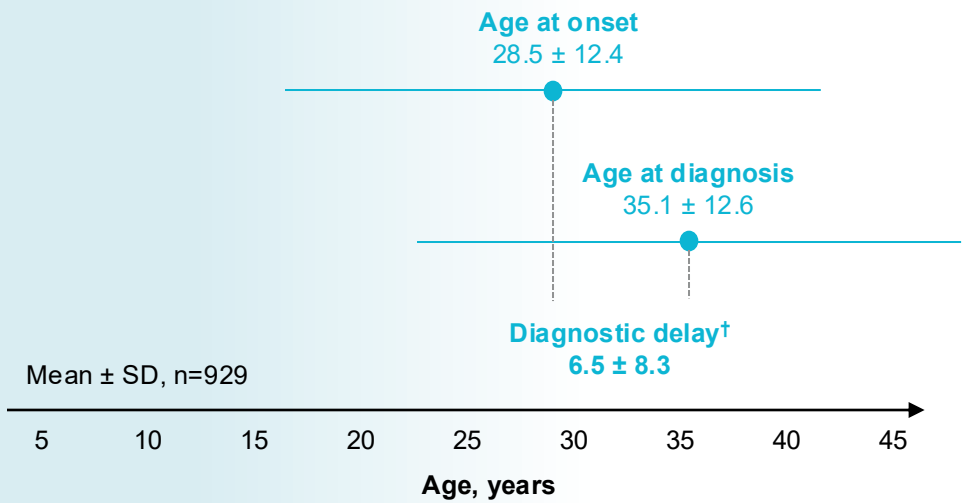
Individuals with DM1 have a higher risk of cardiac abnormalities, cancer, and certain surgical complications than those without DM1[9–16]

CTG, cytosine-thymine-guanine; DM1, myotonic dystrophy type 1.

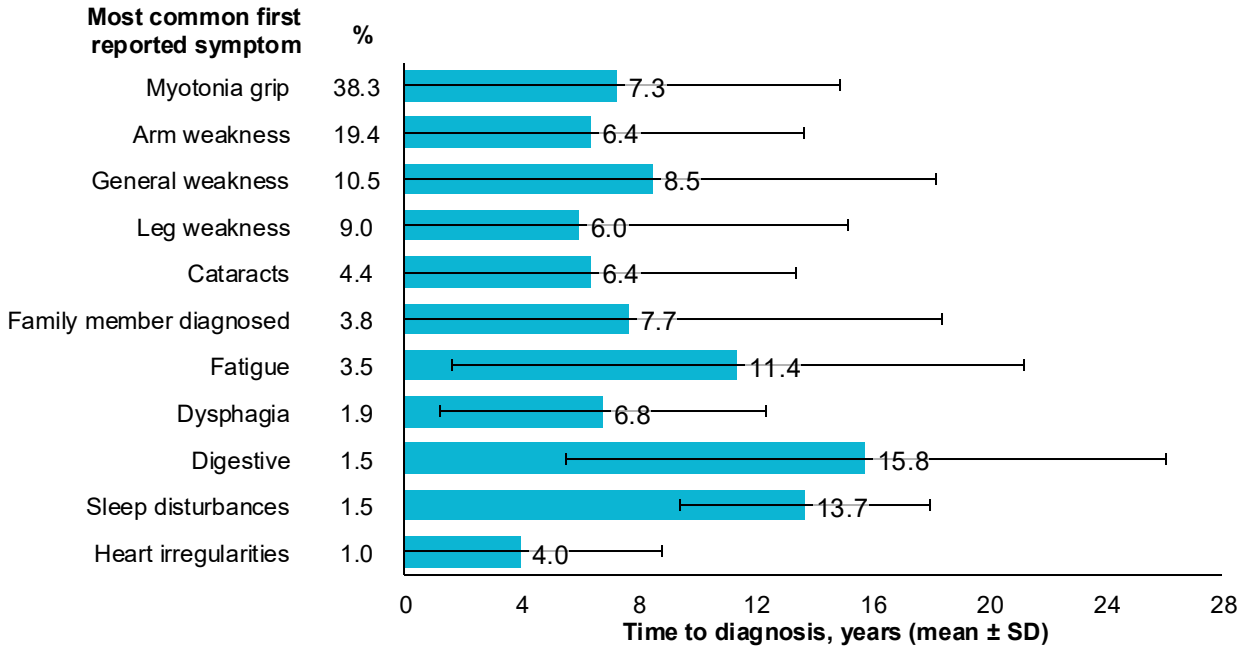
1. Hilbert JE, et al. *J Neurol*. 2013;260:2497–2504; 2. Hagerman KA, et al. *Muscle Nerve*. 2019;59:457–464; 3. Hamel JI, et al. *Muscle Nerve*. 2022;66:508–512; 4. Johnson NE, et al. *Neurol Clin Pract*. 2019;9:443–454; 5. Ho G, et al. *World J Clin Pediatr*. 2015;4:66–80; 6. Bird TD. Myotonic Dystrophy Type 1. 1999 Sep 17 [Updated 2021 Mar 25]. In: Adam MP, Everman DB, Mirzaa GM, et al., editors. GeneReviews® [Internet]. Seattle (WA): University of Washington, Seattle; 1993–2022; 7. Chakraborty S, et al. *Curr Protoc Hum Genet*. 2016;91:9.29.1–19; 8. Gutierrez Gutierrez G, et al. *Neurologia (Engl Ed)*. 2020;35:185–206; 9. McNally EM, et al. *J Am Heart Assoc*. 2020;9:e014006; 10. McNally EM, et al. *Heart*. 2011;1094–1100; 11. Petri H, et al. *Int J Cardiol*. 2014;174:31–36; 12. Alsaggaf R, et al. *Muscle Nerve*. 2018;57:316–320; 13. Galdalla SM, et al. *JAMA*. 2011;306:2480–2486; 14. Zampetti A, et al. *J Am Acad Dermatol*. 2015;72:85–91; 15. Win AK, et al. *Mayo Clin Proc*. 2012;87:130–135; 16. Kim CS, et al. *Sci Rep*. 2021;11:8.

How long does it typically take for DM1 to be diagnosed?

Onset and diagnostic delay[1]*



Time to diagnosis by most common first reported symptom[3†]



- Individuals with DM1 experience significant delays in diagnosis due to the diversity in age of onset, the wide range of body systems involved, the wide variability in severity of the signs and symptoms of the disease, and the number of different practitioners consulted[1–3]

- Myotonia (49.2%) and overall weakness (43.3%) are the most common first reported symptoms leading to a DM1 diagnosis[3]
- Individuals with symptoms such as fatigue, sleep disturbances, and digestive issues often experienced the longest diagnostic delay[3]

DM1 is associated with a diagnostic delay of 6–7 years[2,3]

*Data from the US National Registry for Myotonic Dystrophy.
†This study analyzed de-identified data from Registry members classified with genetically proven or clinically defined DM1.
DM1, myotonic dystrophy type 1; SD, standard deviation.
1. Hamel JI, et al. *Muscle Nerve.* 2022;66:508–512; 2. Hagerman KA, et al. *Muscle Nerve.* 2019;59:457–464; 3. Hilbert JE, et al. *J Neurol.* 2013;260:2497–2504.

What signs or symptoms may lead to a suspected DM1 diagnosis?

Neonates

- Family history of DM1[1]
- Hypotonia[1–3]
- Facial muscle weakness[3]
- General weakness[1,3]
- Positional malformations (e.g. clubfoot)[1,3]
- Respiratory distress[1–3]
- Feeding problems[1,2]
- Cognitive impairment[2]
- Motor and developmental delay[2]

Children/Juveniles

- Family history of DM1[1]
- Eyelid ptosis and/or oral motor weakness[1]
- Distal weakness[1]
- General muscle weakness[2]
- Myotonia and muscle atrophy[1,2]
- Scoliosis[1]
- Visual impairment[2]
- Sleep apnea[2]
- GI issues[1]
- EDS and fatigue[1,2]
- Autism or social communication difficulties[1]
- Conduction disturbances[1,2]
- Testicular atrophy[2]
- Learning disabilities (e.g. dyslexia) and developmental/speech delays[1,2]
- ADHD, anxiety, and behavioral problems[1]

Adults

- Family history of DM1[1]
- Muscle weakness[3]
- Myotonia[2,3]
- Posterior subcapsular cataracts[2,3]
- Conduction defects[2]
- Insulin resistance[2]
- Respiratory failure[2]

Parents of a child with DM1 should be assessed for the possibility that they, too, have DM1[1]

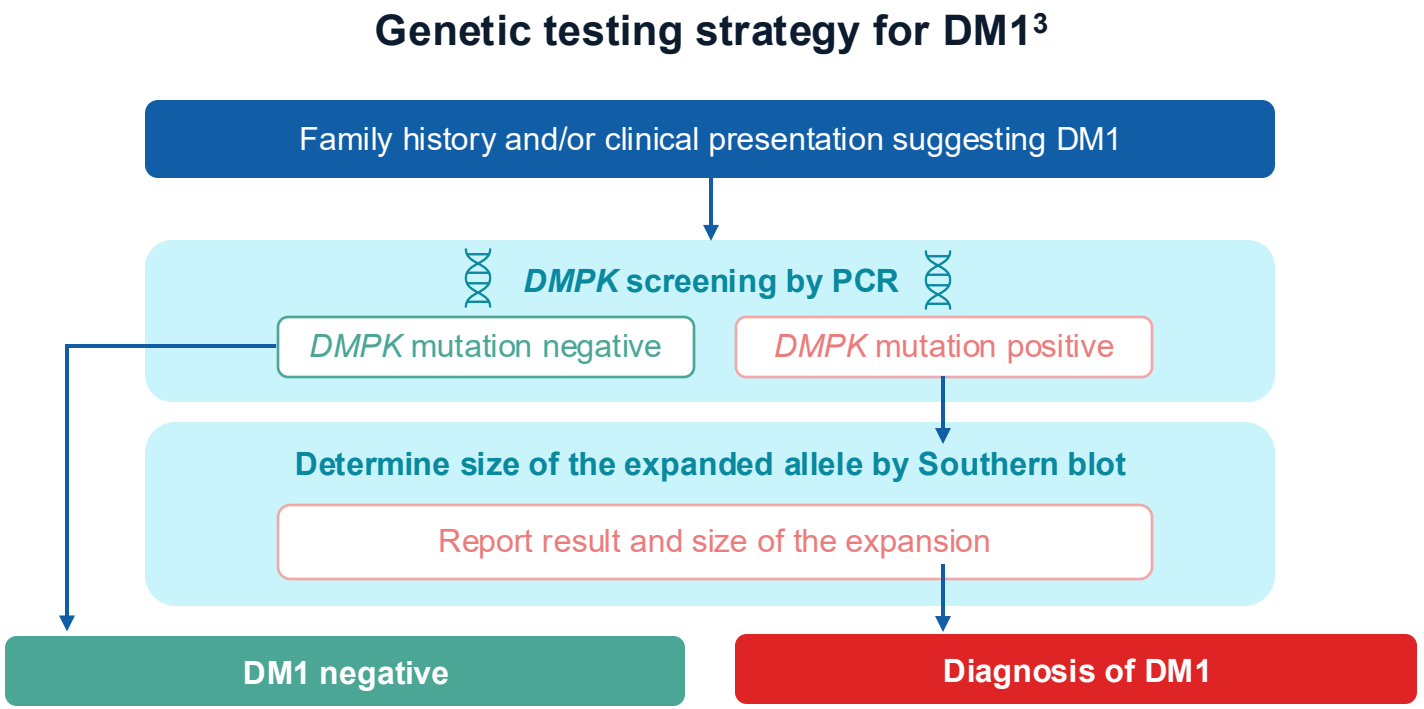
A diagnosis of DM1 should be suspected in individuals with a family history of DM1 and/or associated features[1–3]

ADHD, attention deficit hyperactivity disorder; DM1, myotonic dystrophy type 1; EDS, excessive daytime sleepiness; GI, gastrointestinal.

1. Johnson NE, et al. *Neurol Clin Pract*. 2019;9:443–454; 2. Ho G, et al. *World J Clin Pediatr*. 2015;4:66–80; 3. Bird TD. Myotonic Dystrophy Type 1. 1999 Sep 17 [Updated 2021 Mar 25]. In: Adam MP, Everman DB, Mirzaa GM, et al., editors. GeneReviews® [Internet]. Seattle (WA): University of Washington, Seattle; 1993–2022.

How is a diagnosis of DM1 confirmed?

- Once DM1 is suspected based on family history and/or clinical presentation, molecular testing using a blood sample is used to confirm the diagnosis[1,2]
- Muscle biopsies are not required to confirm the diagnosis of DM1[2]
- After diagnosis, the risk to family members should be explained, even in the absence of symptoms, and a genetic study should be proposed to those aged >18 years[2]
- Asymptomatic individuals found to have CTG repeat expansion should be considered at risk for developing DM1, although they may never develop symptoms[4]



Genetic testing detects abnormal CTG repeat expansion and confirms DM1 diagnosis[1–3]

CTG, cytosine-thymine-guanine; DM1, myotonic dystrophy type 1; DMPK, dystrophia myotonica protein kinase; PCR, polymerase chain reaction.

1. Johnson NE, et al. *Neurol Clin Pract*. 2019;9:443–454; 2. Gutierrez Gutierrez G, et al. *Neurologia (Engl Ed)*. 2020;35:185–206; 3. Chakraborty S, et al. *Curr Protoc Hum Genet*. 2016;91:9.29.1–19; 4. Savic-Pavicevic D, et al. *BioMed Res Int*. 2013;2013:391821.

Why is early diagnosis of DM1 important?

Early diagnosis can help ensure that individuals have the opportunity to be managed by a multidisciplinary team so that known DM1 risk factors are recognized and addressed in a timely manner[1]

High incidence of cardiac abnormalities and risk for arrhythmias, cardiomyopathy, conduction disturbance, and sudden death[2–4]

Regular screening by a cardiologist familiar with neuromuscular disease is recommended[2]

Higher risk of cancer, compared with the normative population, regardless of lifestyle factors[5–8]

Population-based cancer screening guidelines should be incorporated into clinical care[5]

Increased risk of surgical complications when under general anesthesia and cardiac complications after surgery[9]

Anesthesia in individuals with DM1 needs to be carefully planned[10]

Early diagnosis of DM1 is important to introduce appropriate management of disease-associated risk factors[11]

DM1, myotonic dystrophy type 1.

1. Wenninger S, et al. *Front Neurol*. 2018;9:303; 2. McNally EM, et al. *J Am Heart Assoc*. 2020;9:e014006; 3. McNally EM, et al. *Heart*. 2011;1094–1100; 4. Petri H, et al. *Int J Cardiol*. 2014;174:31–36; 5. Alsaggaf R, et al. *Muscle Nerve*. 2018;57:316–320; 6. Galdalla SM, et al. *JAMA*. 2011;306:2480–2486; 7. Zampetti A, et al. *J Am Acad Dermatol*. 2015;72:85–91; 8. Win AK, et al. *Mayo Clin Proc*. 2012;87:130–135; 9. Kim CS, et al. *Sci Rep*. 2021;11:8; 10. Myotonic Dystrophy Foundation. Practical suggestions for the anesthetic management of a myotonic dystrophy patient. Accessed February 12, 2025. https://www.myotonic.org/sites/default/files/pages/files/MDF_PracticalSuggestionsDM1_Anesthesia2_17_21.pdf; 11. Hilbert JE, et al. J Neurol. 2013;260:2497–2504.