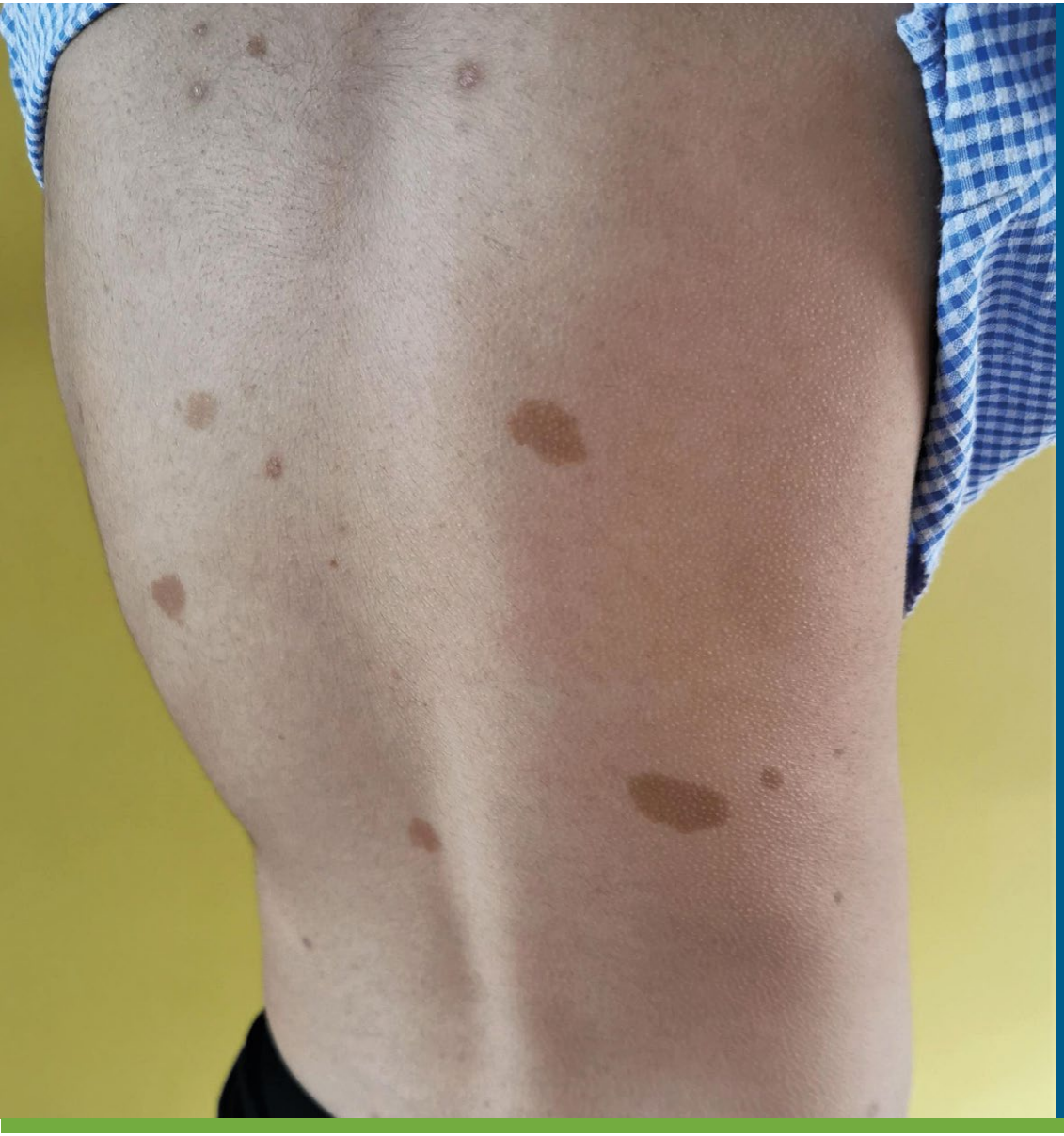

Recognising neurofibromatosis type 1

This CPD module discusses neurofibromatosis type 1 – a rare disease that has many clinical manifestations. It is essential reading for all health professionals, particularly those working in:

- Diagnosis & Monitoring
- Medical Management & Treatment
- Surgical & Procedural Disciplines
- Allied Health, Education & Support
- Anyone with an interest in rare diseases.

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**Contains content reproduced from material written by Kristina Routh MBChB, MPH*

Childhood Tumour Trust

CPD

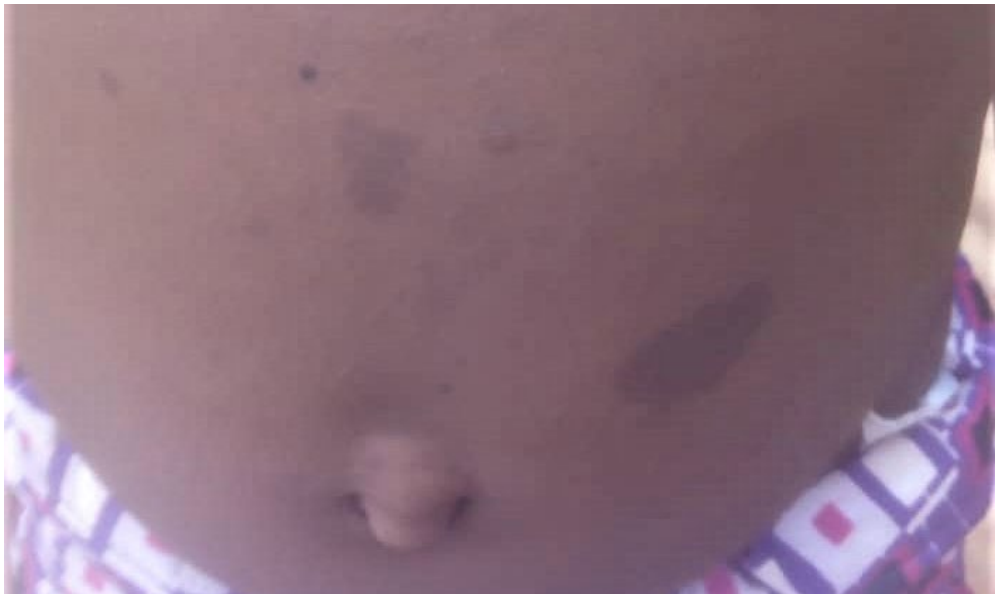
Module summary

Neurofibromatosis type 1 (NF1) is a genetic disorder with many and varied clinical manifestations. Its hallmark lesions affect the skin and nervous system, but people with this condition often present with additional and significant clinical features. Affected individuals also have a greater risk for developing complications such as neurological disturbances, cardiovascular conditions and certain types of cancers, so it's vital that the condition is recognised early so that patients can be monitored, managed and treated appropriately.

Learning objectives

After completing this clinical review and assessment, you should:

- Understand the cause, clinical signs and diagnostic criteria of NF1
- Know how to monitor and manage patients with NF1, and be aware of which specialists might be involved in their care
- Feel confident in discussing NF1 with other health providers involved in the care of your patients



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What is neurofibromatosis type 1?

Neurofibromatosis type 1* (NF1) is caused by changes in the gene that makes a protein called neurofibromin. Changes in this gene may run in families or arise spontaneously due to somatic mutation.

The hallmark lesions of NF1 affect the skin and nervous system, but complications can affect any part of the body.[1]

NF1 can present very differently from person to person – from mild, sometimes unnoticeable symptoms to multiple disabling or sometimes life-threatening effects.[2]

Some features show age-dependent expression – absent at birth and developing during childhood and into adolescence and adulthood.[3-5]

In some cases of NF1, only one part of the body is affected; this is known as **segmental**, **localised** or **mosaic** NF1.[5] (In all cases, this will be a spontaneous, non-inherited, mutation.) Outside of the affected areas, there will be no signs of NF1.

Segmental NF1 can be passed on to children, but the likelihood of this depends on the degree of gonadal involvement (which cannot be determined). On those occasions when it is passed on from a parent with segmental NF1, the affected child will have the generalised form.[6]

The hallmark lesions of NF1 affect the skin and nervous system

**NF1 (also known as von Recklinghausen's disease) is distinct from NF2-related schwannomatosis (NF2-SWN; formerly known as neurofibromatosis type 2) – a clinically distinct condition, which is not covered in this module.*

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How common is NF1?

NF1 affects males and females equally, and is thought to be present in the same proportions in all races and ethnic groups.[3]

NF1 is classified as a 'rare disease' but it is difficult to be sure how many people are affected by it. Estimates vary from around 1 in 2500[7] to 1 in 4650;[8] and a figure of 1 in 3000 is often reported.[9,10] Interestingly, a recent study[11] reported that *screening* for NF1 indicated an incidence of 1 in 2020, but *medical records* suggested 1 in 4329. This reinforces the widely-held opinion that:

- NF1 is an under-recognised condition
- People who show only mild symptoms might never be diagnosed.

Diagnosing NF1 is *essential*, even for those who are only mildly affected. It ensures that patients receive appropriate medical monitoring, management and counselling. See later for further discussion.

**Based on the average GP practice size of 10,000 patients in England[12] and an incidence of 1 in approximately 3000 people[9]*

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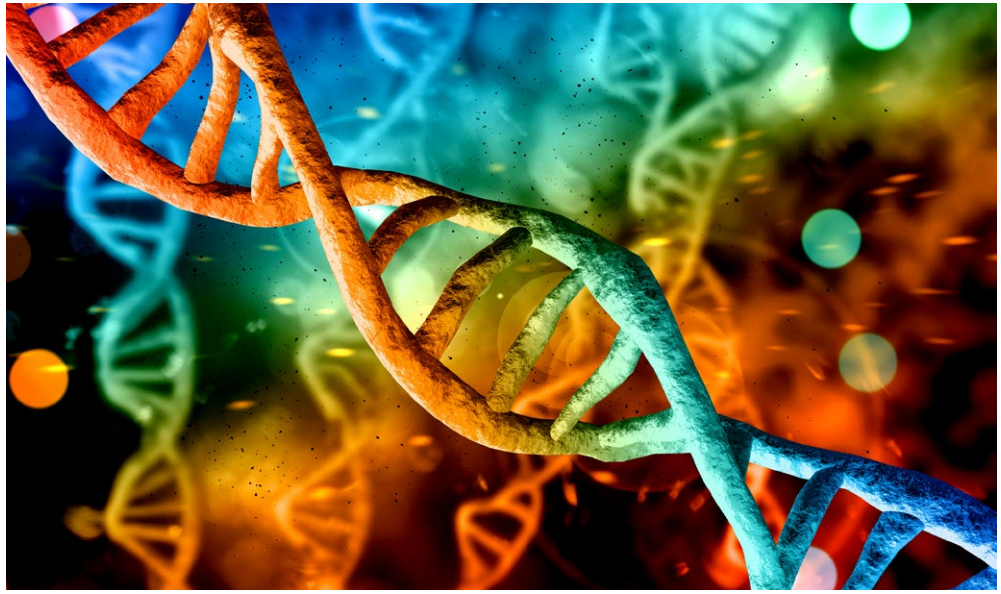
What causes NF1?

NF1 is an autosomal dominant genetic condition caused by a pathogenic variant of the *NF1* gene on chromosome 17.[2] It is the most common autosomal dominant disorder of the nervous system, and is one of the most common conditions caused by a single-gene inheritance.

Everyone who has a pathogenic variant of the *NF1* gene will have NF1. Half of those affected will have inherited NF1 from a parent. For the other half, it is a new (*de novo*) mutation, so they will be the first in their family to have the condition.[2] Whether NF1 is inherited or *de novo*, there is a 50% risk that it will be passed on to any children.

- The *NF1* gene codes for a large, multifunctional protein called neurofibromin, which has a role in suppressing cell overgrowth.[4]
- Lack of neurofibromin has a wide range of consequences in the body, including the formation of pigmented skin lesions, an increased risk of benign and malignant tumours, and skeletal abnormalities.[1,4]



People with NF1 have a pathogenic variant of the *NF1* gene, which codes for a large, multifunctional protein called neurofibromin

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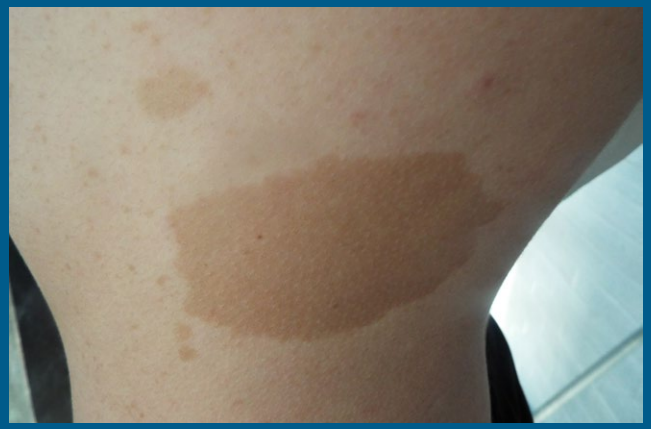
Signs and symptoms of NF1

Signs and symptoms of NF1, as well as symptom severity, are unpredictable, and can vary widely between patients, and even within families, although the reasons not fully understood.[13] In fact, some people who are very mildly affected might never know they have it. The manifestations of NF1 can also change and develop as an affected individual gets older.[3-5]

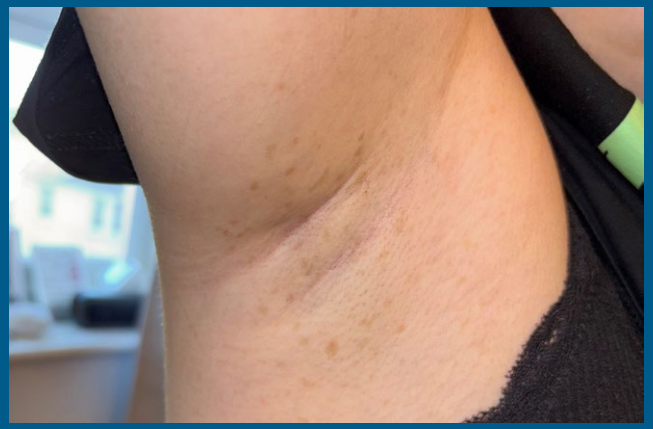
The range of potential symptoms is many and varied, but hallmark signs are:[1,4]

- Café-au-lait spots – from birth or developing in the first few years
- Freckling in unusual places (axilla/groin) – after the age of 5 years
- Neurofibromas in and under the skin – in older children and adolescents.

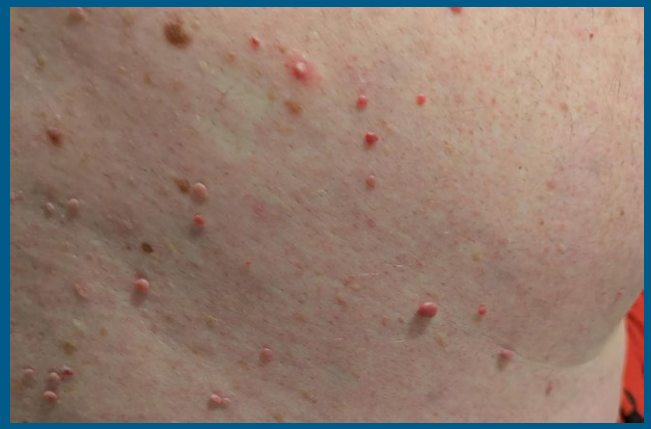
These are further described on the following four pages.



Café-au-lait spots



Axillary freckling



Neurofibromas

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Typical symptoms – café-au-lait spots

Café-au-lait spots (CALs) look like birthmarks (Figure 1). They are typically flat, uniformly pigmented, brownish areas, with well-defined borders.[14] The borders are usually (but not always) smooth.

CALs may be present from birth, or develop during the first few years, increasing in size and number.[2] CALs should be documented and monitored as the number can increase during childhood:

- It's not unusual for children to have one or two CALs, but three or more in the absence of NF1 is uncommon.[4]
- If a child has six or more CALs greater than 0.5 cm in diameter, they should be **referred to a paediatrician**, who will organise further assessments.[4] Note: the number of CALs does not reflect the severity of the condition.[15]

Adults with NF1 also have CALs, although they can fade as people get older.[2] The presence of more than six large (>1.5 cm) CALs in adults without a diagnosis of NF1 should prompt examination of the skin and questioning about other signs and symptoms (see later). If a firm diagnosis cannot be made (see *Diagnosing NF1*) and NF1 is suspected, it would be prudent to refer for genetic screening.

A body map can alert healthcare professionals to the significance of multiple birthmarks and the need to refer.

In some regions in the UK, the body mapping document is included as part of the Personal Child Health Record (PCHR or 'red book'). Where it is not included, a body map can be downloaded from: Information for Health Care Professionals – Childhood Tumour Trust

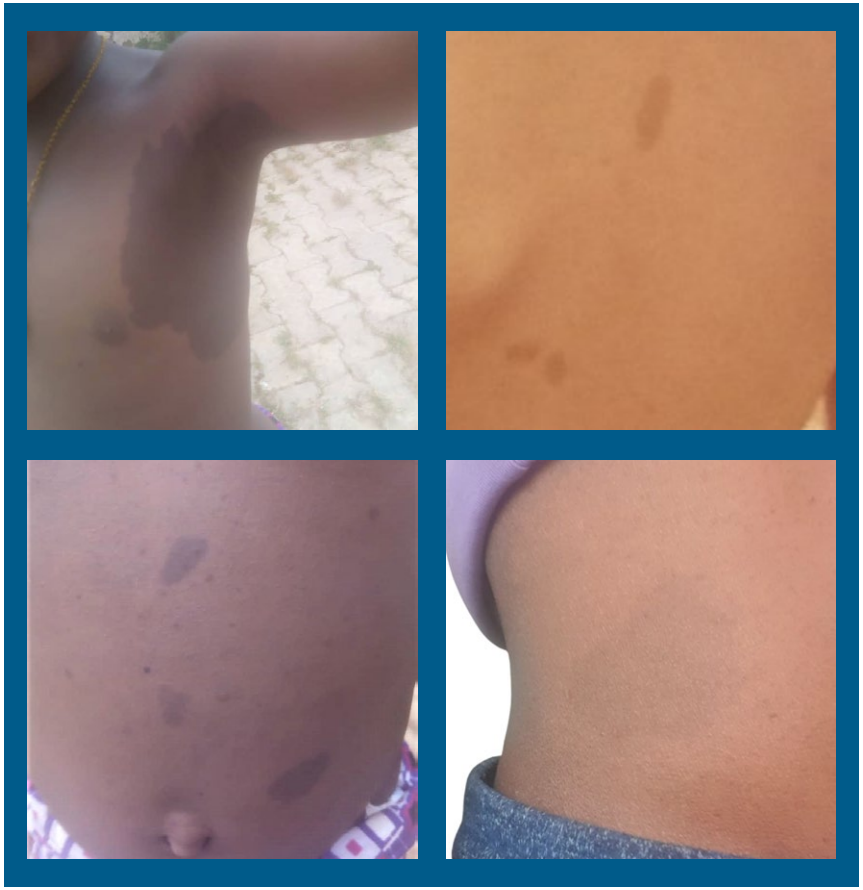

Figure 1: Café-au-lait spots on different skin tones

The name means 'coffee with milk', which describes the colour; the shade can vary. CALs may co-exist with hypopigmented (paler) lesions.[4]

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Typical symptoms – unusual freckling

In people without NF1, freckling usually only occurs in areas exposed to the sun. Those with NF1 develop freckling in areas not exposed to the sun and where skin touches skin, including the axillae (armpits) and groin.[15]

Axilla/groin freckling is rare at birth, but affects around 90% of children with NF1 by age 7 years.[16] Children with this pattern of freckling should be **referred to a paediatrician** who will organise further assessments.

If an adult without a diagnosis of NF1 presents with this freckling pattern, judicious questioning about other signs and symptoms of NF1 (see later) might be appropriate, whereupon a diagnosis might be possible (see *Diagnosing NF1*). If a firm diagnosis cannot be made and NF1 is suspected, it would be prudent to refer for genetic screening.

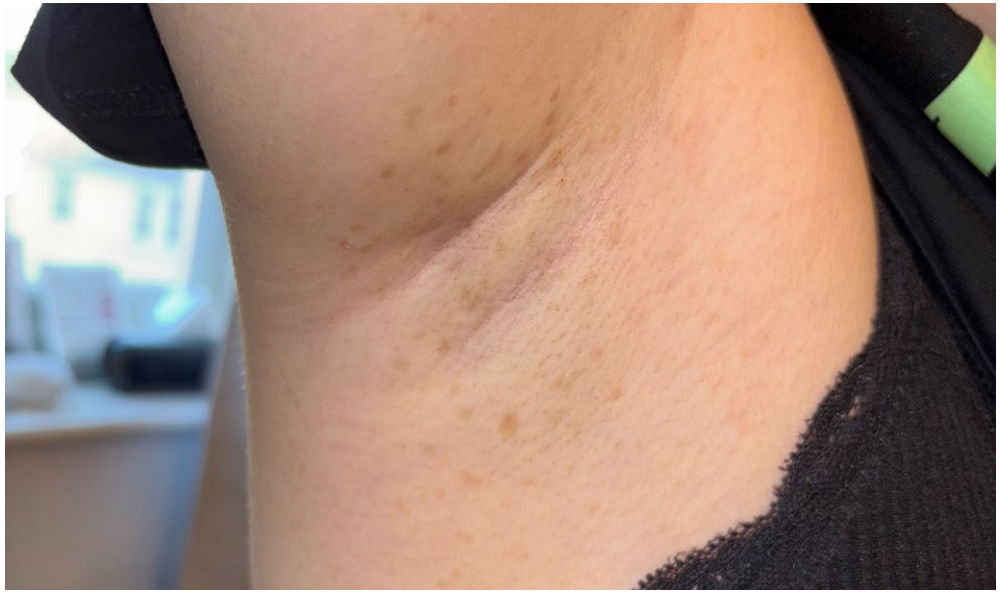

Figure 2: Axillary freckling

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Typical symptoms – cutaneous and subcutaneous neurofibromas

Older children and adolescents will likely develop benign cutaneous and subcutaneous neurofibromas (tumours of nerve sheaths). Cutaneous neurofibromas present in 99% of adults with NF1, while subcutaneous neurofibromas present in about 15%.[17]

They may appear as small, flesh-coloured (or sometimes purple), dome-shaped papules on and under the skin of the trunk, extremities or face.[18,19] They might also be pedunculated (with a stem or stalk).[4] They grow in size and number throughout adulthood.[2]

For patients who already have an NF1 diagnosis, referral for investigations and/or removal of cutaneous or subcutaneous neurofibromas will depend on the burden that they impose.

In a patient without a diagnosis for NF1, the presence of one or more cutaneous or subcutaneous neurofibromas should prompt further physical examination and questioning:

- Upon examination, if a firm NF1 diagnosis can be made (see *Diagnosing NF1*), refer to a Dermatology consultant and other appropriate specialists (depending on presentation).
- If a clinical diagnosis cannot be made, but NF1 is suspected, it may be prudent to refer a child to a paediatrician (who will organise further tests) and an adult for genetic testing.

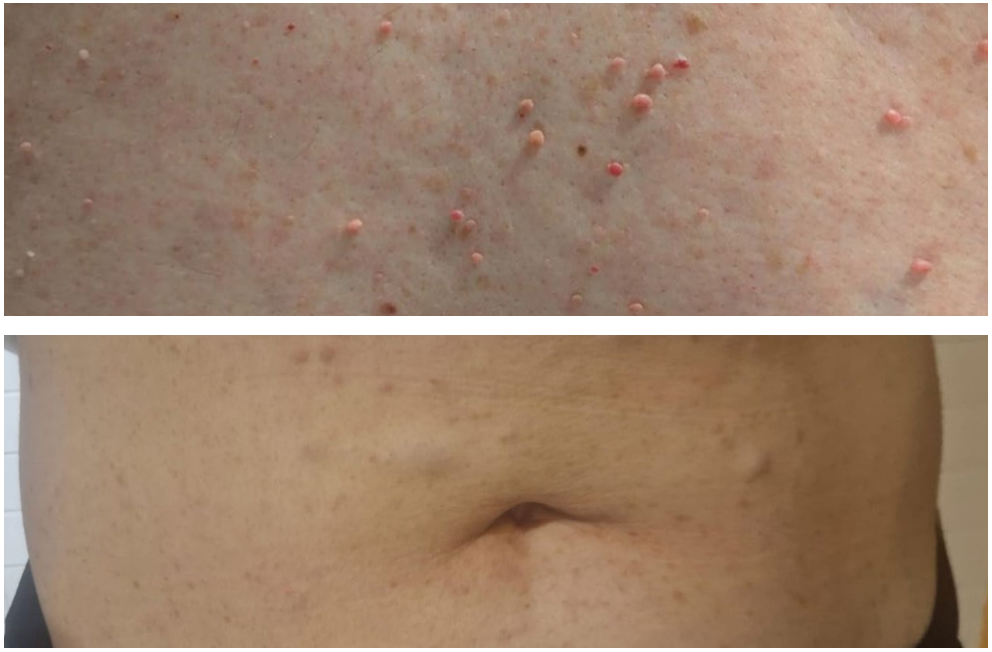

Figure 3: Cutaneous and subcutaneous neurofibromas* are eventually found in most people diagnosed with NF1[4]

- **Cutaneous** neurofibromas may sting, itch, catch on clothing and cause cosmetic problems.
- Subcutaneous neurofibromas may be tender and cause tingling in the **distribution** of the affected nerve.

*If there is uncertainty whether any papules are neurofibromas, the patient should be referred to a dermatologist for assessment.

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Typical symptoms – plexiform neurofibromas

Plexiform neurofibromas are found in 30 to 50% of people with diagnosed NF1.[20] They can cause significant problems including pain, disfigurement and pressure on surrounding structures.

They can develop much earlier than cutaneous neurofibromas, and may even be present at birth; they're often larger, with less well-defined borders, and have been said to feel like a 'bag of worms'.[21] In older children, adolescents and adults, plexiform neurofibromas can cause pain and disfigurement, which arise due to compression of surrounding tissue or nerves, bone erosion and organ displacement.[20]

In addition to clear and obvious evidence of symptoms, plexiform neurofibromas carry a lifelong risk for malignancy of between 8 and 13%.[20] Hence, patients who have these complications carry the lifelong burden of needing regular monitoring, clinical investigations and any necessary treatments.[20]

The presence of one or more plexiform neurofibromas of any type should prompt **referral for specialist assessment**.[14]

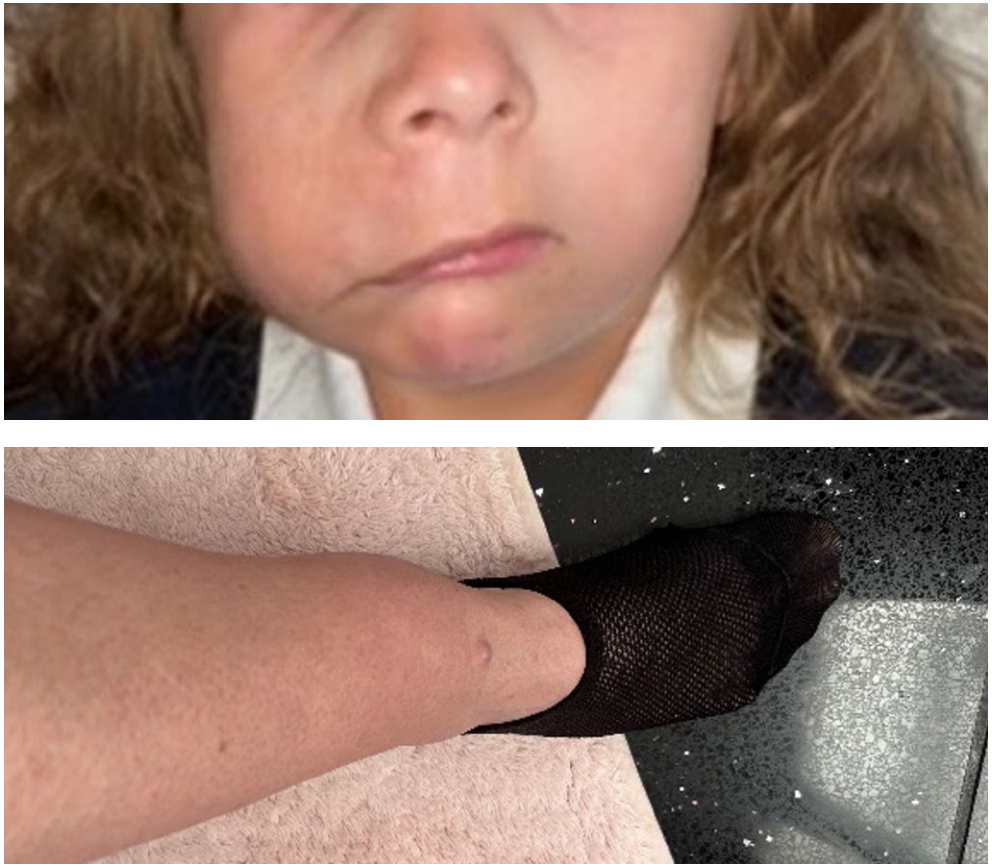

Figure 4: Plexiform neurofibromas develop in up to half of people with NF1

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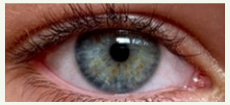
Other common signs and symptoms of NF1

As well as being aware of the typical signs and symptoms of NF1, knowledge of the other common features and manifestations (Table 1) may alert a healthcare professional to the possibility that NF1 might be present, and to seek further assessment.

Table 1: Other common manifestations of NF1

Lisch nodules 	• Small, often pigmented bumps on the iris; sometimes visible without magnification (more often in adults); slit-lamp examination can distinguish them from nevi. They don't usually affect vision.[22] • They are the most common clinical feature of NF1 in adults. In children, they are less common, but develop gradually such that, by the age of 20, all patients may exhibit them.[17,22]
Choroidal abnormalities	• Bright, patchy nodules as seen by optical coherence tomography (OCT)/near-infrared reflectance (NIR) imaging.[23] • Reported frequency of up to 100%.[17,23]
Cognitive and neurodevelopmental problems	• Children with NF1 are more likely to have: cognitive impairment (e.g. deficits in learning, memory, executive function, broad language deficits and fine motor skills) – around 80%;[24] developmental dyslexia – 5 to 10%;[25] ADHD – up to 50%;[26] autism spectrum disorder – 21 to 40%.[27] • Children with NF1 need educational assessments and, potentially, more support in school.
Ocular problems	• A tumour (glioma) of the visual pathway is found in around 15% of people with NF1.[15,28] They're usually detected by age 5 and rarely develop after age 10.[8] • Optic pathway gliomas (OPGs) may be asymptomatic but, in some children, they cause problems including visual loss, squint and abnormal colour vision.[29]
Skeletal abnormalities	• Bone malformations, include bowing of the long bones (especially the tibia) may occur in 2% of children with NF1.[15,17] These may be seen in the first few months of life. • Other skeletal abnormalities include scoliosis (curvature of the spine; thought to affect 5 to 10% of people), abnormalities of the chest wall and spontaneous fractures.[30]
Dental issues	• Multiple, common, age-related manifestations, including: gingival enlargement; impacted, supernumerary, missing or displaced teeth; overgrowth of the alveolar process; neurofibromas of the oral cavity.[31]
Other signs	• Muscle pain, weakness, fatigue;[32] short stature, larger heads;[3] itching.[33]

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Complications associated with NF1

NF1 patients have an increased risk of developing medical complications (Table 2). It is important to be familiar with these so that, upon diagnosis, a patient can be monitored and appropriately treated.

Table 2: Additional complications associated with NF1	
Cardiovascular problems	An increased risk of cardiovascular problems including congenital heart disease, hypertension and renal artery stenosis.[15] Hypertension is common among NF1 patients, and even children can develop it.[15,34] Children and adults should have regular (at least annual) blood pressure checks.[15] It is especially frequent during pregnancy.[34]
Increased risk of cancer	People with NF1 have a 5- to 15-fold increased risk of developing cancer relative to the general population, the risk varying by type of cancer.[35] For example: • People with NF1 have around a 10% chance of developing a malignant peripheral nerve sheath tumour in their lifetime.[15] • The risk of early-onset breast cancer is increased.[5] The ERN GENTURIS* surveillance guidelines recommend to start annual breast cancer screening between age 30 and 50, and thereafter as per national guidelines.[36] However, the NHS advises to begin screening only at age 40.[15] • People with NF1 have a 7% chance of developing a gastrointestinal stromal tumour.[37] Because of the increased cancer risk, people with NF1 should avoid unnecessary radiation. Hence, if medical imaging is ever needed, alternatives (such as MRI or ultrasound imaging) might be preferable;[36,38] when considering radiation treatment, the increased risk posed should first be carefully balanced against expected benefit.
Neurological issues	NF1 has been linked to many neurological conditions, including headache, sleep disturbances, epilepsy, Parkinson's Disease and multiple sclerosis.[39]
Pregnancy complications	A population-based review suggests that NF1 is associated with increased maternal morbidity (but not mortality). Complications included: gestational hypertension, preeclampsia, intrauterine growth restriction, preterm labour and caesarean delivery.[40]

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The importance of recognising NF1

Frontline child health professionals and GPs are well placed to notice common signs of NF1, allowing for referral to specialist care early in the course of the condition. Acting on a clinical suspicion can lead to earlier diagnosis, monitoring and management, and can vastly improve quality of life for those with NF1.

Getting a diagnosis:

- Gives parents an answer to relevant concerns they may have about their child
- Affords parents the opportunity to seek support for their child's medical and educational needs
- Empowers parents to educate their child so that they are equipped to manage their health in later life.

Recognising signs in people who are mildly affected, and haven't noticed symptoms can help secure a diagnosis and:

- Shed light on doubts they may have had about their health
- Ensure that they receive appropriate monitoring for complications and avoid additional risks, for example:
  - Regular blood pressure checks and treating any previously unsuspected hypertension
  - Being aware of the increased risk of assessments using X-rays
  - Being aware of the increased risk of treatments involving radiation
  - Receiving genetic counselling if planning a family
  - Receiving appropriate care during pregnancy.

Recognising NF1 is essential for improving quality of life, monitoring for complications to enable appropriate treatment, and minimising potential health risks

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Diagnosing NF1

The diagnosis of NF1 is primarily clinical, together with an assessment of the patient's family history.[1] Criteria for the diagnosis of NF1 are shown in Box 1.

Most people with NF1 are identified after a routine examination while being assessed for cosmetic complaints, or as part of an evaluation because of a family history of NF1.[8] If a child who is at risk of NF1 reaches 10 years without meeting the diagnostic criteria, they are unlikely to be affected.[3]

MRI scanning may be used if there are neurological symptoms or signs.[7]

In most cases a clinical diagnosis is sufficient, although genetic testing can be helpful:

- In a young child who has only CALs and no family history[1,4]
- In an adult when there is suspicion of NF1 (e.g. with inconclusive presentation or if their child has confirmed NF1 and there is no known family history)
- In an adult or child with suspected segmental NF1.

Genetic testing is a personal choice for the patient/parents, and should only be undertaken after expert consultation.[4] It cannot predict the likely manifestations of NF1, nor their severity.[8]

A negative genetic test does not exclude NF1 – around 5% of people with NF1 test negative.[3]

Box 1: Diagnostic criteria for NF1[41] *Two criteria are needed if neither parent has NF1; only one is needed if a parent has NF1*
Six or more café-au-lait spots (>0.5 cm greatest diameter in children or >1.5 cm in adults)
Axillary or groin freckling
Two or more cutaneous/subcutaneous neurofibromas or one plexiform neurofibroma
Optic pathway glioma
Two or more iris Lisch nodules (seen on slit lamp examination) or two or more choroidal abnormalities (seen on optical coherence tomography/near infrared reflective imaging)
Bony dysplasia (sphenoid dysplasia, bowing of long bone or pseudarthrosis of a long bone)
Genetic testing showing a pathogenic NF1 variant in apparently normal tissue

- A child diagnosed with NF1 should be under the care of a paediatrician, who can act as the point of contact for different specialists.
- A newly diagnosed adult should be managed in primary care, with specialist referral as needed.

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How is NF1 managed?

Currently, there is no cure or specific treatment for NF1. Management consists of regular monitoring with symptomatic treatment of complications.[1,42] Any health professional involved in the care of patients with NF1 should be made aware of their condition.

Counselling

- Counselling should be offered to children, their parents and other family members, as well as to newly diagnosed adults to discuss possible complications.

Monitoring

- **Children** with NF1 should be reviewed annually, preferably by one paediatrician in **each specialty** to allow co-ordinated care.
  - Until the age of seven, children should have annual eye examinations (visual acuity and fundoscopy).[4]
  - Monitor children for learning and behavioural problems. Children should have a detailed developmental assessment before school age. At school, the involvement of a special educational needs co-ordinator may be necessary.[4]
- **Adults** should have regular (at least annual) blood pressure checks[15] and other assessments appropriate to their condition. They should receive genetic counselling (see next page) when transitioning from paediatric to adult services, and offered it again if they plan to start a family. Women who become pregnant should be made aware of additional risks of pregnancy complications, and the relevant healthcare teams should be notified.

Treatment of complications

- The complications of NF1 are likely to appear between monitoring appointments, so patients and their carers should be encouraged to report significant changes as and when they happen.[4] It is likely that many different specialties will be involved in the care of patients with NF1 due to the wide range of body systems affected.
- The range of treatments for complications of NF1 includes medication for hypertension or ADHD, surgery for removal of neurofibromas and orthopaedic interventions for bone malformations. Clinical trials are under way to assess potential new medical treatments for NF1.[19]

Support

- Charities providing information and support to those with NF1 in the UK include Nerve Tumours UK, the Childhood Tumour Trust, Tumour Support Scotland, and Funny Lumps (see *Resources* page for contact details).

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Genetic counselling

Genetic counselling is recommended for all people with NF1 who are transitioning from paediatric care to adult services, and should be offered again if they considering having children.[4]

A person with generalised NF1 has a **50% chance** of passing the condition to their offspring. The degree to which that child will be affected by NF1, and the severity of any complications, is unpredictable. Altogether, the risk of a person with NF1 having a child severely affected by NF1 (lifelong morbidity or early mortality) is about 1 in 12.[4]

If a child has NF1, but their parents have no clinical signs, it remains prudent to offer genetic testing to both the child and parents to confirm that the child's case is *de novo*. If both parents test negative, they can be reassured that the risk of a further child of theirs having NF1 is extremely small (<1%).[4]

Prenatal testing is possible, but many people choose not to do it because it is not possible to know how severely a child will be affected. Preimplantation genetic diagnosis is also available.[4]

Genetic counselling is recommended if a person with NF1 is considering starting a family

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Advising parents and newly-diagnosed adults

When parents first discover that their child has NF1, it can be a very worrying time. They will have many questions, and will look to healthcare providers to provide guidance and reassurance.

Newly diagnosed adults may finally have an answer to explain the niggling health issues they may have, but now carry the burden of knowing they potentially have more serious ones to come.

Providing support and advocating for your patients will help them navigate the complicated healthcare journey they may face – from multiple appointments across many different specialties to treatments for symptoms and complications as they develop.

It's important that parents talk to their child's school so that they can provide the right educational support.

Linking with other families with children who have NF1 can also help a child feel less isolated and less 'different'. Details can be found on various NF1 charity websites – a list of relevant charities is provided on the *Resources* page.

Two specialist NF1 centres in the UK – Guy's & St Thomas' NHS Foundation Trust (London) and Manchester Centre for Genomic Medicine – deal with complex cases. Their websites provide useful additional information and guidance about their work with complex NF1 cases. See the *Resources* page for details.

Specialties that may become involved in the care of patients with NF1 include:

- Dermatology
- Ophthalmology
- Neurology
- Cardiovascular
- Plastics
- Obstetrics
- Oncology
- Endocrinology
- Psychology
- Paediatrics
- Dentistry
- Orthopaedic
- Educational

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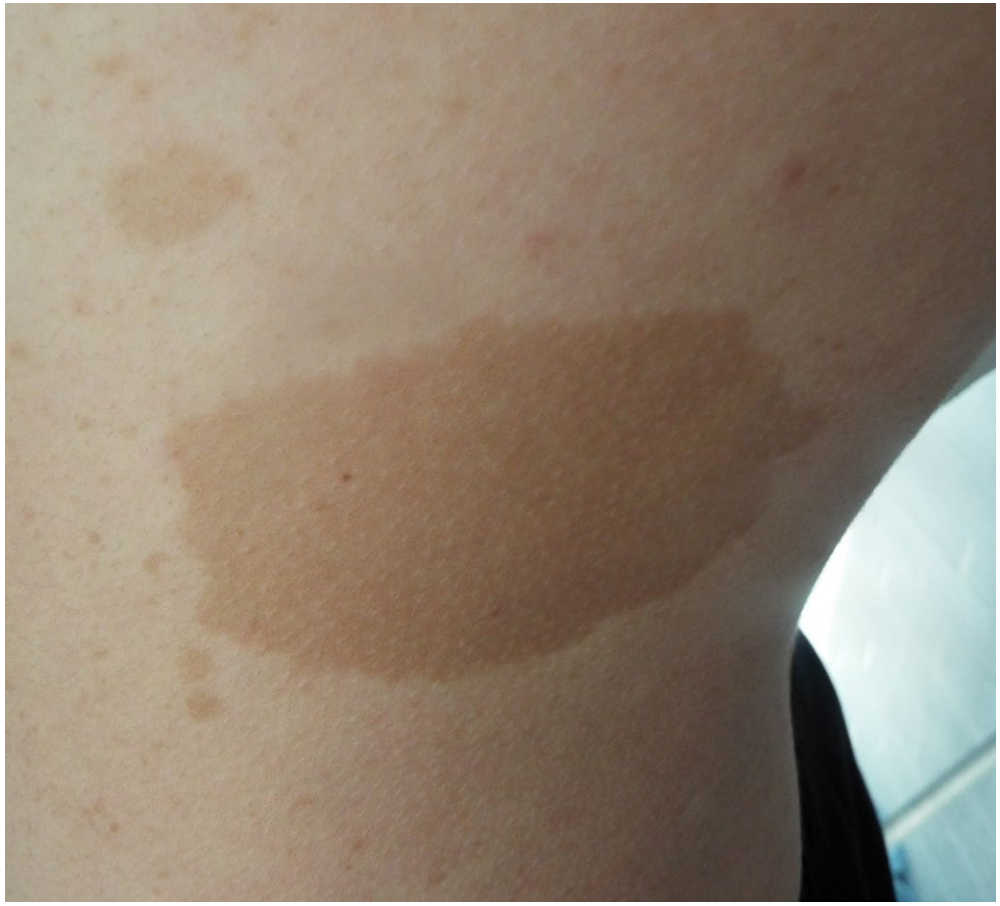
Key points – recognising and referring for NF1

- NF1 is an autosomal dominant genetic condition with wide-ranging clinical manifestations.
- Frontline child health professionals are in a good position to notice the early, common signs of NF1.
- Café-au-lait spots should be documented and monitored. Three or more is unusual. If a child has six or more CALs, they should be referred for specialist assessment.
- Specialist assessment should also be sought for a child with axillary/groin freckling or neurofibromas without an existing diagnosis of NF1.
- Body mapping can be a useful tool for recording and monitoring birthmarks.
- Monitoring and managing patients with NF1 is complex; it involves coordinating multiple medical appointments and assessment outcomes across a wide range of specialties.
- Parents should be supported in accessing the appropriate specialist care and sources of support (including appropriate educational provision) for their children.



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Assessment – about NF1

Now that you have reviewed the learning, please check your understanding using this quick self-test

QUESTION 1:

Which of the following statements about NF1 are TRUE? (Select all that apply)

- ◯ NF1 affects around 1 in 10,000 people
- ◯ More boys are affected by NF1 than girls
- ◯ Many mildly-affected people with NF1 may never be diagnosed
- ◯ Members of a family who have NF1 are likely to be affected to the same degree
- ◯ 50% of people with NF1 have no family history of the condition

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Assessment – about NF1

ANSWER 1:

Which of the following statements about NF1 are TRUE? (Select all that apply)

- ◯ NF1 affects around 1 in 10,000 people
- ◯ More boys are affected by NF1 than girls
- ◉ Many mildly-affected people with NF1 may never be diagnosed
- ◯ Members of a family who have NF1 are likely to be affected to the same degree
- ◉ 50% of people with NF1 have no family history of the condition

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Assessment – manifestations of NF1

QUESTION 2:

Which of the following are common manifestations of NF1? (Select all that apply)

- ◯ Neurodevelopmental disorders
- ◯ Kyphosis
- ◯ Café-au-lait spots
- ◯ Cutaneous neurofibromas
- ◯ Freckling in unusual places

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Assessment – manifestations of NF1

ANSWER 2:

Which of the following are common manifestations of NF1? (Select all that apply)

- [x] Neurodevelopmental disorders
- [ ] Kyphosis
- [x] Café-au-lait spots
- [x] Cutaneous neurofibromas
- [x] Freckling in unusual places

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Assessment – café-au-lait spots

QUESTION 3:

Which of the following statements about café-au-lait spots (CALs) are true? (Select all that apply)

- ◯ A child with six or more CALs should be referred for assessment
- ◯ CALs may increase in size and number over time
- ◯ It is not uncommon for a healthy child to have one or two CALs
- ◯ CALs typically develop after the age of five years
- ◯ CALs are typically flat, uniformly pigmented and with well-defined borders

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Assessment – café-au-lait spots

ANSWER 3:

Which of the following statements about café-au-lait spots (CALs) are true? (Select all that apply)

- [x] A child with six or more CALs should be referred for assessment
- [x] CALs may increase in size and number over time
- [x] It is not uncommon for a healthy child to have one or two CALs
- [ ] CALs typically develop after the age of five years
- [x] CALs are typically flat, uniformly pigmented and with well-defined borders

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Assessment – diagnosis of NF1

QUESTION 4:

Which of the following statements about the diagnosis of a child with suspected NF1 are TRUE? (Select all that apply)

- ◯ Genetic testing is always recommended
- ◯ A negative genetic test excludes NF1
- ◯ The diagnosis is primarily clinical, with an assessment of the family history
- ◯ Only one of the diagnostic criteria is necessary to confirm the diagnosis if the child has an affected parent
- ◯ A child who does not meet the criteria by the age of 10 is unlikely to be affected

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Assessment – diagnosis of NF1

ANSWER 4:

Which of the following statements about the diagnosis of a child with suspected NF1 are TRUE? (Select all that apply)

- ◯ Genetic testing is always recommended
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- ◉ The diagnosis is primarily clinical, with an assessment of the family history
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Assessment – genetic counselling

QUESTION 5:

With regard to genetic counselling for people with NF1 planning a family, which of the following statements are TRUE? (Select all that apply)

- ◯ A person with NF1 has a 25% chance of passing it to their offspring
- ◯ The risk of a person with NF1 having a severely affected child (lifelong morbidity or early mortality) is estimated to be 1 in 12
- ◯ If parents of a child with NF1 do not have it themselves, they are extremely unlikely to have another child with NF1
- ◯ Prenatal testing can predict how severely affected a child with NF1 will be
- ◯ Preimplantation diagnosis is possible

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Assessment – genetic counselling

ANSWER 5:

With regard to genetic counselling for people with NF1 planning a family, which of the following statements are TRUE? (Select all that apply)

- ○ A person with NF1 has a 25% chance of passing it to their offspring
- ◉ The risk of a person with NF1 having a severely affected child (lifelong morbidity or early mortality) is estimated to be 1 in 12
- ◉ If parents of a child with NF1 do not have it themselves, they are extremely unlikely to have another child with NF1
- ○ Prenatal testing can predict how severely affected a child with NF1 will be
- ◉ Preimplantation diagnosis is possible

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Assessment – patient monitoring

QUESTION 6:

When a child is diagnosed with NF1, what advice may be useful for parents? (Select all that apply)

- ◯ It may be helpful to investigate and contact charities that support children with NF1
- ◯ Not all children with NF1 will develop severe symptoms
- ◯ They may have many different specialist appointments over the coming years
- ◯ They should be watchful for significant changes in their child's condition between medical appointments
- ◯ They should discuss the diagnosis and its implications with their child's school

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Assessment – patient monitoring

ANSWER 6:

When a child is diagnosed with NF1, what advice may be useful for parents? (Select all that apply)

- ◉ It may be helpful to investigate and contact charities that support children with NF1
- ◉ Not all children with NF1 will develop severe symptoms
- ◉ They may have many different specialist appointments over the coming years
- ◉ They should be watchful for significant changes in their child's condition between medical appointments
- ◉ They should discuss the diagnosis and its implications with their child's school

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Resources

For parents/carers and health professionals

- NHS. Neurofibromatosis 1: www.nhs.uk/conditions/neurofibromatosis-type-1
- Childhood Tumour Trust: https://www.childhoodtumourtrust.org.uk/
- Tumour Support Scotland: https://tumoursupport.scot/
- The Brain Charity: https://www.thebraincharity.org.uk/condition/neurofibromatosis/
- Useful video on NF1: https://www.youtube.com/watch?v=lM7r-U1sKnI

Additional websites for heath professionals

- Manchester Centre for Genomic Medicine: https://www.mangen.co.uk/healthcare-professionals/clinical-genomic-services/nf1/
- Guy's and St Thomas' NHS Foundation Trust: https://www.guysandstthomas.nhs.uk/our-services/neurofibromatosis
- NHS England National Genomics Education Programme: https://www.genomicseducation.hee.nhs.uk/genotes/in-the-clinic/presentation-patient-with-neurofibromatosis-type-1/

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