CONDITION

X-linked mental retardation

X-linked intellectual disability is a group of inherited conditions affecting learning, development, and daily living skills.

WHAT IT IS
Intellectual disability caused by changes on the X chromosome

BODY SYSTEM
Nervous system and development

MAIN SYMPTOMS
Developmental delay, learning difficulty, speech delay, daily-living challenges

WHAT CAUSES IT
Inherited or new changes in X-chromosome genes

HOW IT IS DIAGNOSED
Developmental assessment and genetic testing

MAIN TREATMENT
Developmental, educational, communication, and symptom-based support

CAN IT BE CURED?
No - genetic changes remain lifelong

IS IT AN EMERGENCY?
Sometimes - prolonged seizure or breathing trouble

LONG-TERM OUTLOOK
Lifelong support needs, with continued learning often possible

Overview

"X-linked mental retardation" is an older term for X-linked intellectual disability . "Mental retardation" is now considered outdated and hurtful. Healthcare and support services generally use "intellectual disability" instead.

X-linked intellectual disability is not one single disease. It describes many genetic conditions caused by changes in genes on the X chromosome. The X chromosome is one of the chromosomes that carries genetic information.

These conditions affect brain development. A person may have difficulty learning, communicating, solving problems, or managing everyday tasks. Some people need occasional support, while others need help throughout the day.

Males are often more strongly affected because they usually have one X chromosome. Females usually have two X chromosomes, so the unchanged copy may partly reduce the effect of a genetic change. However, females can still have mild, moderate, or severe symptoms.

Some forms affect only learning and development. These are sometimes called nonsyndromic X-linked intellectual disability. Other forms cause a recognizable combination of developmental, physical, neurological, or behavioral features. Fragile X syndrome is one well-known example, but it is only one of many possible causes.

Symptoms

Symptoms usually become noticeable during infancy or childhood. Early signs may include reaching developmental milestones later than expected. Milestones include sitting, walking, speaking, playing, and learning self-care skills.

Possible features include:

Depending on the specific genetic condition, a person may also have low muscle tone, unusual movements, seizures, sleep problems, feeding difficulties, hearing or vision problems, or differences in growth.

Behavioral or emotional features can occur. These may include anxiety, attention difficulties, impulsive behavior, repetitive behavior, or features associated with autism. These are not present in everyone.

Physical features can sometimes suggest a particular syndrome. Examples include differences in head size, facial appearance, hands, feet, or genital development. Such features cannot confirm a diagnosis by themselves.

The term intellectual disability covers a broad range of abilities. It does not describe a person's personality, relationships, interests, or capacity to learn.

- Delayed speech, movement, or social development
- Difficulty learning, reasoning, planning, or remembering
- Problems with communication and everyday tasks
- Needing extra support at school, work, or home

Causes and risk factors

X-linked intellectual disability is caused by a harmful genetic change on the X chromosome. The change may affect how the brain forms or how nerve cells communicate.

Different types of genetic change are possible. A gene may contain a small spelling change, a missing or duplicated section, or another alteration that disrupts its function. Fragile X syndrome is caused by an abnormal expansion of repeated DNA within the FMR1 gene.

A genetic change may be inherited from a parent. It may also arise for the first time in an egg, sperm, or early embryo. This is called a de novo , or new, genetic change. It is not caused by anything a parent did during pregnancy.

In a typical X-linked inheritance pattern, a male does not pass his X chromosome to his sons. He passes it to all his daughters. A female with an X-linked change has a chance of passing that chromosome to children of any sex. The exact chance of symptoms and their severity is different for each condition.

Females may be less affected because their cells naturally switch off one X chromosome. This process is called X-inactivation. If more cells switch off the unchanged X chromosome, symptoms may be stronger. X-inactivation does not always explain the full difference between people.

A family history of intellectual disability, developmental delay, or affected male relatives may raise suspicion of an X-linked condition. However, many families have no known history.

Diagnosis

Intellectual disability is diagnosed by assessing both intellectual abilities and adaptive functioning . Adaptive functioning means practical skills used in daily life, such as communication, personal care, safety, money management, and social judgment. Diagnosis is not based on an IQ score alone.

In very young children, clinicians may use the term global developmental delay when several areas of development are delayed but formal intellectual testing is not yet reliable.

An assessment may include developmental history, school information, observation, standardized testing, and hearing and vision checks. A physical and neurological examination can look for clues to a specific genetic condition.

Genetic testing is needed to identify an X-linked cause. Testing may include:

Fragile X testing is separate because its repeat expansion may not be detected reliably by standard exome sequencing or chromosomal microarray.

A result may identify a disease-causing genetic change. It may instead find a variant of

uncertain significance , meaning there is not enough evidence to know whether the change caused the symptoms. Sometimes testing does not find a cause. A negative result does not rule out a genetic condition because current tests cannot detect every possible change.

Genetic counseling can help a family understand the result, inheritance pattern, and possible implications for relatives or future pregnancies.

- Chromosomal microarray to detect missing or duplicated genetic material
- Fragile X testing to examine the repeated DNA in the FMR1 gene
- A gene panel, exome sequencing, or genome sequencing
- Testing of biological parents or other relatives when appropriate

Treatment and management

There is no single treatment for all X-linked intellectual disabilities. Treatment is based on the person's abilities, health needs, and specific genetic diagnosis.

Early developmental support can help a child build skills. This may include speech and language therapy, physical therapy, occupational therapy, or support with communication and behavior. Some people benefit from picture systems, communication devices, or other forms of augmentative communication.

Educational support should match the child's learning profile. This may involve an individualized education plan, classroom adjustments, extra time, life-skills teaching, or specialist instruction.

Associated health problems are treated separately. For example, a person may need care for seizures, sleep difficulties, feeding problems, anxiety, attention difficulties, hearing loss, or vision problems. Some specific genetic syndromes require regular checks of certain organs or body systems.

Medicines do not remove the underlying genetic change. They may be used to manage particular symptoms when appropriate.

Care often involves primary care, developmental services, school staff, therapists, genetics specialists, and other specialists selected for the person's needs. Regular reviews can adjust support as communication, education, independence, and health needs change.

Complications

Possible complications differ greatly between genetic conditions. Intellectual disability itself may make it harder for someone to report pain, describe symptoms, understand danger, or manage healthcare independently.

Some X-linked conditions can involve epilepsy, movement disorders, muscle weakness, feeding or swallowing problems, or changes in vision and hearing. A smaller number are progressive, meaning certain abilities may decline over time.

Communication barriers and limited access to suitable support can contribute to frustration, isolation, anxiety, or challenging behavior. These concerns should not automatically be blamed on the intellectual disability. Pain, illness, sensory overload, medication effects, or changes in routine may be involved.

As a person becomes older, support may be needed for decision-making, personal safety, relationships, employment, housing, and financial matters.

Prevention

X-linked intellectual disability cannot usually be prevented through lifestyle choices, food, exercise, or actions during pregnancy. The genetic change is inherited or occurs naturally as a new change.

Once a genetic cause is known, genetic counseling can explain the chance of it occurring in another pregnancy. Reproductive options may include testing during pregnancy or preimplantation genetic testing with in vitro fertilization. These are personal choices and are not suitable or acceptable for every family.

Testing adult relatives may sometimes show who else carries the genetic change. This should be offered with clear information and appropriate consent.

Living with it and what to expect

X-linked intellectual disability is generally lifelong. The genetic change does not go away, but abilities and support needs can change over time.

Children may continue to gain language, movement, social, and self-care skills, although development may be slower or follow a different pattern. Progress is not always even. A person may make rapid gains in one area and need long-term help in another.

Many adults take part in work, community activities, relationships, and hobbies. Some live independently or with limited support. Others need supervised housing, help with personal

care, or continuous assistance. The specific genetic condition, health problems, communication abilities, and access to support all influence daily life.

Most X-linked intellectual disabilities are not progressive. In these conditions, intellectual disability does not itself steadily worsen. However, new demands at school or during adulthood can make difficulties more noticeable. A few genetic forms do involve loss of skills, so the exact diagnosis matters.

Long-term planning can cover education, transition to adult healthcare, employment, benefits, housing, legal decision-making, and care arrangements. Families may also benefit from condition-specific organizations and disability support services.

When to get medical help

Arrange routine medical or developmental follow-up if there are concerns about delayed milestones, learning, speech, behavior, movement, hearing, vision, feeding, or sleep. A review is also appropriate if previously useful support is no longer meeting the person's needs.

Seek prompt medical advice for:

Call emergency services for a seizure lasting more than five minutes, repeated seizures without recovery, serious breathing difficulty, severe injury, or unresponsiveness. Follow an existing seizure emergency plan if one has been provided.

Immediate help is also needed if the person is at risk of harming themselves or someone else. These situations are emergencies because of the immediate symptoms, not simply because intellectual disability is present.

- New seizures, unusual staring spells, or repeated unexplained falls
- Loss of previously learned skills
- New swallowing problems, frequent choking, or unexplained weight loss
- A clear change in movement, alertness, behavior, or coordination
- Persistent pain or illness that the person cannot easily describe

Common questions

Is X-linked mental retardation the same as fragile X syndrome?

No. Fragile X syndrome is one cause of X-linked intellectual disability. Many other X-chromosome gene changes can produce a similar pattern of developmental and learning

difficulties.

Can girls have X-linked intellectual disability?

Yes. Girls and women may have no obvious symptoms, mild learning difficulties, or significant intellectual disability. The effect depends on the gene involved, the genetic change, and patterns of X-inactivation.

Does an affected father pass it to his son?

An affected father does not usually pass an X-linked genetic change to his sons because sons inherit his Y chromosome. All his daughters inherit his X chromosome, although whether they develop symptoms depends on the condition.

Can someone with X-linked intellectual disability learn to talk?

Many people develop spoken language, but the timing and level differ. Others communicate more effectively through signs, pictures, gestures, or electronic devices. Communication support can be useful even when speech is present.

Will intellectual disability get worse with age?

In many forms, the underlying intellectual disability is stable rather than progressive. Skills can still change with health, education, aging, and support. Some rare X-linked conditions cause loss of abilities, so a confirmed genetic diagnosis can clarify what monitoring is needed.

Can genetic testing give a definite answer?

Sometimes. Testing may find a clearly disease-causing change, but it can also produce an uncertain result or no explanation. Reassessment may be useful later as genetic knowledge and testing methods improve.

Sources

- American College of Medical Genetics and Genomics. Manickam K, McClain MR, Demmer LA, et al. "Exome and genome sequencing for pediatric patients with congenital anomalies or intellectual disability: an evidence-based clinical guideline." Genetics in Medicine . 2021.
- American Academy of Pediatrics. Moeschler JB, Shevell M. "Comprehensive evaluation of the child with intellectual disability or global developmental delays." Pediatrics . 2014.
- GeneReviews. Hunter JE, Berry-Kravis E, Hipp H, Todd PK. "FMR1 Disorders." University of Washington, Seattle.
- MedlinePlus Genetics. "What are the different ways a genetic condition can be inherited?" U.S. National Library of Medicine.

- Neri G, Schwartz CE, Lubs HA, Stevenson RE. "X-linked intellectual disability update 2017." American Journal of Medical Genetics Part A . 2018.
- National Health Service. "Learning disabilities." NHS conditions guidance.