

ACTIVATING GLOBAL COLLABORATION TO DRIVE ADVANCEMENTS IN CHILD RESTRAINT SYSTEMS FOR CHILDREN WITH DISABILITIES

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ABSTRACT

Research shows that children with disabilities face an increased risk of injuries and fatalities in a crash compared with other children. However, a recent literature review concluded that these particularly vulnerable road users continue to be inappropriately restrained in vehicles, constituting an ongoing road safety problem. This also impacts on their human right to safe and accessible transport. Although globally, there are established independent assessment programs for child restraint systems, there is no such program for special purpose child restraints or other restraint types used by children with disabilities. With the formation of a new Australian charity dedicated to advancing the rights of children with disabilities to safe and accessible transport, the objective of this project is to enhance the protection of children with disabilities travelling in child restraint systems in motor vehicles through the establishment of an independent safety and assessment program. The development of the Australian Safety Assessment Program (AuSAP) was supported with funding from the Victorian Transport Accident Commission, and in-kind support from NeuRA and Britax.

A mixed methods research approach was used, consisting of:

Desktop review

A review of the legislative and regulatory environment impacting on the supply, sale and use of special purpose child restraints and accessories in Australia was conducted. A global product scan identified restraints for inclusion.

Governance framework

Several governance framework options were developed, with the recommended option being a not-for-profit lead agency model supported by an Expert Committee.

Protocols

The Expert Committee developed the Test and Assessment Protocol based on a review of standards/regulations.

Assessments/crash testing

Fifty-four crash tests have been undertaken (forward and side impact testing), with results shared with relevant suppliers and manufacturers.

Communication/education

MACA is developing individual Product Guides that incorporate AuSAP findings to support allied health professionals in their prescribing role.

AuSAP is implementing a global approach to improve motor vehicle restraint systems for children with disabilities in line with the recommendations in the World Health Organization's global report on Assistive Technology and the Convention on the Rights of Persons with Disabilities. The program has rapidly stimulated the Australian market to supply special purpose child restraints by increasing the confidence of suppliers, prescribers, consumers, and government funders. This has expanded safe motor vehicle transport options for children with disabilities. It has also provided a unique opportunity for global collaboration with manufacturers to improve the design and safety of restraint systems for children with disabilities. AuSAP has facilitated international engagement about the suitability of current requirements in standards/regulations for special purpose child restraints and consideration of potential improvements for future reviews. This has the potential to remove barriers to access not only in Australia but globally. The first program of its kind, AuSAP has achieved early success in encouraging international cooperation and learning to advance the human rights of our most

vulnerable road users to safe and accessible motor vehicle transport. Access to such life changing assistive technology is a precondition for equal opportunities and participation.

INTRODUCTION

It is estimated that approximately 1 in every 10 (more than 150 million) children globally under the age of 18 has a disability [1].

Some children with disabilities and medical conditions, such as Cerebral Palsy and Autism Spectrum Disorder, require additional support and features not provided by conventional child restraints. Special purpose child restraints have been specifically designed to support the needs of these children.

However, children with disabilities and medical conditions in Australia face significant barriers in accessing special purpose child restraints when unable to travel in a conventional child restraint [2]. This situation is not unique to Australia, with the gaps greatest in low- and middle-income countries. This global inequity requires urgent collective attention and action [3].

A literature review in 2019 reflected little change in how children with disabilities are being transported since a previous literature review in 2001, noting that they “continue to be inappropriately restrained in vehicles, constituting an ongoing road safety problem” [4]. Further, 74 per cent of children with autism escape their child restraint, and more than 20 per cent of parents report their child demonstrates aggressive or self-injurious behaviour during travel, impacting on their safety and others [5].

More recently Australian families of children with disabilities and medical conditions have raised significant concerns about their child’s safety during transport and reported that their transport situation restricts their child’s participation [3]. Key safety concerns include having to pull over to reposition their child, becoming distracted as a result of their child becoming upset or distressed, and having difficulty physically getting their child in and out of the car. Over half of parents reported their child was getting out of their child restraint or vehicle seatbelt whilst the vehicle was moving and ten per cent reported their child had escaped the vehicle into the road environment. Over two thirds of parents reported never receiving information about how to safely transport their child and nearly half reported that their child was missing out on participating in everyday life [2].

Access to assistive technology, such as special purpose child restraints, is regarded as a precondition for achieving equal opportunities, enjoying human rights, and living in dignity [1]. This right is enshrined in Article 32 of the UN Convention on the Rights of Persons with Disabilities that calls for international cooperation to support national efforts to improve access to assistive technology across the world. Such cooperation can support efforts in areas of research, policies, regulations, fair pricing, market shaping, product development, technology transfer, manufacturing, procurement, supply, service provision and human resources [3].

Australian context

Mobility and Accessibility for Children in Australia Ltd (MACA) Established in 2019, MACA is a not-for-profit charity dedicated to advancing the rights of children (under 16 years) with disabilities and medical conditions to safe and accessible transport. MACA is the first Australian organisation of this type focused on addressing the significant gaps and barriers impacting on the motor vehicle transport needs of children with disabilities and medical conditions.

National Disability Insurance Scheme (NDIS) There has been a fundamental shift in the past decade in Australia’s approach to supporting the everyday needs of people living with disability. People with a "permanent and significant" disability (under the age of 65) can now access full funding for any "reasonable and necessary" support needs related to their disability. This funding is accessed through the NDIS, the first scheme of its kind in Australia.

Funding includes access to *assistive technology*, which the NDIS defines as “items that help you do things you can’t do because of your disability. Or things that help you do something more easily or safely.” Special purpose child restraints are classified by the NDIS as high-risk assistive technology.

Due to the lack of knowledge about special purpose child restraints, including compliance with standards, safety and performance, the NDIS experienced challenges in approving funding applications, resulting in some children not benefiting from the scheme for their motor vehicle transport needs. Where funding approval was achieved, NDIS participants experienced long wait times, ranging from three weeks to three years [2].

Australian standards Australia has a long-established standard for child restraints (AS/NZS 1754 *Child restraint systems for use in motor vehicles*) however this standard does not cater for the restraint types used by children with disabilities - which include special purpose child restraints, harnesses/vests, and modified child restraints. This situation has resulted in Australian children travelling in either locally made products that do not comply with standards, (e.g., harnesses and modified child restraints), or special purpose child restraints from overseas which may comply with a relevant regulation or standard.

Australia's child restraint standard (AS/NZS 1754) is mandated through a national consumer protection notice and reflected in each of Australia's eight state and territory road laws. As this standard does not provide for special purpose child restraints, products can be legally supplied and sold in Australia from overseas, with exemption provisions in road laws for use in motor vehicles. AS/NZS 1754:2013 is currently under review, with a new section being drafted to consider allowing for some variations to Australian standard child restraints to cater for the needs of children with disabilities and medical conditions. However, this approach requires analysis of the potential benefits and barriers that may impact industry, families, and government policy if these changes are accepted for Australia and New Zealand.

In addition, Australia (and New Zealand) has a unique standard, AS/NZS 4370 *Restraint of children with disabilities, or medical conditions, in motor vehicles* (current version 2013), to guide allied health professionals when assessing and prescribing for children's motor vehicle transport needs. This standard however does not cover the safety and performance of the restraint types used by children with disabilities and medical conditions and is scheduled for review to ensure it reflects recent research and learnings.

Child restraint evaluation program Like many other countries, Australia has an established independent review program for its Australian standard child restraints. This program, aimed at consumers, is known as the Child Restraint Evaluation Program. It's funded by government and road safety focused organisations and tests child restraints to a higher level than the Australian standard.

However, until the establishment of AuSAP, no such program existed for special purpose child restraints (and other products) used by children with disabilities and medical conditions.

OBJECTIVES

MACA established the Australian Safety Assessment Program (AuSAP) to improve knowledge of the safety and performance of restraint types used by children with disabilities and medical conditions. This is the first independent assessment program for special purpose child restraints (and other restraint types) used by children with disabilities and medical conditions when travelling in motor vehicles.

AuSAP is a key program contributing to MACA's vision that *every child has access to safe and equitable transport*. The objectives of AuSAP are broad, invite collaboration, and encompass a whole-of-system approach:

AuSAP aims:

- To uphold the rights of children with disabilities to safe and accessible motor vehicle transport
- To improve knowledge and raise awareness of the motor vehicle transport needs of children with disabilities and medical conditions
- To influence the design and safety of vehicle restraint systems for children with disabilities and medical conditions
- To expand safe vehicle restraint options for families
- To support health professionals in their prescribing role.

METHODS

The establishment of AuSAP involved extensive development and research spanning three years, involving industry, government, researchers, and parents of children with disabilities and medical conditions.

Funding

MACA invested 12 months in developing the AuSAP scope and engaged in extensive stakeholder engagement to secure funding.

In 2020, the Transport Accident Commission (Victoria, Australia) provided establishment funding with MACA receiving in-kind support from Britax Childcare Pty Ltd (Victoria, Australia) and the Neuroscience Research Australia – Transurban Road Safety Centre (NSW, Australia).

In addition, AuSAP industry participants donated special purpose child restraints for crash testing.

Governance

Four governance options were considered in establishing AuSAP. The model implemented is coordinated and promoted by MACA and supported by an Expert Committee and Reference Group.

The Expert Committee consists of preeminent Australian child restraint experts and researchers, responsible for setting the aims of the program, developing and reviewing test and assessment protocols and reviewing results.

The Reference Group advises on the development and distribution of AuSAP resources. This group includes parents of children with disabilities, allied health professionals, communications and road safety experts.

Desktop review

Two desktop reviews were undertaken – a legislative and regulatory review and product/practice review.

The legislative and regulatory review investigated the environment impacting on the supply, sale and use of special purpose child restraint systems and other devices (e.g., harnesses) in Australia. This review identified significant complexity, inconsistency, and lack of clarity in rules, regulations, and interpretation in relation to special purpose child restraints and other devices.

The product and practice review used selected restraint types as outlined in AS/NZS 4370 *Restraint of children with disabilities, or medical conditions, in motor vehicles* as a guide to investigate product types, allied health professional practice, and how these restraint types are used by families of children with disabilities and medical conditions. The selected restraint types (see Table 1), included:

- Australian standard child restraints
- Modified Australian standard child restraints
- Special purpose child restraints
- Customised restraints

Table 1.

AS/NZS 4370 Selected restraint types

AS/NZS 4370 Restraint category	Description	Details
Australian standard child restraint	Child restraint that complies with AS/NZS 1754	<ul style="list-style-type: none"> ➤ Mandatory standard ➤ Independent safety and assessment program childcarseats.com.au ➤ Various government supported initiatives for consumer information, fitting and use ➤ Established evidence-base
Modified Australian standard child restraint	Australian standard child restraint that includes changes or add-on items such as postural supports, buckle covers, extended crotch strap, additional padding - not provided with the child restraint and not included in the manufacturer's instructions	<ul style="list-style-type: none"> ➤ Voluntary accessory standard AS 8005:2020 (no products certified to this standard) ➤ No safety information available ➤ Common prescriber practice in Australia ➤ No evidence-base
Special purpose child restraint	Restraints made specifically for children with disability/medical condition that comply with one or more of the following standards: CMVSS 213; FMVSS 213; ECEr44; ECEr129	<ul style="list-style-type: none"> ➤ No Australian standard requirements (new section being drafted in current review) ➤ Overseas child restraint standards and regulations ➤ New independent safety assessment program (AuSAP) ➤ Common prescriber practice ➤ Limited government supported initiatives ➤ Emerging evidence-base

Customised restraint	Designed or custom made for the individual child's needs and not compliant with any standard (e.g., bespoke harness)	<ul style="list-style-type: none"> ➤ No standards ➤ No safety information ➤ No government supported initiatives ➤ Limited prescriber practice ➤ No evidence-base
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It was identified that harnesses/vests are not included in AS/NZS 4370, however, these products were also considered in the desktop review.

The review identified the range of special purpose child restraints, harnesses/vests, and modification practices in Australia. It found there was a limited range of special purpose child restraints available in Australia, and they all complied with the US, Canadian or European standards/regulations.

The Expert Committee determined that special purpose child restraints be prioritised for assessment/testing, whilst further research was required to investigate modified Australian standard child restraints and harnesses/vests. Customised restraints were considered out of scope.

Protocol development

The development of the AuSAP Test and Assessment Protocol (protocol) [6] for special purpose child restraints involved extensive research over nearly 12 months.

Following a desktop review of relevant overseas standards and regulations (and test methods), including Canada, US, Europe, Brazil, China, and Japan, the Expert Committee agreed to use selected criteria (frontal and side impact) from the AS/NZS 1754:2013 for the protocol. This standard calls up test methods from AS/NZS 3629.1:2013 *Methods of testing child restraints, Method 1: Dynamic testing*.

The Expert Committee felt it was necessary to include side impact testing, even though most products selected for testing did not comply with standards/regulations requiring side impact protection. This decision reflected the fact that side impact protection is a key feature of Australian standard child restraints.

As well as frontal and side impact crash tests, the protocol includes a limited assessment of product design features to identify and evaluate potential sources of risk not covered by dynamic assessments, and any potential issues that may pose challenges to test set-up – for example, foot props.

The protocol includes a parameter assessment template which uses the criteria of 'good', 'acceptable', 'marginal' or 'not acceptable' for post-test reviews. The parameter assessments are for internal purposes only, used to guide assessment discussions with the Expert Committee. Direct comparisons between product parameter assessments are not undertaken due to the unique nature of special purpose child restraints, unlike some independent assessment programs that make direct comparisons, or use a star rating system.

Assessments/crash testing

Seven Australian importers (see Table 2) signed an agreement to participate in AuSAP. To date, fifty-four crash assessments have been completed, involving fifteen special purpose child restraints, with new products currently under testing and review.

Table 2.

Australian importer participation and product list

Australian importer	Products (Manufacturer/country)
Specialised Wheelchair Company Pty Ltd	Stabilo Multiseat (Stabilo – Poland)
Medifab Australia Pty Ltd and Medifab Global Pty Ltd	Carrot 3000 Carrot XL (Seeds – Japan) Hero NXT IPAI LGT Starlight NXT Kidsflex (Hernik GmbH – Germany)
Dejay Medical and Scientific Pty Ltd	Special tomato soft touch booster seat

	(Special Tomato – United States)
FAS Therapeutic Equipment P/L	Spirit Car Seat (Inspired by Drive)
	IPS 2000 series (Inspired by Drive – United States)
Active Rehab	Baffin.1 (LIW Care Technology – Poland)
Apex Mobility Pty Ltd	Thomashilfen Commander (Thomashilfen) Thomashilfen Defender (Thomashilfen – Germany)
Etac ANZ Pty Ltd	Quokka Wallaroo (Etac – United States)

The fifty-four tests were undertaken between June 2021 and August 2022 across three testing centres - Britax Childcare Pty Ltd, Victoria, Australia (see Image 1); NeuRA (Transurban Road Safety Centre), NSW, Australia; and APV-T Test Centre, Victoria, Australia.



Image 1. Carrot 3000 set-up for testing at Britax Childcare Pty Ltd, Australia.

RESULTS

The testing revealed mixed results. Whilst some products performed well against the AuSAP Test and Assessment Protocol for frontal testing, no product met the side impact test criteria (see Image 2). Other findings included products with significant submarining (see Image 3), ISOFIX/LATCH and top tether failures (see Image 4), and one product with a broken splitter plate (see Image 5).



Image 2. Side impact test example.



Image 3. Significant submarining.



Image 4. LATCH and top tether failure.



Image 5. Frontal test resulting in splitter plate breakage.

Following testing, meetings were held with Australian importers and overseas manufacturers to communicate AuSAP independent assessment findings. As a result, several products are undergoing further investigation and/or testing, and a few products have subsequently been withdrawn, or will not be introduced to the Australian market

Eight special purpose child restraints have progressed to publication on MACA's national product register with their status published on MACA's website (see Figure 1).

















 Baffin.1 Further review required	 Carrot 3000 Published on MACA's National Product Register	 Carrot XL Further review required	 Hernik Starlight Published on MACA's National Product Register	 Stabilo Multiseat Further review required	 Special Tomato Soft Touch Booster Seat Further review required
 Thomashilfen Commander Published on MACA's National Product Register	 Thomashilfen Defender Published on MACA's National Product Register	 Hernik Hero-NXT Published on MACA's National Product Register	 Spirit Car Seat Removed from MACA's National Product Register as withdrawn from the Australian market	 IPS 2000 series Removed from MACA's National Product Register as withdrawn from the Australian market	 Quokka Withdrawn from AuSAP
 Hernik IPAI-LGT Published on MACA's National Product Register	 Hernik Kidsflex 2 Published on MACA's National Product Register	 Hernik Kidsflex 2XL Published on MACA's National Product Register	 Wallaroo Withdrawn from AuSAP		

Figure 1. AuSAP product status www.macahub.org as at 11 December 2022.

Communicating AuSAP results

AuSAP outcomes are communicated through a range of practical tools and resources, including:

National product register MACA's [national product register](#) is a centralised register of restraint types used by children with disabilities and medical conditions in Australia, including special purpose child restraints, Australian standard child restraints and harnesses/vests.

The special purpose child restraint product register only includes products that have been independently assessed through AuSAP, and meet the AuSAP Test and Assessment Protocol.

Product Guides MACA has developed product guides for the special purpose child restraints published on the national product register. The guides bring together important independent information such as AuSAP testing outcomes, safe use, compliance with standards/regulations, and prescribing advice. The guides support allied health professionals who assess children's transport needs, as well as importers, product suppliers and government funders/regulators.

Training Knowledge and learning from AuSAP is incorporated in MACA's Australian-first on-line [training course](#) targeted at allied health professionals: *Transporting Children with Disabilities and Medical Conditions*.

DISCUSSION

This paper presents an overview of the development, aims, and outcomes of the Australian Safety Assessment Program (AuSAP), since its establishment in 2020. No other program has been identified that independently assesses the specialty restraint types used by children with disabilities and medical conditions when travelling in motor vehicles.

Although this program is a significant advancement and is demonstrating its potential as a catalyst for change, several areas require further investigation and research.

Instruction manuals

Special purpose child restraints often have multiple parties involved in their design and manufacture, with some products complying with standards and regulations in more than one country. This results in products often having more than one set of instruction manuals (with differing information).

To illustrate, where a conventional child restraint is modified for use by a third party as a special purpose child restraint, they develop their own instruction manual, often with no reference to the originating manual. In some cases, the product may also have accessories (e.g., swivel base) made by another organisation, with a separate set of instructions for use. Local importers may also produce their own branded instructions and include additional information.

This situation causes confusion about product installation and use. This may contribute to incorrect consumer advice and product misuse, impacting on safety. Through AuSAP, MACA's desktop review of the various instruction manuals identified the need for an intervention to reduce the risks associated with products having multiple and varied instruction manuals. In response MACA developed Product Guides (see Image 6), which include independent information about compliance with standards/regulations, AuSAP outcomes, and prescribing advice that clarifies key information relating to safe installation and use of products in Australian vehicles. The guides support allied health professionals, as well as importers, suppliers, government regulators and funders.



Image 6. Product Guides.

The role of standards/regulations

Although there are well established standards and regulations for child restraint systems throughout the world, not all have provision for special purpose child restraints, and other devices commonly used by children with disabilities and medical conditions. Where they are provided for, requirements are often inadequate, not informed by evidence and user needs - particularly for older and larger occupants.

The development of the new UNECE r129 did not consider the motor vehicle transport needs of children with disabilities, nor the impact on these road users of the changes being introduced by this new regulation. This situation has the potential to impact on the rights of children with disabilities and medical conditions to safe and accessible vehicle restraint systems.

MACA is convening a working group of global experts to discuss what steps are urgently needed to respond to this situation, and more broadly to discuss what type of standards and regulatory system is needed to ensure equitable access to affordable, durable, safe, and effective products.

Systems change

There are many barriers to people accessing assistive technology - including lack of awareness and affordability, lack of services, inadequate product quality, range and quantity, inadequate government policies, standards and procurement and supply chain challenges [3].

As discovered in Australia there has been a reluctance for suppliers to import products, and for government to fund products, due to the standard and regulatory environment being unclear, inconsistent, and inadequate. Whilst MACA (and AuSAP), is stimulating an increase in supply to Australia and informing government funding policy (e.g., the NDIS is reviewing the impact of MACA's work and AuSAP on its funding decisions) further mechanisms are needed to improve access for other small markets, and low- and middle- income countries.

Unlike access to conventional child restraints in Australia, family access to special purpose child restraints is also impacted by the silos of the disability, education, health, and transport sectors. This makes it easy to deflect responsibilities across the system, creating systemic barriers which impact on children's rights to safe and accessible transport.

AuSAP, with its tangible, evidence-informed outcomes, is an effective vehicle for MACA to engage across sectors and borders to influence change in policies, programs, and systems. However, this requires ongoing government commitment, investment, and global collaboration, for the benefits to be fully realised and systemic change to occur.

LIMITATIONS

AuSAP's outcomes are only relevant to the products tested to date, therefore not representative of all available special purpose child restraints in the world. In addition, the AuSAP Test and Assessment Protocol [6] is based on selected criteria from AS/NZS 1754, and provides an independent review, not certification, of each product.

At this stage, AuSAP has not been evaluated. Curtin University, in Western Australia, will be implementing a follow up national survey in July 2023 to evaluate the effectiveness of MACA's work to-date.

CONCLUSION

As the first program of its kind globally, AuSAP has achieved early success in encouraging international cooperation and learning to advance the human rights of our most vulnerable road users to safe and accessible motor vehicle transport.

AuSAP findings are bringing confidence to industry, government, parents, and health professionals, and influencing policy, legislation, research, products and standards development.

Access to life changing assistive technology, such as special purpose child restraints, is a precondition for equal opportunities and participation. MACA's work to date demonstrates an ongoing need for AuSAP to advance the rights of children with disabilities and medical conditions to safe and accessible transport.

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