



Vehicle Safety for Older Drivers and Passengers

GUIDELINES FOR TAILORING ADVICE ABOUT SAFE AND COMFORTABLE TRAVEL

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Disclaimer:

This document is a general guide for tailoring advice to guide safe and comfortable travel for older drivers and passengers. These guidelines are to be followed subject to the specific circumstances of the individual and vehicle in which they are travelling. The guidelines are designed to provide information to assist decision-making and are based on the best available evidence at the time of development of this publication.

Copies of these guidelines can be downloaded from:

The George Institute for Global Health website at

www.georgeinstitute.org.au/projects/vehicle-safety-for-older-drivers-and-passengers

Neuroscience Research Australia at

www.neura.edu.au/health/translational-neuroscience/road-safety

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Preface

The purpose of this document is to provide evidence-based guidance for occupational therapists, medical practitioners, physiotherapists, and road safety professionals who may be advising older people about travel in vehicles. These have been developed as an adjunct to existing literature and resources that may already be used by occupational therapists such as the International Handbook of Occupational Therapy Interventions [1], CarFit [2], and Assessing Fitness to Drive [3].

Mobility is critical to independent and healthy ageing. The primary means of transport for most Australians aged over 65 years is the use of a private motor vehicle. However, older people are over-represented in crash statistics, with death and casualty rates almost as high as our youngest drivers [4,5]. Every year, approximately 175 Australians aged 65 years and older die as a driver or as a passenger involved in a crash and more than 4,000 are hospitalised [6]. Chest injuries are the most common injury among older vehicle occupants who die or are hospitalised following a crash [7]. While seatbelts are highly successful in reducing the risk of death and injury in crashes, the seatbelt is the most common source of chest injury in older vehicle occupants [7]. Optimal seatbelt effectiveness requires correct use and proper positioning of the sash belt over the mid-clavicle region and positioning of the lap belt low over the bony pelvis. Seatbelt effectiveness may be affected by the use of add-on accessories to improve occupant comfort. Incorrect use and poor positioning of the seatbelt, and the use of comfort accessories are common, yet few programs and sources of advice to counter these practices exist.

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Introduction

Many older people experience difficulties achieving good seatbelt fitment and comfort in vehicles [8]. The use of comfort accessories like cushions and pads is relatively common among older people travelling in vehicles [8]. Research has shown that some of these accessories can have a detrimental effect on safety in a crash [9]. Medical practitioners, allied health and road safety professionals are ideally placed to provide advice to older people about how to redress these issues and how to safely achieve comfort in vehicles. The 'Vehicle Safety for Older Drivers' project was initiated to develop evidence-based guidelines for tailoring advice about safe and comfortable travel in vehicles as a tool for use by these practitioners.

The guidelines presented in this document were developed using a multidisciplinary expert panel, and a modified Delphi consensus method through which the panel were asked to review existing evidence through the lens of their expertise. Consensus statements on challenges faced by older people in vehicles, and best-practice advice for addressing these were then generated and refined through this Delphi process. This process also identified areas where further evidence is required.

The Delphi process comprised of three rounds. Participants were asked to independently rank statements using a 5-point Likert scale. A free-text response was available to participants within each survey domain, providing the opportunity to elaborate and explain responses. Controlled feedback was provided to the expert Delphi panel between rounds. Consensus was defined as $\geq 75\%$ of panel participants agreeing/strongly agreeing with a statement. Therefore, consensus did not mean 100% of the panel agreed to a statement.

Older people also need to be able to access guidance about comfort and safety in vehicles. However, the consensus from the panel was that older people may not need the same level of detailed guidance as required by practitioners providing advice to others. For this reason, simple informative material targeting older people to raise awareness of safety issues in vehicles, and to allow for informed decision making has also been developed. This is provided as an Appendix to this document. This resource has been developed as an adjunct to existing resources that may already be used by older people relating to vehicle use and ageing [10 -13].

The guidelines were reviewed by Occupational Therapy Australia and the OTA National Driving Taskforce and provided to other stakeholders who reviewed and provided comment on draft versions of the guidelines.

The following section provides an overview of the principles of occupant protection as a background to why it is important that older people receive good advice on the use of seatbelts and comfort in vehicles. This is then followed by the detailed challenge and guidance statements.

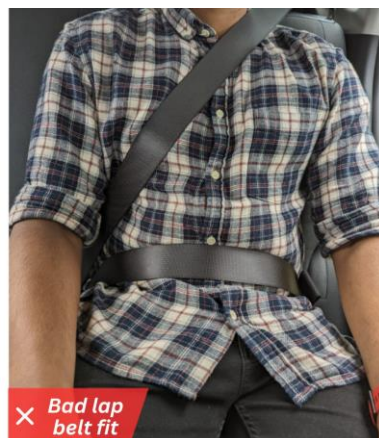
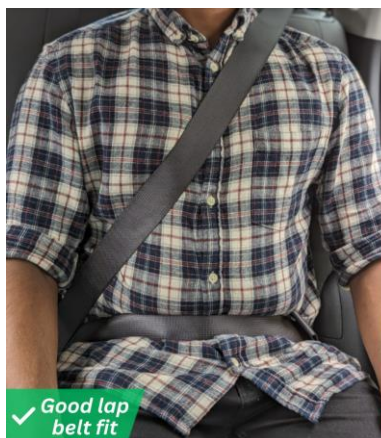
Principles of Occupant Protection

The principles of occupant protection are largely based on Newtonian physics that aim to prevent and/or mitigate the forces transferred to an occupant during a crash. Primarily this is achieved by the use of crumple zones and energy absorption paths built in a vehicle. Seatbelts have been developed in line with the principles of occupant protection and are one of the most effective interventions in automotive safety.



Three main principles underpin the protection of an occupant during a crash. The key principle involves maximising the distance over which the occupant's motion can 'slow down' in a crash. This is achieved through purposely designed crumple zones and energy absorption paths in the vehicle design. These features effectively lower the deceleration forces transferred to the occupants. This concept is called 'ride down'. The process of 'ride down' is most effective when the occupant is tightly coupled to the vehicle via the seatbelt. In addition to ensuring the occupant makes full use of the available 'ride down', a correctly fitted seatbelt also prevents the occupant from being ejected from the vehicle.

The next principle relates to how forces are distributed and transferred to the occupant in a crash. While the seatbelt is critical for allowing an occupant to decelerate with the vehicle ('ride down'), during this deceleration the seatbelt applies a force to the occupant's body which must be distributed to the parts of the body that can best withstand them. Seatbelts are designed to work most effectively when the lap belt sits across the pelvis and the sash belt lays across the sternum and clavicle, contacting relatively strong bony parts of an adult occupant, rather than softer parts. The occupant must remain restrained during the whole crash event.



Thirdly, once the occupant is securely coupled to the vehicle seat and the loads are distributed in a controlled manner, focus is placed on ensuring minimal contact between the occupant and structures within the vehicle interior to prevent the risk of injury. Airbags are used as a supplementary restraint system to assist in this third principle of occupant protection.

Correct use and positioning of a seatbelt is therefore critical to optimal crash protection. Older vehicle occupants are commonly observed with incorrect seatbelt positioning, and the use of add-on accessories such as cushions to alter their posture or reduce discomfort in vehicles. While people over the age of 65 years are naturally more fragile, thus more susceptible to injury than younger adults, the use of cushions or other 'add-ons' to change their seating position or reposition the seatbelt to reduce discomfort, may put them at even further injury risk.

Around a quarter of older Australian drivers use some type of comfort or orthopaedic aftermarket accessory on their vehicle seat while travelling in a vehicle [8]. These accessories and aids have been found to negatively impact crash protection [8]. The positioning of a compressible cushion behind the back induces slack in the seatbelt. This in turn reduces the tight fitment between the occupant and the vehicle seat and reduces the available distance between the occupant and contact partner of the vehicle (steering column, instrument panel or seat).

Similarly placing cushions under the buttocks is not favourable. The standard vehicle seat is an important component of the integrated restraint system. It provides the necessary means of load distribution between the occupant and seat frame. It is designed to include energy absorbing padding for force moderation and load distribution during collision. The vehicle seat contour also ensures the buttocks engages with the vehicle's seat, restraining the forward motion of the pelvis. The addition of aftermarket accessories such as cushions and pillows under the buttocks interferes with these mechanisms of action, potentially reducing the restraining effect.

Addressing the challenges for older people while travelling in motor vehicles

This section provides a summary of the consensus advice from the panel of experts, who were brought together to consider nine key safety and comfort challenges for older people as drivers or passengers in motor vehicles. The experts included road safety researchers, occupational therapy driver assessors, geriatricians, physiotherapists, and expert vehicle bioengineers.

Below is a set of recommendations from this panel of experts about how health professionals can best respond to these challenges. This set of guidelines covers recommendations relating to challenges in three broad areas:

- Achieving comfort and safety
- Addressing cognitive and physical challenges
- Addressing pain and discomfort

Achieving comfort and safety

Challenge 1: Older people may experience difficulties in achieving a correct seatbelt fit.

Advice that should be given to older vehicle drivers and passengers by professionals working with them:

- 1) Seatbelts should always be used.
- 2) Raise awareness of the safety implications of poor positioning of the seatbelt.
- 3) Encourage older people to identify and use sash belt height adjustment mechanisms in their vehicle to achieve a correct and comfortable sash belt position.
- 4) Encourage older people to correctly position the lap portion of the belt low and tight over their pelvis whenever they travel in a vehicle.
- 5) To contact an occupational therapist¹ or road safety program designed to provide education and tailored advice to older vehicle occupants if they cannot achieve good seatbelt fitment in their vehicle.

Explanatory note for health professionals:

Older people should be provided with information that encourages them to use vehicle adjustments to achieve good sash belt fitment such as adjustable sash height/D-rings, adjustable seat height, and proper initial placement of the lap belt. In most cases, older people should be able to achieve correct positioning through adjustment of the lap and sash belt. Proper positioning requires the sash part of the belt to be positioned over the mid-clavicle. Closer to the neck is better than closer to/off the shoulder. Comforters that do not introduce slack into the seatbelt, redirect the path of the sash belt or interfere with the belt retraction mechanism could be used to alleviate discomfort associated with the webbing contacting the neck if this cannot be rectified through adjustment to the vehicle. Placing the sash part of the seatbelt under the arm, off the shoulder or behind the back increases the risk of injury in a crash. The lap part of the belt should always be positioned low over the bony pelvis, under and not over any belly fat. All slack from the seatbelt should be removed so that both the sash and lap portions of the seatbelt are firm.

¹ An Occupational Therapist can explore a person's general mobility, cognition and functional capacity for vehicle transfers and within this consider the ergonomics of the vehicle seat and accessories. Driver Trained Occupational Therapists have specialist knowledge and skills that explore the range of factors required for a person to access and operate a vehicle. This often includes advice and training on how to address vehicle set up, posture, management of pain and strategies for continued safe use of a vehicle. Driver Trained Occupational Therapists also assess and prescribe vehicle modifications and conversions to support individual challenges that may be impacting on safe access and use of the vehicle.

Challenge 2: Older people may not know about the vehicle adjustment features and/or how to make adjustments to the vehicle.

Advice that should be given to older vehicle drivers and passengers by professionals working with them:

- 1) To identify and use sash belt height adjusters available in the driver and front seat passenger positions to achieve a correct and comfortable mid-shoulder position of the sash portion of the seatbelt.
- 2) To always seek information about vehicle safety adjustment features from the vehicle manufacturer's sales team at the point of sale.
- 3) Beyond the point of purchase or when purchasing second-hand from a non-commercial source, to seek information about vehicle adjustments from the manual provided with the vehicle.
- 4) To seek assistance from an occupational therapist or road safety programs designed to provide education and tailored advice to older drivers if they need help accessing information from the vehicle manual.

Explanatory note for health professionals:

Most safety and comfort problems can be addressed for most people in most vehicles through the available adjustments in the vehicle. Professionals working with older people are encouraged to raise awareness on how vehicle adjustments can be used to improve comfort and safety in vehicles in conjunction with providing any tailored advice related to driving and travelling in vehicles.

Challenge 3: Different people may need to make different adjustments, depending on their specific circumstances and the features available in the vehicle.

Advice that should be given to older vehicle drivers and passengers by professionals working with them:

- 1) While there may be a defined set of conditions where advice might be common to the condition, all older vehicle occupants would benefit from access to individually tailored advice.
- 2) To seek assistance to identify tailored solutions for comfort and safety needs from an occupational therapist or a road safety program designed to provide education and tailored advice to older vehicle occupants.
- 3) Older people with complex needs should be referred to an occupational therapy driver assessor to identify tailored solutions.

Explanatory note for health professionals:

All information needed to make adjustments to the vehicle may be provided in the vehicle manual, but older people may need assistance accessing this information or need more tailored advice. Older people may also need assistance in making all necessary adjustments to the vehicle. Authorised restraint fitters, vehicle mechanics and dealers may be a source of general assistance on how to make adjustments to specific makes and models of vehicle. Professionals working with older people should use these sources as necessary when providing advice to older people.

Addressing cognitive and physical challenges

Challenge 4: Older people may have cognitive and/or physical limitations that interfere with their ability to make necessary adjustment to a vehicle.

Advice that should be given to older vehicle drivers and passengers by professionals working with them:

- 1) Occupational therapy driver assessors are appropriate to assist older people with cognitive and/or physical limitations that interfere with their ability to make necessary adjustments to their vehicles.

Challenge 5: Older people may experience difficulties entering and exiting the vehicle due to the vehicle height or due to physical limitations (restricted range of motion, injury, or comorbidities).

Advice that should be given to older vehicle drivers and passengers by professionals working with them:

- 1) To encourage older people to consider ease of entry and exit to a vehicle when they purchase a new vehicle.
- 2) If difficulties entering or exiting a vehicle are due to injury or comorbidities, contact an occupational therapist, occupational therapy driver assessor or physiotherapist.
- 3) If difficulties entering or exiting a vehicle are due to reasons other than vehicle height or physical limitations, contact an occupational therapist.
- 4) Aftermarket accessories to assist older people to enter and exit vehicles should be used only on advice of an occupational therapist after an appropriate assessment.

Explanatory note for health professionals:

Ease of entering and exiting a vehicle is an important aspect of ensuring mobility for older people and is best addressed when purchasing a new vehicle. However, physical difficulties may arise later. If this occurs, appropriately trained professionals can work with an individual to identify a solution. Accessories should only be used when all other options are exhausted. Swivel seats that remain under the occupant in the vehicle during travel should be avoided and only used as a last resort on the advice of an occupational therapist or an occupational therapy driver assessor. If an occupational therapy driving assessor advises modification of the vehicle seat, each state in Australia has their own procedure for vehicle modification approvals and this process should always be followed.

Challenge 6: Older people may need to raise the seated height in a vehicle to see over the dashboard and/or achieve a correct sash belt position.

Advice that should be given to older vehicle drivers and passengers by professionals working with them:

- 1) To encourage older people to consider the ability to achieve adequate seated height for visibility over the dash for all drivers when purchasing new vehicles.
- 2) Use available vehicle adjustments to achieve a seated height to see over the dashboard and/or achieve a correct sash belt position.
- 3) If the seat height and/or seatbelt adjustor cannot be adjusted sufficiently to ensure good vision and/or good sash belt positioning, the older person should consult an occupational therapist or road safety practitioner providing road safety programs designed to provide education and tailored advice to older drivers.
- 4) Household items such as pillows and cushions should not be used to raise seated height.

Explanatory note for health professionals:

The driver and front passenger position seats in most vehicles can be raised to address these issues, however there may be some people and/or vehicles where vehicle adjustments cannot raise the seat height enough to ensure good vision. If the seat height and/or seatbelt adjustor cannot be adjusted sufficiently to ensure good vision and/or good sash belt positioning, the use of an accessory that does not impact safety may be used (a driver's ability to reach pedals effectively must also be considered. See Challenge 7 below). Any type of aftermarket device designed for drivers and occupants with special needs should only be used as a last resort and on the advice of, and after assessment by, an occupational therapy driver assessor. If an accessory to boost seated height is deemed necessary by an occupational therapist, this should be considered carefully. Occupational therapists should keep in mind that it is not possible to assess whether aftermarket devices would have a negative impact in a crash without crash testing. If an occupational therapist or occupational therapy driver assessor deems boosting height with a device is needed as a last resort, this device should be designed to remain in place during typical vehicle motion including emergency braking, but not permanently fixed to the seat, and should not impact the driver's ability to reach the vehicle pedals effectively. It is also recommended that any device used to 'boost' seated height should be as firm as possible (i.e. non-compressible), and boost seated height to only the minimum height required. An occupational therapy driver assessor or an occupational therapist experienced in vehicle modifications may need to be consulted to consider adaptations to support correct seat height. If an occupational therapy driving assessor or an occupational therapist experienced in vehicle modifications advises modification of the vehicle seat, each state in Australia has their own procedure for vehicle modification approvals and this process should always be followed.

Challenge 7: Older people who are driving may need to make adjustments to the vehicle to achieve appropriate access to the steering wheel and foot pedals.

Advice that should be given to older vehicle drivers by professionals working with them:

- 1) Use available vehicle adjustments to achieve appropriate access to the steering wheel and foot pedals.
- 2) Adjustment to the vehicle should prioritise achieving optimal access to the steering wheel and foot pedals without the use of an accessory.
- 3) If this cannot be achieved due to a specific functional issue being experienced by the driver, an occupational therapy driving assessment should be considered.
- 4) If a driver reports discomfort after adjustment to the vehicle to ensure optimal access to the steering wheel and foot pedals (i.e., an adequate driving position), further vehicle adjustments should be explored to alleviate discomfort without compromising the driving position.
- 5) If comfort cannot be achieved in an adequate driving position through vehicle adjustment alone, the older person should be referred to an occupational therapy driver assessor or appropriate road safety practitioner.

Explanatory note for health professionals:

Vehicle adjustments are available in most modern vehicles to achieve appropriate access to the steering wheel and foot pedals for most people. In rare instances where this may not be the case, older people should be referred to a professional qualified to provide advice on vehicle adaptations. An occupational therapy driver assessor or appropriate road safety practitioner may consider advising the use of an accessory when vehicle adjustments cannot achieve both comfort and an adequate driving position. However, the accessory should not impact on safety and, the choice of accessory should occur in consultation with a practitioner. An occupational therapy driver assessor or an occupational therapist experienced in vehicle modifications may need to be consulted to consider vehicle adaptations to support correct access to the steering wheel or foot pedals. If an occupational therapy driving assessor or an occupational therapist experienced in vehicle modifications advises modification to support correct access to the steering wheel or foot pedals, each state in Australia has their own procedure for vehicle modification approvals and this process should always be followed.

Addressing pain and discomfort

Challenge 8: Older people may experience pain when sitting in or driving a vehicle for a prolonged period.

Advice that should be given to older vehicle drivers and passengers by professionals working with them:

- 1) Use available vehicle adjustments to alleviate the likelihood of pain induced by prolonged sitting.
- 2) Take regular breaks and stretch to relieve pain.
- 3) Consult a physiotherapist for tailored exercises and pain management strategies.
- 4) In general, do not use lumbar supports or place anything behind the back when travelling in a vehicle.
- 5) People who need to use a lumbar support following surgery/during rehabilitation who cannot refrain from vehicle travel, should consult an occupational therapist to identify a solution.

Explanatory note for health professionals:

Postural support to alleviate pain does not align with the current understanding of pain and is not supported by evidence. Cushions or supports placed behind the back in a vehicle interfere with the occupant protection provided by a seatbelt and the vehicle seat and may expose an occupant to increased risk of injury in a crash. Occupational therapists or occupational therapy driver assessors providing advice on the use of lumbar supports following surgery/rehabilitation should take an evidence-based and risk/benefit approach to identifying a solution. An occupational therapy driver assessor or an occupational therapist experienced in vehicle modifications may need to be consulted to consider vehicle adaptations to address pain. If an occupational therapy driving assessor or an occupational therapist experienced in vehicle modifications advises a modification to address pain, each state in Australia has their own procedure for vehicle modification approvals and this process should always be followed.

Challenge 9: Older people may experience discomfort when sitting in or driving a vehicle.

Advice that should be given to older vehicle drivers and passengers by professionals working with them:

- 1) Use available vehicle adjustments to achieve comfort.
- 2) Seek advice from an occupational therapist or road safety program designed to provide education and tailored advice to older drivers if there is difficulty resolving discomfort in a vehicle.
- 3) If comfort cannot be achieved through vehicle adjustment, work with an occupational therapy driver assessor to identify a solution that does not involve using a cushion or pad on the vehicle seat.

Explanatory note for health professionals:

Cushions or supports placed behind the back in a vehicle interfere with the occupant protection provided by a seatbelt and the vehicle seat and, may expose an occupant to increased risk of injury. General advice should always be not to place anything behind the back when travelling in a vehicle. Sitting on a thick and/or highly compressible cushion or comfort accessory may also interfere with the occupant protection provided by the seatbelt and vehicle seat and increase the risk of injury in a crash. Any type of aftermarket device designed for drivers and occupants with special needs should only be used as a last resort and on the advice of, and after assessment by, an occupational therapy driver assessor. If an accessory to boost seated height is deemed necessary by an occupational therapy driver assessor, this should be considered carefully. Occupational therapists and occupational therapy driver assessors should keep in mind that it is not possible to assess whether aftermarket devices would have a negative impact in a crash without crash testing. If an occupational therapy driver assessor deems boosting height with a device is needed as a last resort, this device should be designed to remain in place during typical vehicle motion including emergency braking, but not permanently fixed to the seat, and should not impact the driver's ability to reach vehicle pedals effectively. It is also recommended that any device used to 'boost' seated height should be as firm as possible (i.e. non-compressible), and boost seated height to only the minimum height required. An occupational therapy driver assessor or an occupational therapist experienced in vehicle adaptations may need to be consulted to consider adaptations to support correct seat height. If an occupational therapy driving assessor or an occupational therapist experienced in vehicle modifications advises a modification to boost seated height, each state in Australia has their own procedure for vehicle modification approvals and this process should always be followed.

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Appendix

The following flyer is an example of information material created to provide advice to older people on safe and comfortable travel in vehicles. This flyer was developed in consultation with a small group of older people and can be used by occupational therapists, medical practitioners, physiotherapists, and road safety professionals to distribute to their clients.