Spinal Muscular Atrophy
AUSTRALIA INC.

SMA INFORMATION GUIDE

Spinal Muscular Atrophy has long term health implications, and this information guide has been produced as an important resource for those newly diagnosed and starting on their SMA journey.

Stay informed with our SMA Community app

Want to connect with the SMA community?

SMA Australia, in partnership with Roche Australia, has developed a Community App to house all our dedicated SMA resources.

Create your own profile to start connecting with other families within the SMA community. Pin your location to our map, so you can connect with other local families.

Download our resources which include:

- Factsheets
- Videos
- Information Booklets
- Brochures
- eBooks
- Podcasts

Take time to browse the dedicated SMA community forum:

Our forum is for families to ask questions of their peers; to support their care questions and other hints, tips, or ideas they may have found useful.

We encourage you to download the app today!

Head to the Apple App Store or Google Play to download your app today and get started.

Available on the App Store

GET IT ON Google Play

Spinal Muscular Atrophy AUSTRALIA INC.

Proudly sponsored by Roche

CONTENTS

Spinal Muscular Atrophy
AUSTRALIA INC.

SPINAL MUSCULAR ATROPHY - AN OVERVIEW

Introduction

"It is likely that you are reading this information as a parent or carer of a person recently diagnosed with Spinal Muscular Atrophy (SMA). Receiving this diagnosis is one of the most devastating moments a parent and or family can experience. You may find you have many questions regarding SMA, about care options and what you can possibly do to manage your lives. You are not alone, we are here to support you.

Spinal Muscular Atrophy Australia Inc. (SMA Australia) has prepared a series of guides to provide you with factual and relevant information. By sourcing information from professional literature, listening to the stories of family's experiences and health professionals involved in care, there is now a wealth of information related to SMA issues available. As each SMA journey is unique and incomparable to the experience of others, the guides are not "best practice guides", but are a resource for discussing options with your experienced health care professional and to assist you to make informed decisions.

The SMA space is moving forward right now. Due to extensive research,there are now treatment options available for those living with SMA. Historically, families were given minimal hope as there was no cure or treatment. Whilst there is still no cure, treatment options and research have been developing in leaps and bounds over the past few years. You are starting your SMA journey with options and hope compared to several years ago when the story was quite different. You will get to know how the condition changes with your child and ultimately make sure you plan early, seek and process all options, and most of all do what is right for you and your family.

The most important issue you will need to tackle early will be to develop a medical care plan according to your child's specific and individual needs, and those of your family with your health care team. You will decide what works for you and your family along the journey. Be guided by your responses to care and interventions you choose. Most of all, remember your place in the family, and do whatever possible to experience the love and laughter, and to create moments of joy that will remain forever within your heart."

Julie Cini, CEO SMA Australia Inc.

What is Spinal Muscular Atrophy and what causes it?

Spinal Muscular Atrophy (SMA) is a genetic condition. This inherited condition affects the motor neurones in the spinal cord which control the muscle movement of the body, including the muscles for head control, arm and leg movement, and the actions of breathing, coughing and swallowing. As SMA progresses coughing becomes more difficult and breathing becomes laboured.

SMA Facts

- SMA is the childhood version of Motor Neurone disease.
- 1 in 35 people in Australia unknowingly carry the faulty SMA gene. Being a carrier does not mean you are affected by the condition.
- One in 10,000 live births in Australia are affected by SMA.
- 60-70% of all SMA patients have the most severe form (Type 1).
- SMA is a physical condition only. Children with SMA have reduced movement.
- There is no known cure for Spinal Muscular Atrophy, however, with recent drug advancements there are some new treatment options for SMA.
- Untreated Babies (Type 1) don't often reach milestones like sitting or rolling in early infancy, have hypotonia (floppiness), progressive weakness and loss of motor function.
- Initially, babies born with SMA appear perfectly normal in every way except they become extremely weak. They are bright, alert, interested in people and what's going on around them. They enjoy music and being played with – just like other babies.
- SMA children's intelligence is unaffected. Many people with SMA have above average intelligence. Children go to mainstream schools, adults work (ie: graphic design, lawyer) and even have children themselves.
- A person is born when BOTH parents are carriers of this gene, neither parent is to blame. There is a 1 in 4 chance of this couple having future babies with SMA.
- Children with SMA can be more susceptible to catching colds so washing hands before having contact is very important. Avoid visits by anyone suffering a cough / cold or anything contagious.
- Infants / Children / Adults diagnosed with Type 3 and 4 have a full life expectancy, but mobility and dexterity are compromised.
- Those affected by infantile and childhood SMA will rely on a wheelchair for mobility from an early age. Some may develop scoliosis, a curved spine, and require surgical intervention.

- SMA does restrict people's ability to care for one's self but usually someone with SMA will require assistance with daily living activities.
- SMA, historically (untreated) was the number one genetic cause of infant mortality in the world.

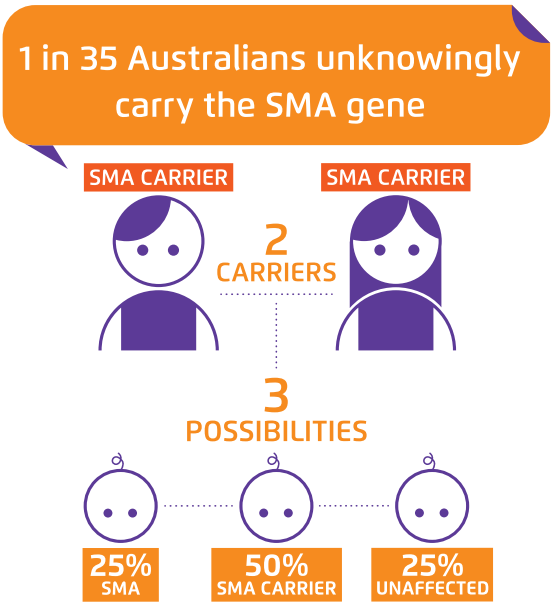
Estimates show that SMA occurs in 1:10,000 live births and untreated is the number one genetic cause of death for children under the age of two[1].

How is SMA inherited?

SMA is a recessive disorder caused by a deficiency in the survival motor neuron (SMN) protein. The SMN protein is encoded by the SMN1 gene.

This means that individuals with SMA have inherited two non-working copies of the SMN1 gene, one from each parent. Parents of children who have SMA are called carriers because they have only one non-working copy and do not have SMA.

Parents of SMA children are usually unaware they carry the change in their SMN1 genes and often have not heard of SMA until their child has been diagnosed. Two carriers will have a one in four (25%) chance of having an affected child in each pregnancy, a one in two (50%) chance of a child who is unaffected carrier, and one in four (25%) chance of a child who does not have an SMA and is not a carrier.



In rare cases, about 2% SMA is not inherited, but is due to a spontaneous error (de novo), in which case parents do not carry the SMA causing gene.

Individuals with SMA have inherited two non-working copies of this gene, one from each parent. Two carriers of the faulty SMA gene will have a:

- 25% chance of having a child in each pregnancy affected by SMA,
- 50% chance of a child who is an unaffected carrier, and
- 25% chance of a child who does not have SMA and is not a carrier.

How many types of Spinal Muscular Atrophy are there?

SMA is a very complex condition and each child, and each set of parents face their own unique journey and their own unique decisions, as SMA affects each person so very differently. It is important to care for the person in a way that best meets their specific needs and those of their family.

There are many types of SMA that are caused by changes in the same gene. Current classification of five types is based on age of onset and achievement of motor milestones at the initial assessment, but overlap between these exists, so considering SMA as a spectrum is more correct.

- Type 0 (prenatal onset or arthrogryposis multiplex congenital SMA)
  - Symptoms are evident at birth
- Type 1 (Infantile SMA or Werdnig-Hoffman disease)
  - Symptoms can develop during the first few weeks of life, usually 3 – 9 months. Child never sits unsupported.
- Type 2 (Intermediate SMA or chronic childhood SMA)
  - Symptoms usually appear around 7 – 19 months of age. Child never pulls to stand or walks.
- Type 3 (Juvenile SMA or Kugelberg-Welander disease)
  - Symptoms appear usually by 2 – 7 years of age. Child may learn to walk, however they will gradually lose this skill.
- Type 4 (Adult onset Spinal Muscular Atrophy)
  - Symptoms are mild and can appear from puberty to late adulthood.
- SMARD (SMA with respiratory distress)
  - It is non-responsive to treatment leading to early death.

*SMA Type 0 should not be confused with SMARD1, which may have very similar symptoms and course but has a different genetic cause than SMA.

The predictive value of the classical classification of SMA, which is solely based on motor assessment at initial presentation is now very limited and not very practical for newly diagnosed patients commencing treatment. Updated clinical guidelines for management now recommend classification as nonsitters, sitters and walkers to recognise current functional status and therapy response.

Refer to specific SMA Type fact sheet given to you with this booklet.

Spinal Muscular Atrophy
AUSTRALIA INC.

How is Spinal Muscular Atrophy diagnosed?

Parents tend to raise concerns about noticeable weakness or reduced function in their child's limbs. They may see that their child may seem floppy, and have low muscle tone. Their head may lag, and they are unable to support themselves when sitting or standing. You may see them with a weak cry and cough and have trouble swallowing. A physical examination reveals loss of, or a reduction of tendon reflexes in the legs and weakness in both sides of the body (especially the legs). Other symptoms may include fine twitches of the muscles in the limbs and tremor (fasciculation) of the tongue.

The diagnosis usually begins with a physical examination and is confirmed by a molecular genetic testing. If an SMA diagnosis is confirmed, carrier testing is offered for at-risk relatives (called cascade testing).

Patients are currently categorised into their type by the motor milestones they achieve.

The advancement of genetic technology and knowledge, and the ever-changing landscape of drug development are changing the way SMA is diagnosed. Currently there is a Newborn screening pilot for SMA in NSW to screen newborns for SMA on the heel-prick test. The goal of new born screening is to identify those at risk of developing SMA, to enable confirmatory diagnostic testing and planning of treatment by health professionals and families to enable the best health outcomes for those affected. There is currently (Nov 2019) an application in with the national newborn screening committee, and we hope that in late 2020 or in 2021 they will adopt and fund the addition of SMA to the national newborn heel prick test at birth.

Classification and typical clinical features of SMA are listed in Table 1.

Are there treatments for Spinal Muscular Atrophy?

Up until 5 years ago there was no treatment for SMA. The global SMA community has seen the landscapechange rapidly with not one but three potential treatments being researched and developed.

Current available treatment

SPINRAZA (by Biogen) is the first available treatment in Australia currently approved by the Pharmaceutical Benefit Scheme (PBS) for individuals with SMA less than 18 years of age. It is delivered through a lumber puncture. Spinraza works on a back up gene called SMN2 that makes a small amount of SMN protein (but not enough) to increase its production of the SMN protein.

Currently Spinraza is awaiting approval to be listed into the PBS for adults 19 years and older.

Table 1. Clinical Classification of SMA (untreated)

SMA Type	Age of Onset	Highest Function (untreated)	Life Expectancy	Typical Features
Type 0 *Rarest and most severe infantile*	Before birth	Extremely weak	<12 months	Move less in the womb and are often born with joint deformities. Extremely weak muscle tone at birth Often do not survive due to respiratory failure. Heart defects present from birth (congenital).
Type 1 *(Severe) Werdnig-Hoffman disease*	0-6 months	Never sits	<2 years	Profound weakness and hypotonia, impaired head control, weak cry and cough, difficulty with swallowing and handling of oral secretion, early morbidity due to respiratory insufficiency and aspiration pneumonia.
Type 2 *(Intermediate)*	7-18 months	Never stands	>2 years	Delayed motor milestones, poor weight gain, weak cough, fine hand tremors, joint contractures and scoliosis.
Type 3 *(Mild)* Kugelberg-Welander	>18 months	Stands and walks	Adult	Variable muscle weakness and cramp, joint overuse, loss of walking ability at some point in life.
Type 4 *(Adult onset)* Rare	Early adulthood	Mild	Normal life expectancy	Mild to moderate muscle weakness, tremors, mild breathing problems.

[2]TREAT-NMD Neuromuscular Network. 2007. *Standards of Care for Spinal Muscular Atrophy.* United Kingdom.

Future treatments

ZOLGENSMA (by AveXis, a Novartis company) Zolgensma treats paediatric patients with SMA less than 2 years of age (as per USA label).

The gene replacement therapy the missing or non-working survival motor neuron 1 (SMN1) gene with new working copy of a human SMN1gene. It is delivered inside a harmless virus, called adenoassociated virus type 9 (AAV9) as a single intravenous infusion to young children 2 (approved in US and currently is awaiting approval in Australia).

RISDIPLAM (by Roche) is developing an oral treatment that also targets SMN2 to increase SMN protein production. It is taken on a daily basis

Risdiplam is under clinical trials for pre-symptomatic individuals. It is expected to be approved in the US in mid-2020 and coming to Australia in 2021.

Family History and Carrier Testing

We have found that if you are a carrier of the SMA gene (this doesn't mean you are affected) that your siblings are more than likely to be carriers as well. So make sure that you inform your siblings and other extended family members like cousins, so that they understand about how it could affect them. They can then choose if they would like to be tested to see if they are a 'carrier' of the SMA gene (1 in 35 here in Australia)

Families can contact their local genetic counselling service. These are available in all major public hospitals in every state - just ask for the Genetics Department.

Usually when a child is diagnosed with SMA the immediate family should be referred for genetic counselling and then 'cascade testing' of other adult family members can be facilitated for them.

It is preferable that referral to these genetic counselling services is through a general practitioner, medical specialist or other health care professional.

Carrier testing is not always straightforward and does not give a clear-cut 'yes/no' answer so for the best results to be interpreted correctly this should be done through a Genetic Counsellor or a genetic service.

Where to be tested

There are many providers within Australia who carry out genetic screening. Please visit www.carrierscreening.org.au to find out more information and a list of centres who test for Spinal Muscular Atrophy.

For more information please refer to our 3 dedicated Carrier Screening brochures; 'Starting the conversation', 'How to be tested' and 'If you find out if you're a carrier...' - Available for download on the SMA Community App on both Google Play and the Apple Store (see inside cover for details).

Spinal Muscular Atrophy
AUSTRALIA INC.

STARTING THE CONVERSATION FOR CARRIER TESTING

At this point in time, newborn screening – a process to detect SMA in newborn babies, is only available in NSW as a pilot program. We have hope that it will become a nation standard in 2020/21.

Those pre-planning a pregnancy or expectant parents can have carrier testing to find out if they have the SMA gene prior to conceiving or in early pregnancy, which can help them ensure their baby is not affected by SMA.

If SMA has affected you or your children, encouraging family members to take these steps may be something you wish to do. Here are some tips to start the conversation;

1. Find a place where everyone will feel comfortable speaking.
2. Explain what SMA is and how it is inherited (you can use the explanation and diagrams in this brochure to help).
3. Explain what carrier testing is, and what it involves (a blood or saliva test).
4. Encourage them to get tested, but also listen to their concerns or reservations, and try to remain open-minded.
5. Let them know that if they wish to speak to a professional about this, they can book an appointment with a genetic counsellor who specialises in prenatal genetics.

For more information please refer to our 3 dedicated Carrier Screening brochures; 'Starting the conversation', 'How to be tested' and 'If you find out if you're a carrier...'. They have been developed to help you give this sensitive information to your extended family.

What Happens in Genetic Counselling for SMA?

Genetic Counselling is proved by a team of health professionals working together to provide current information, guidance and support to assist in the understanding of Spinal Muscular Atrophy.

Consultation: (Brief over view of what may be covered)

- Discuss the impact and effects of SMA on the sufferer and their family.
- Explain how and why SMA occurs, i.e. both partners have to be a carrier of SMA.
- If both carriers there is a one in four chance of having a child with SMA.
- One in thirty five people are carriers of SMA.
- The implications and the need for Carrier testing for other siblings and family members.
- Discuss other reproductive options to ensure that any decisions are made on an informed basis.
- Discuss and provide current information regarding prenatal testing, offering counselling and support so that informed decisions can be made.
- Discuss and arrange appropriate genetic testing.
- Provide information regarding support groups, supply both verbal and written information about the condition, appropriate booklets and pamphlets.

Follow Up:

After the initial consultation an opportunity may be provided to go over information and offer on-going support. It is common for people to think of many questions after the first genetic counselling consultation; also new questions arise as the condition develops. The follow up can be as simple as a phone call. A letter should be provided summarising the initial consultation.

Families can contact their local genetic counselling service. These are available in all major public hospitals in every state - just ask for the Genetics Department.

Usually when a child is diagnosed with SMA 1 or SMA 2 the immediate family should be referred for genetic counselling and then 'cascade testing' of other adult family members can be facilitated for them. It is preferable that referral to these genetic counselling services is through a general practitioner, medical specialist or other health care professional.

Carrier testing is not always straight forward or doesn't give a clear cut 'yes/no' answer, so for the results to be interpreted correctly this should be done through a counsellor or genetic service.

Palliative Care:

Whilst reading the various options for those diagnosed with Spinal Muscular Atrophy, palliative care is also an option for your family. Palliative care can be confronting and is where you choose the option of no treatment for your loved one. Making these decisions are never taken lightly, but you need to remember your wishes will always be respected and honoured.

The consensus statement (217) describes palliative care for SMA children as more complex, when compared with other life limiting conditions. Opinions may differ considerably between families and clinicians, be influenced by personal values, or conflicting goals about perceptions of quality versus quantity of life. Opinion differs about whether one should prolong life or whether the priority is quality of life?

There are different ideas about what practices to adopt, and of the role of the palliative care team. The role of the palliative care is to provide support and options to live as well and as comfortable as possible during times of decline. Palliative care provides resources for pain management, respite and making memories for families. These palliative care teams are a great resource for your family. They will assist and guide you through this non familiar and often confusing process. Remember they are here to help you on your SMA journey and only have your best interests at heart, they are patient and family focused.

Early planning and early intervention, including the use of feeding tubes or non-invasive respiratory support may be discussed along this journey. Clinicians will aim to provide the best care possible for your child and take into consideration the family needs. In some circumstances, palliative care relationships are long lasting, even extending into months and years.

At times there will be some tough decisions to be made, for either yourself or family member living with SMA. Rest assured your rights and responsibilities will be honoured at all times during any decision making processes. If you feel you cannot speak up for yourself, you should seek an advocate who is aware of your or your family's wishes in the care decision process.

CREDITS

Produced by:

Spinal Muscular Atrophy Australia Inc. Victoria, Australia

www.smaaustralia.org.au

Spinal Muscular Atrophy Australia Inc.
Unit 7, 16-28 Melverton Drive
Hallam VIC 3803
PO Box 5245, Hallam VIC 3803

Phone (03) 9796 5744
Email reception@smaaustralia.org.au
Fax (03) 8373 7787

Acknowledgments:

Our thanks to all who contributed to the preparation of this information guide: Sandra Holland (Clinical Nurse Consultant/ Clinical Research Nurse, Sydney Children's Hosptial), Associate Professor Michelle Farrar (Paediatric Neurologist, Sydney Children's Hosptial), and Julie Cini (CEO, SMA Australia).

References:

[1] Carre, A. & Empey, C. (2016). Review of Spinal Muscular Atrophy (SMA) for Prenatal and Pediatric Genetic Counselors. Journal of Genetic Counselling, 25, 32-43. doi:10.1007/s10897-015-9859-z

[2] https://www.zolgensma.com/

Mercuri E, Finkel RS, Muntoni F, et al. Diagnosis and management of spinal muscular atrophy: Part 1: Recommendations for diagnosis, rehabilitation, orthopedic and nutritional care. Neuromuscul Disord. 2018;28(2):103-115. doi:10.1016/j.nmd.2017.11.005

Finkel RS, Mercuri E, Meyer OH, et al. Diagnosis and management of spinal muscular atrophy: Part 2: Pulmonary and acute care; medications, supplements and immunizations; other organ systems; and ethics. Neuromuscul Disord. 2018;28(3):197-207. doi:10.1016/j.nmd.2017.11.0

Spinal Muscular Atrophy
AUSTRALIA INC.

HISTORY OF SMA AUSTRALIA

Our CEO, Julie Cini founded Spinal Muscular Atrophy Australia Inc. after losing both her children to Spinal Muscular Atrophy in 2005 and 2007.

Julie's first daughter Montanna, died on June 25, 2005 aged only ten months. In the midst of dealing with this tragic loss, came the death of Julie's partner, Ross Brownlaw who was struck by a truck in the driveway of their family home in May 2006, when Julie was just thirteen weeks pregnant. Zarlee was welcomed on December 13, 2006 and lost her battle with SMA on Christmas Day, 2007 aged 12 months. The charity was started 6 weeks after Montanna passed away, with Julie and Ross knowing well before this the need for a support service in Australia. Julie is extremely passionate about ensuring access to treatment for the whole community, as well as advocating to relevant stakeholders about a range of issues within our community.

OUR SERVICES

Spinal Muscular Atrophy Australia Inc. is Australia's peak body, providing Australians living with Spinal Muscular Atrophy and their families with best practice information care options, resources and choices for themselves or their children, when living with the condition.

Since being founded in 2005, SMA Australia has been supporting families for 15 years. Evolving from one on one family support to a national advocacy campaign to gain access to treatments. We continue to bring together the SMA community, through peer to peer support programs, as well as developing best practice outcomes for those living with SMA in Australasia. Our advocacy efforts have created options for families, past, present and future. We provide a cough assist machine equipment loan pool to our members.

Until recent treatment advancements there was no known cure for SMA; and historically, nearly half of those born with Type 1 died before the age of two, and children with type 2 generally died before adulthood. Advancements have seen the first drug, Spinraza, become available on the P.B.S. in May 2018 for those with Type 1, 2 and 3 under the age of 19 years. We are currently advocating for an additional two treatments to be funded on the PBS in Australia.

In 2018 the charity were instrumental in campaigning for an initiative from the government called "Mackenzie's Mission". Currently a pilot study (January 2020) is testing 10,000 couples for more than 700 genetic conditions (of which SMA is one) to pick up carrier couple before they start family planning. This will enable families to make informed decisions about their reproductive future. The three year pilot study aims to determine the evidence for making free reproductive genetic carrier screening available to all couples in Australia who wish to have it.

Spinal Muscular Atrophy Australia Inc. is a not-for-profit, registered, tax exempt charity with deductible gift recipient (DGR) status. The charity receives no Government funding and relies on sponsorship, events and generous donations so they can provide their support services to their SMA families. The charity is governed by a voluntary committee of management.

VISION

We are the peak body for SMA in Australasia. Providing timely access to best practice resources, support advocacy and access to treatments for the SMA community.

Our vision is for our community to be aware of SMA and supportive of those individuals and their families.

MISSION

To pro-actively care, support and provide best practice resources for all SMA communities.

Care: for those directly and indirectly affected by SMA, i.e. people living with SMA and their families and healthcare professionals.

Provide: to assist in providing services to those affected by SMA, or helping them navigate the system for services.

Support: to provide a holistic approach and support the mental, physical and emotional wellbeing of those living with SMA.

STATEMENT OF PURPOSE

- To encourage and promote awareness of Spinal Muscular Atrophy to the general public, community, professional services and support networks.
- To promote and provide ongoing support and best practice information to families and people affected by Spinal Muscular Atrophy.
- To maintain and promote a pool of cough assist machines not provided by hospitals, or funded by other means, that may help with quality of life.
- To encourage families to become regular contributors within the SMA community, to promote awareness and inclusiveness amongst families.

Support

Improve the care and access to treatment for all Australians living with SMA, by offering a range of community based initiatives that result in the SMA community being cared for, heard, supported and empowered.

Education

Empowering our community to be ambassadors for SMA to educate the wider public, to increase the profile of the condition.

Advocacy

Ensure the voice of the SMA community is heard by advocating to key stakeholders to achieve access to carrier screening, timely diagnosis, and access treatment options.

Research

Support research initiatives that improves diagnosis, treatment and preventions for SMA.

Fundraising

Maintain and grow sustainable fundraising practices to enable us to achieve our mission.

Values

Tolerance: towards others without passing judgment.

Differences: acknowledge these within our community.

Accountability: for actions and decisions.

Understanding: to SMA families and each other.

Respectful: of personal choices and decisions.

Honesty: to our families and within our business.

Communication: to become aware and share best practice SMA related information and resources for the community.

Inclusiveness: to include all families living with SMA, in the wider SMA community.

OUR 3 KEY MESSAGES

Spinal Muscular Atrophy
AUSTRALIA INC.

Spinal Muscular Atrophy Australia Inc.

Unit 7, 16-28 Melverton Drive, Hallam VIC 3803

PO Box 5245, Hallam VIC 3803

Phone 03 9796 5744

Email reception@smaaustralia.org.au

FOLLOW US

REGISTERED CHARITY
acnc.gov.au/charityregister