

4. Adult onset neurological conditions

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4.1 Key points

Most common adult onset neurological conditions are multifactorial in cause. A minority of common adult onset neurological conditions are due primarily to a dominantly inherited genetic alteration (mutation) (for example, Huntington disease). Some gene alterations (polymorphisms) may be associated with a higher risk of developing certain neurological conditions. Testing for polymorphisms is currently only on a research basis and neither recommended nor available for routine use (for example, ApoE4 in Alzheimer disease).

Examples of inherited adult onset neurological conditions

Creutzfeldt-Jakob disease and other prion diseases^a
 Familial Alzheimer disease^a
 Familial epilepsy^a
 Familial motor neurone disease^a
 Friedreich ataxia^b
 Hereditary peripheral neuropathies (Charcot Marie tooth disease)^a
 Mitochondrial disorders^a
 Hereditary spastic paraparesis^a
 Huntington disease^b
 Muscular dystrophies^a
 Myotonic dystrophy^b
 Spinal muscular atrophy^b
 Spinocerebellar ataxias^a

^a Genetic testing may be available for some familial forms of this condition.

^b Genetic testing is available for this condition.

Features of inherited adult onset neurological conditions

- Many later onset genetic conditions will be severely and progressively disabling, and some are ultimately fatal.
- Most are inherited from a parent in an autosomal dominant fashion.
- For most conditions, all people with an altered copy of the relevant gene will develop the condition.
- Genetic testing is available for some conditions in some circumstances. See box above.
- Most of these conditions will have significant and complex impacts on families and carers.

Neurogenetics clinics

Neurogenetics clinics provide:

- Neurological assessment for accurate phenotype classification.
- Genetic counselling (including the genetic implications of the condition and an assessment of risk to other family members).
- Genetic testing.
- Referral to support services.

Indications for referral

Individuals or family members with:

- Proven (clinically or by genetic testing) personal or family history of an inherited adult onset neurological condition.
- Personal features consistent with an inherited neurological condition.
- A suspicious family history. That is, two or more family members were affected with apparently the same condition in two generations.
- Unusual features indicating a personal or family history that may be due to an inherited adult onset neurological condition. For example, a significantly earlier age of onset than average, or other unusual aggregation of neurological diagnoses.

Management of a symptomatic individual

Refer to a neurologist for diagnosis and ongoing management:

- Diagnostic genetic testing may be performed to confirm a clinical suspicion and/or to identify the causative genetic alteration, enabling at-risk individuals to have testing. Genetic testing is discussed further in Appendix 1.
- Genetic testing is complex and is arranged by neurologists or clinicians in a neurogenetics clinic *after a detailed neurological assessment*.

Referral of the individual and/or family members to a neurogenetics clinic before or after genetic testing may be beneficial as information, counselling and/or case management ensure people have access to the best range of supports to meet their needs.

Management of an asymptomatic individual

- *Take a family history*, noting family members believed to have the neurological condition or suggestive neurological symptoms. Where possible, the family history should cover three generations and include grandparents, uncles, aunts and cousins.
- *Refer to a neurogenetics clinic* if there is a family history suggestive of an inherited neurological condition (see Neurogenetics clinics, Appendix 2) or to a predictive testing counsellor if the causative genetic alteration for the condition is known (for example, Huntington disease).
- *Consider* referral to the consumer support organisation for the condition they are at risk for, as it may be a useful and supportive contact for the person over time.

If the family history is not suggestive (see box on previous page):

- Reassure the individual that most neurological conditions are not inherited and the family history may be a series of 'chance events'. They should inform the GP of any changes to the family history as this may alter the assessment.
- *Update the family history regularly since information given over time may alter the individual's risk.*

Genetic testing

Referral to a neurogenetics clinic must be made prior to blood collection if an asymptomatic individual requests genetic testing.

- **Genetic testing cannot be performed on at-risk individuals unless:**
 - ✦ The gene alteration causing the condition is known.
 - and
 - ✦ The individual has had extensive pre-test genetic counselling at a neurogenetics clinic or by a specialised predictive testing counsellor.
- Genetic testing of an asymptomatic individual involves complicated ethical, psychological and clinical issues.
- Up to 80% of asymptomatic people eligible for genetic testing for an adult onset neurological condition choose not to have testing (Binedell, Soldan & Harper 1998). Reasons for not undergoing testing include a reluctance to confront the certainty of risk, perceived inability to cope with having a gene-positive result, the lack of a cure or preventive treatment, and concerns about insurance or workplace discrimination.
- Despite the lack of a cure or preventive treatment, some people find knowledge of their genetic status has psychological and life planning benefits.
- If an asymptomatic individual is found to carry a gene alteration, the implications depend on the condition. For conditions such as Huntington disease, with a 100% penetrance, affected individuals will develop the condition in the future. For conditions with a lower penetrance, such as familial motor neurone disease, they may or may not develop symptoms.

For further information about genetic testing, see Appendix 1.

4.2 Background

Introduction

Most inherited adult onset neurological conditions are uncommon. The following conditions have been selected for greater attention because they either provide a model of a classic, dominantly inherited neurogenetics condition (for example, Huntington disease), or are a common multifactorial condition with a genetic component (for example, schizophrenia) and are therefore likely to be seen more frequently by general practitioners.

Huntington disease

- Huntington disease has a population frequency of approximately one in 10,000.
- Huntington disease is an inherited disease that gives rise to progressive, selective, localised neuronal cell death.

Genetics

Huntington disease is an autosomal dominant condition. Each child of an individual with Huntington disease has a 50% risk of developing symptoms.

Huntington disease is caused by an abnormality in the 'huntingtin' gene. The abnormality is a result of an increase in size (expansion) of a certain part of the gene due to a tri-nucleotide sequence being repeated over and over again. There is a range of expansion that is clearly disease causing, and all people with expansions in this range develop Huntington disease. A small number of people with expansions that are just above the normal range may develop Huntington disease late in life. The size of the gene expansion is unstable across generations. Expansions of any size have the potential to increase from one individual to their child, especially if paternally transmitted.

Clinical features

Symptoms can be categorised into three basic groups:

- *Physical* – involuntary, jerky movements or 'chorea', abnormal gait, bradykinesia, hyperflexia, abnormal eye movements, dysarthria and dysphasia.
- *Cognitive* – impairment including disturbances in verbal fluency, cognitive speed, the retrieval of memories, ability to persist at a task or change cognitive sets, therefore causing difficulties with judgement, planning, problem solving and eventually dementia.
- *Emotional* – including personality changes such as impulsiveness, perseveration, disinhibition, depression, mood swings and aggression.

These symptoms become progressively worse over time. Each individual affected by Huntington disease has a unique manifestation of the disease and not all people will experience all the symptoms, nor will the symptoms appear in a particular order.

The symptoms usually develop as the person is approaching middle age; however, onset can occur in children and people in later years. An individual with Huntington disease may live for 15 to 25 years after developing the first symptoms. There is currently no cure. Treatment is available to manage movement disorders and depression.

Management of a symptomatic individual

- Refer to a neurologist or neurogenetics service for assessment and genetic testing.
- If diagnosis is confirmed, discuss informing other family members of the diagnosis with the individual (see also Part A, *Talking with families about genetics*).
- Suggest/encourage contact with Australian Huntington Disease Association (Vic.) (AHDA) for information, support, counselling, advocacy and ongoing monitoring of the patient's/family's support and service needs.

Management of an at-risk individual

Explore the family history of Huntington disease. If the individual wishes to explore their risk further, discuss direct referral to the Huntington Disease Predictive Testing Service or contact with AHDA for information (including an informative video) and counselling.

The Huntington Disease Predictive Testing Service will include:

- Detailed assessment of risk and availability of genetic testing.
- Support during decision making regarding testing.
- Pre- and post-test counselling.

Up to 80% of people at risk of Huntington disease choose not to have testing prior to onset of symptoms, called 'predictive testing', as they feel that knowledge of their genetic status would not be helpful and may increase anxiety (Binedell, Soldan & Harper 1998). If the individual does not wish to discuss genetic testing with the predictive testing service, they may still benefit from ongoing support and contact with AHDA.

Major features of guidelines for offering predictive testing for Huntington disease

- Those requesting testing should be given up-to-date information regarding Huntington disease and its genetics in order to make an informed voluntary decision.
- The request should come from that person and not from a third party.
- Testing should only be available to those who have reached the age of majority.

The rationale for this is that testing of minors means they lose the opportunity to decide for themselves whether or not they wish to know their genetic status once they reach an age when they can appreciate the significance of their family history.

- If possible, testing should not be undertaken on an individual where the result will reveal the genetic status of a third party.

For example, when a grandparent has Huntington disease and their grandchild wishes to be tested (that is, they are at 25% risk) the grandchild's at-risk parent should be offered testing in the first instance

Counselling should be provided both pre- and post-testing within specialised genetic counselling units.

Confidentiality regarding participation in the program and the test result is paramount.

Source: Delatycki, M & Tassicker, R 2001, 'Adult onset neurological disorders', *Australian Family Physician*, 30:948–52.

Alzheimer disease

- Alzheimer disease is the most common cause of dementia in people older than 40.
- The risk of developing Alzheimer disease increases with age.
- Alzheimer disease is a multifactorial condition.
- Early-onset, dominantly inherited Alzheimer disease is rare (<1% of all cases).
- Alzheimer disease is a pathological diagnosis based on the presence of amyloid plaques and neurofibrillary tangles and cannot be diagnosed with certainty by clinical assessment.

Familial Alzheimer disease (FAD)

- Early-onset familial Alzheimer disease (EoFAD) is a rare cause of Alzheimer disease, causing less than 1% of cases.
- EoFAD is inherited in autosomal dominant fashion.
- EoFAD tends to have an early age of onset (<60–65 years) but is otherwise indistinguishable from sporadic early-onset Alzheimer disease.
- Alterations in the genes presenilin-1 (PS-1), amyloid precursor protein (APP) and presenilin-2 (PS-2) are known to cause EoFAD.
- Late-onset FAD (onset >65 years) is responsible for perhaps 10% of late-onset cases, but no causative genes are known.

Criteria for EoFAD

- A *family* with two or more affected people with onset age <65 years in more than one generation of a family, with post-mortem pathologically proven Alzheimer disease in at least one individual.
- An individual or family member with a disease-causing genetic alteration in one of the genes causing Alzheimer disease.

Genetic risk factors for Alzheimer disease

Family history

- Many people have a family history of Alzheimer disease; however, not all with a family history are at increased risk.

Individuals at population risk of Alzheimer disease

There is no discernable increase in risk for the individual if the family history comprises:

- No relatives with Alzheimer disease.
 - or
 - Grandparent only with Alzheimer disease.
 - or
 - Parent only with Alzheimer disease diagnosed over the age of 65.
 - or
 - Parent with Alzheimer disease diagnosed before the age of 65, and your patient is asymptomatic and now several years older than 65.
- For individuals with a family history of late-onset Alzheimer disease, the risk of Alzheimer disease depends on the degree of relationship and number of relatives affected. *In most cases, the individual is more likely not to develop Alzheimer disease.*
 - There is not consensus on the extent to which an individual's risk is increased by their family history late-onset Alzheimer disease.

Genetic susceptibility

- A susceptibility gene, ApoE, has been identified for Alzheimer disease.
- The ApoE gene has three forms (alleles) (ApoE2, ApoE3 and ApoE4). Everyone has two copies of the gene and can have either two identical forms (for example, ApoE2/ApoE2) or can have a combination of two alleles (for example, ApoE3/ApoE4).
- An individual's risk of developing late-onset Alzheimer disease is related to the combination of ApoE forms they carry.
- Those individuals with one or two copies of the ApoE4 allele are at increased risk of developing Alzheimer disease; however, 50% of all late-onset Alzheimer disease cases do not have a copy of ApoE4.
- Ongoing research is attempting to clarify the significance of ApoE in causing Alzheimer disease.
- Testing for ApoE status for Alzheimer disease has been the subject of debate. To date, local collaborative groups and international bodies have recommended that ApoE is not used for diagnostic or predictive testing for Alzheimer disease.

Who should be referred to a neurogenetics clinic?

- Any individual with a personal or family history consistent with early-onset familial Alzheimer disease (see *Criteria for EoFAD* box).
- Any individual with three or more affected family members with late-onset Alzheimer disease over two generations within the same parental line.
- While ApoE testing for Alzheimer disease risk is not recommended, individuals requesting ApoE testing for Alzheimer disease risk may benefit from referral to a neurogenetics clinic for further discussion.

Motor neurone disease

Motor neurone disease is also known as amyotrophic lateral sclerosis (ALS) or Lou Gehrig disease.

- Motor neurone disease is a rapidly advancing condition characterised by progressive muscle weakness due to the death of motor neurones in the brain, brain stem and spinal cord.
- Five to 10% of motor neurone disease is inherited, with an autosomal dominant inheritance pattern.
- Inherited motor neurone disease shows familial aggregation and an earlier age of onset than average (40s or younger); otherwise, clinical features are essentially the same as the sporadic form.
- About 20% of inherited motor neurone disease are due to mutations in the SOD1 gene; however, causative mutations in SOD1 are not fully penetrant.
- The genetic cause(s) of the other 80% of inherited motor neurone disease is unknown.
- As motor neurone disease is uncommon and causative mutations may not be fully penetrant, if more than one member of a family has motor neurone disease, consider referral to a neurogenetics clinic.
- *Contact a neurogenetics clinic for advice regarding arranging genetic testing.*

Parkinson disease

- Affects 1% of population over the age of 60 but may also affect younger people.
- Seventy to 90% of cases of Parkinson disease are sporadic.
- The majority of cases with a family history do not have a clear inheritance pattern and could be the result of common exposure to environmental factors, a genetic predisposition, or simply a chance aggregation.
- Genetic testing for Parkinson disease is not currently available outside research protocols.
- Some cases of juvenile onset Parkinson disease have been shown to be a recessive condition due to mutations in the parkin gene and, in a very few dominant cases, to mutations in the α -synuclein gene.
- Referral to a neurogenetics clinic may be considered for families with unusual features, such as familial aggregation and/or early-onset Parkinson disease.

The epilepsies

- The epilepsies are a group of disorders with differing genetic components. The inheritance or genetic contribution relates to each specific disorder.
- Knowledge about inherited epilepsies is rapidly growing.
- Subjects with *two or more individuals* in their family with epilepsy may benefit from advice regarding the nature and inheritance of their form of epilepsy.
- Referral to a neurologist may be helpful.

Psychiatric conditions

Schizophrenia

- Schizophrenia is a common disorder with a lifetime prevalence of approximately 1%.
- Schizophrenia has a clear genetic component but the genetics are complex and poorly understood.
- The risk of first-degree relatives developing schizophrenia is based on empirical data. See Table 1.
- No genes causing schizophrenia have been identified or characterised to date, however large regions of some chromosomes have been associated with schizophrenia.
- Genetic testing is not available.

Table 1. Genetic risks (approximate) in schizophrenia and manic-depressive illness

Affected relative	Risk%	
	Schizophrenia	Bi-polar disorder
No close relative (general population risk)	1	2-3
Sibling	9	13
Parent	13	15
Sibling and one parent	15	20
Both parents	45	50
Second-degree relative	3	5
Monozygotic twin	40	70
Dizygotic twin	10	20
First cousin	1-2	2-3

Source: Harper, P 1998, *Practical genetic counselling*, Butterworth & Heinemann, Oxford

Mood disorders

Mood disorders may have a manic-depressive (bipolar) or purely depressive (unipolar) course. Individuals with a first-degree relative have an increased risk of a mood disorder. See Table 1. The genetics of mood disorders is not understood and genetic testing is not available.

Appendix 1: Genetic testing

- Genes involved in the some inherited adult onset neurological conditions have been identified. These conditions tend to be rare.
- Broadly speaking, there are two types of genetic tests: diagnostic tests and predictive tests.

See Table 2 for a summary of genetic testing.

Diagnostic testing

- Diagnostic testing is the attempt to find the causative gene change in an affected family member. Diagnostic testing can only be performed for conditions where the causative gene(s) are known, and there is access to a laboratory offering that test.
- When one type of gene alteration in just one gene causes virtually all cases of a disorder, for example, Huntington disease, diagnostic testing is usually straightforward. However, testing is more complicated when many gene alterations in a number of different genes may be responsible for causing the same condition (for example, early-onset familial Alzheimer disease). For most conditions, not all genes involved have been identified.
- *Diagnostic testing is arranged by a neurologist or at a neurogenetics clinic after detailed neurological assessment and with informed consent.*
- Genetic testing has a wide range of clinical, psychological, ethical and genetic consequences.
- A referral to a neurogenetics clinic for genetic counselling may be beneficial.

Predictive genetic testing

- Predictive testing indicates if an individual is likely to develop an inherited neurological condition, prior to the onset of symptoms. The gene change causing the condition in the family must be known.
- For many at-risk individuals, predictive testing is not possible. This is because either the causative mutation in the family is not known, or the gene involved in causing the condition is not known.
- For most of the autosomal dominant adult onset neurological conditions, carrying the family gene alteration means the family member will definitely develop the condition (that is, penetrance is 100%).

Issues in predictive testing

(Material for this section has been drawn from Delatycki, M & Tassicker, R 2001, 'Adult onset neurological disorders', *Australian Family Physician*, 30:948–52.)

Counselling

- The aim of predictive testing (PT) counselling is to ensure that the individual understands the implications of PT and that they have considered the personal implications of a high- or low-risk result.
- PT counselling is carried out over a number of sessions by a trained genetic counsellor or social worker, and other health professionals such as a neurologist, psychiatrist and a clinical geneticist.
- The sessions are adapted to the needs of the individual undergoing the testing but still need to incorporate the minimal exploration of essential issues.
- The guidelines established for Huntington disease have been applied to predictive testing for other adult onset neurological conditions.

Uptake

- Uptake of predictive testing is lower than was anticipated prior to testing becoming available. Seventy-five per cent of people at risk of Huntington disease believed they would undergo predictive testing (Barette & Marsden 1979), before such testing was available. The actual uptake rate was approximately 20% (Binedell, Soldan & Harper 1998).
- This indicates that many people prefer uncertainty, rather than taking the risk of a genetic test showing that HD will occur in the future.

Psychological consequences

A systematic review of the literature indicates:

- A lack of long-term informative studies.
- Those individuals who were aware of their genetic test results showed decreased distress one year after testing, the effect being greater for those with decreased risk results.
- Some studies suggest that pre-test emotional state is predictive of subsequent emotional distress.

Events such as suicide, attempted suicide and psychiatric hospitalisation are more common among those who receive a gene positive test result than for those who do not, but these remain rare observations (2% versus 0.3%). Major predictors of such events, other than test result, were a past history of psychiatric illness and early symptoms of Huntington disease.

Insurance

- If an individual is at 50% risk of an adult onset neurological disorder, they will usually be able to obtain life and disability insurance; however, this will be at a significantly increased premium.
- If testing shows that they will develop the disorder, they need to inform an insurance company of this prior to a life and disability insurance policy being offered.
- People who will develop the disorder will generally be refused a new policy for life and disability insurance.
- People with existing policies in place do not need to inform insurers of test results obtained after they have been insured.

Table 2. Comparison of diagnostic and predictive genetic testing

	Diagnostic testing	Predictive testing
Who is tested?	A symptomatic individual	An asymptomatic individual
Who should consider testing?	<ul style="list-style-type: none"> • An individual clinically suspected to have the condition or • An individual diagnosed with the condition but the causative gene alteration in the family has not yet been identified. <p><i>Note: the gene involved in causing the condition must be known and testing be available locally</i></p>	<p>An individual who is at risk of inheriting a known causative gene change</p> <p><i>Note: the alteration causing the condition in the individual's family must be known or the condition must be caused by a single common gene alteration (for example, Huntington disease)</i></p>
Who arranges testing?	Neurologists or neurogenetics clinics (Appendix 2)	Neurogenetics clinics and predictive testing service (Appendix 2)
Aims and advantages of testing	<p>To identify the causative genetic change in the family ('family-specific mutation') for:</p> <ul style="list-style-type: none"> • Confirmation of diagnosis • Availability of predictive testing to other family members 	<p>To determine if a family member carries the alteration known to cause the condition <i>in their family</i>:</p> <ul style="list-style-type: none"> • Certainty regarding risk • Psychological benefits • Life planning
Disadvantages of testing	<ul style="list-style-type: none"> • Difficulty coping with knowledge of genetic status 	<ul style="list-style-type: none"> • Difficulty coping with knowledge of genetic status • Insurance and/or employment discrimination
What is tested?	The extent of testing will depend on the gene change detection method and the number of genes known to be involved in the condition	Only the known causative gene alteration is tested
How long does testing take?	Depends on the condition – months to years	If test is available in Victoria, ~8 weeks to 3 months

Appendix 2: Neurogenetics clinics

Neurogenetics clinics are multidisciplinary services involving neurologists, medical geneticists and genetic counsellors.

Neurogenetics clinics provide:

- Neurological assessment.
- Genetic counselling.
- Genetic testing.
- Referral to support services.

During an appointment (one to two hours) the following aspects may be covered:

- Collection of the family history, including details of affected family members.
- Neurological assessment.
- Discussion regarding the possibility of a genetic basis of the family history.
- Education regarding inheritance and chance of the individual and/or other family members developing the condition.
- Genetic counselling, including pre- and post-test counselling.
- Genetic testing.

Referral provides the opportunity for multidisciplinary assessment, identification of other at-risk family members and support.

Conditions (including childhood and adult-onset) seen at neurogenetics clinics include:

- Adrenoleukodystrophy
- Creutzfeldt-Jakob disease and other prion diseases
- Familial Alzheimer disease
- Familial epilepsy
- Familial motor neurone disease
- Friedreich ataxia
- Hereditary peripheral neuropathies (Charcot Marie tooth disease)
- Hereditary spastic paraparesis
- Huntington disease
- Mitochondrial disorders
- Muscular dystrophies
- Myotonic dystrophy
- Spinal muscular atrophy
- Spinocerebellar ataxias.

4.3 Patient and further information

Support groups and patient information

Alzheimer's Association Victoria
PO Box 5096, Glenferrie South 3122
Call: (03) 9818 3022
Email: alz@alzvic.asn.au
Website: <http://www.alzvic.asn.au>

Australian Huntington Disease Association (Vic)
PO Box 60, Holmesglen 3148
Call: (03) 9563 3922
Freecall: 1800 063 501
Fax (03) 9563 3489
Email: ahdavic@bigpond.net.au
Website: <http://www.ahda.com.au>

Australian Leukodystrophy Support Group Inc
C/- 10 Mitchell Street, Mentone 3194
Call Julie on: (03) 9584 7070
Email: leuko@vicnet.net.au
Website: <http://avoca.vicnet.net.au/~leuko/>

Charcot Marie Tooth Association
PO Box 30, Somers 3927
Call Ted: (03) 5983 1566
Email: bjasers@bigpond.com

Friedreich's Ataxia Association Victoria
C/- 7 Strathallyn Road, Ringwood 3134
Call Steve on: (03) 9859 9585
Email: contact@faavictoria.org.au
Website: <http://www.faavictoria.org.au>

Muscular Dystrophy Association
(covers muscular dystrophies, SMAs, inflammatory myopathies, diseases of peripheral nerve, disease of the neuromuscular junction, myotonias, metabolic diseases of the muscle, less common myopathies)
Head Office and Member Centre
Level 5, 641 Mount Alexander Road
Moonee Ponds 3039
Call: (03) 9370 0477
Freecall: 1800 656 632
Email: bms@mda.org.au
Website: <http://www.mda.org.au>

Motor Neurone Disease Association Victoria
265 Canterbury Road, Canterbury 3126
Postal address: PO Box 23, Canterbury 3126
Call: (03) 9830 2122
Freecall: 1800 806 632
Fax: (03) 9830 2228
Email: info@mnd.asn.au
Website: <http://www.mnd.asn.au>

Parkinson's Victoria
20 Kingston Road, Cheltenham 3192
Call: (03) 9551 1122
Freecall: 1800 644 189
Fax: (03) 9551 1310
Website: <http://www.parkinsons-vic.org.au>
Email: parksvic@satlink.com.au

Spinocerebellar Ataxia
Contact MS Society of Victoria
The Nerve Centre, 54 Railway Road, Blackburn 3130
Call: (03) 9845 2700
Fax: (03) 9845 2777
Email: infoline@mssociety.com.au
Website: <http://www.msaustralia.org.au/vic/>

Websites

Better Health Channel:
<http://www.betterhealth.vic.gov.au>

Relevant topics:

- Huntington's disease – common behavioural problems
- Huntington's disease – genetics explained
- Huntington's disease is an inherited condition
- Motor neurone disease is an incurable disease that causes paralysis
- Parkinson's disease explained
- Alzheimer's – ongoing research
- Alzheimer's – the latest research
- Dementia – causes and care
- Bipolar disorder

Further reading

Delatycki, M & Tassicker, R 2001, 'Adult onset neurological disorders', *Australian Family Physician*, 30(10):948–52.

Scheffer, I & Berkovic, S 2000, 'Genetics of the epilepsies', *Current Opinion Pediatrics*. 12(6):536–42.

4.4 Where to refer

Neurogenetics clinics

Referrals for:

- Neurogenetics Clinic, Alfred Hospital
- Neurogenetics Clinic, Austin Repatriation Medical Centre
- Neurogenetics Clinic, Box Hill Hospital
- Neurogenetics Clinic, The Royal Melbourne Hospital
- Neurogenetics Clinic, St Vincent's Hospital

Can be posted or faxed to:

Neurogenetics Clinic Coordinator
Genetic Health Services Victoria
PO Box 1100, Parkville 3052
Call: (03) 8341 6248
Fax: (03) 8341 6390

Referrals for:

- Monash Medical Centre Neurogenetics Clinic
- Friedreich Ataxia Clinic

Can be posted or faxed to:

Clinical Genetics/Genetic Health Services Victoria
Monash Medical Centre
Clayton Road, Clayton 3168
Call: (03) 9594 2026
Fax: (03) 9594 2022

Referrals for:

- Paediatric Neurogenetics Service
- Neurofibromatosis Clinic

Can be posted or faxed to:

Clinic Coordinator
Genetic Health Services Victoria
PO Box 1100, Parkville 3052
Call: (03) 8341 6201
Fax: (03) 8341 6390

Predictive testing and counselling services

Huntington Disease Predictive Testing Service

Genetic Health Services Victoria
PO Box 1100, Parkville 3052
Call: (03) 8341 6294
Fax: (03) 8341 6390

Other conditions: contact the neurogenetics clinic coordinator at the relevant clinic.

Assessment and management

Alfred Hospital
Attention: Outpatients
Neurology Department
The Alfred Hospital
Commercial Road, Prahran VIC 3181
Call: (03) 9276 2025
(03) 9276 2037
(03) 9276 2025
Fax: (03) 9276 6938

The Royal Melbourne Hospital
Neurosciences (Neurology)
The Royal Melbourne Hospital
Grattan Street, Parkville 3052
Call: (03) 9342 8448
Fax: (03) 9342 8427

Austin and Repatriation Medical Centre
Neurology Department
Studley Road, Heidelberg 3084
Call: (03) 9496 5529
Fax: (03) 9457 2654

St Vincent's Hospital
Neurology Department
Outpatients
Level 1, Daly Wing
St Vincent's Hospital
PO Box 2900
Call: (03) 9288 3475
(03) 9288 3489
Fax: (03) 9288 3489

Kingston Centre
Movement Disorder Clinic
Warrigal Road, Cheltenham 3192
Call: (03) 9265 1000
Fax: (03) 9265 1100
Website: <http://www.southernhealth.com.au>

4.5 References

Barette, J & Marsden, CD 1979, 'Attitudes of families to some aspects of Huntington's chorea', *Psychol Medicine*, 9:3278–36.

Binedell J, Soldan, JR & Harper, PS 1998, 'Predictive testing for Huntington's disease: 1. Predictors of uptake in South Wales', *Clinical Genetics*, 54:477–88.

Delatycki, M & Tassicker, R 2001, 'Adult onset neurological disorders', *Australian Family Physician*, 30:948–52.

