



MOBILITY DEVICE TRANSPORTATION SAFETY: WHAT DO I NEED TO KNOW?

WRITTEN BY: TRICIA KARG, MS AND GINA BERTOCCI, PHD PE

Motor vehicle transportation is essential to access jobs, education, health care and leisure activities, as well as other activities and services. Motor vehicles are designed to transport passengers from one location to another, and to transport them safely. Vehicles are manufactured with a variety of safety features, designed specifically to transport passengers and drivers seated in vehicle seats. Safety is more complicated for those who choose to remain seated in their mobility device rather than transfer to the vehicle seat. For the occupant to travel safely, the mobility device must become part of the vehicle safety system, provide a crashworthy seat and remain securely anchored to the vehicle. The Americans with Disabilities Act (ADA) and Individuals with Disabilities Education Act (IDEA) require access to public and school transportation and the provision of wheelchair securement stations with occupant safety belts on the vehicles. The missing link in the safety system is most often a wheelchair that has been designed and tested for use as a seat during transportation. RESNA recognized this problem and issued a white paper¹ stating its position that prescribed wheelchairs that will serve as a seat in a motor vehicle should: “(1) demonstrate that they can be effectively secured and provide effective occupant support under the same frontal-impact conditions used to test occupant-restraint systems and seats in passenger cars, and child safety seats used by children; (2) facilitate the proper placement of vehicle-anchored belt restraints; and (3) have design

THE MISSING LINK IN THE SAFETY SYSTEM IS MOST OFTEN A WHEELCHAIR THAT HAS BEEN DESIGNED AND TESTED FOR USE AS A SEAT DURING TRANSPORTATION.

features that reduce user error in securing the wheelchair by four-point, strap-type tie-downs. When seating systems from a second manufacturer are needed, the seating system (i.e., seat, back support and attachment hardware) should also demonstrate the ability to provide effective occupant support during frontal crashes and should not interfere with proper use of belt restraints.”

MOBILITY DEVICE EVALUATION: ADDRESSING TRANSPORTATION

Individuals should transfer out of their mobility device to the vehicle seat if possible, provided they have adequate postural stability while seated in a moving motor vehicle. Those who cannot transfer to a vehicle seat or choose not to due to medical reasons should be provided guidance in identifying a mobility device that meets their functional needs and is compliant with the voluntary standard, RESNA WC-19 Wheelchairs Used as Seats in Motor Vehicles.² Suppliers and therapists can facilitate the process of getting a crash-tested wheelchair funded through documentation and

justification of need. Injury prevention and wellness, avoiding expensive transportation-related injuries, along with the increased durability of crash-tested wheelchairs make a strong case to justify the additional cost. Suggested wording for letters of justification for medical necessity can be found at: <http://bit.ly/2cVV3rK>

The Assistive Technology (AT) team can begin a conversation about transportation by asking their clients how they plan to use their mobility device outside the home. Questions should focus on travel in both private and public vehicles. Even those who typically transfer to a vehicle seat when traveling in a private vehicle may remain seated in their wheelchairs when using paratransit or public transportation. Therefore, questions should cover what type of motor vehicles the person may be transported in, the possible locations the individual will sit during travel in a motor vehicle, and what mobility device securement and safety belts will be used in the vehicles. Additional questions may focus on the client’s current transportation solutions, if applicable. A suggested script for this discussion can be found under Prescriber Resources—Clinical Tools at: <http://bit.ly/2d05ab3>.

CRASH-TESTED MOBILITY DEVICES

Crashworthiness is evaluated by subjecting a mobility device to a simulated impact event in a laboratory

setting using a sled mounted on a test track. Mobility devices that are WC19 compliant have survived 30 mph, 20 G's frontal impact sled testing and have demonstrated structural integrity. These mobility devices have four crash-tested securement points labeled and easily identified by a hook symbol (see Figures 1 and 2). These devices also provide improved stability during normal travel and reduce potential injury-producing sharp edges. Power wheelchair models use gel-cell batteries and offer improved battery retention. Frames are rated for ease of properly positioning a vehicle-anchored lap and shoulder belt restraint system on the wheelchair-seated occupant, so that belts make proper contact with the skeletal structures of the shoulder, torso and pelvis, and must receive an "acceptable" rating for accommodation of lap and shoulder belts.

A WC19-compliant device must also offer a wheelchair-anchored pelvic safety belt that meets crashworthiness criteria, or must provide a five-point restraint harness and head support if intended for children under 50 pounds. A list of compliant mobility devices can be found at: <http://bit.ly/2cwF4eW>.

This list includes manual, power and stroller-type wheelchair models for both adults and children. Some WC19-compliant models include tilt-in-space, recline and folding frames. With this information, clients and the AT team can identify a mobility device that satisfies goals for function, fit and features, as well as improving safety during transportation.

WC19-compliant devices are not necessarily heavier than their noncompliant counterparts. For example, even a lightweight stroller-type wheelchair model complies.

No transportation standards have been developed for the design and/or use of postural support devices (PSDs) on wheelchairs, such as headrests, lateral supports or chest harnesses. However, a paper on Guidelines for Use of Secondary Postural Support Devices by Wheelchair Users during Travel in Motor Vehicle provides information on how to use PSDs safely and effectively during transportation.³

In general, PSDs should and can be used during transportation since these help the wheelchair occupant to maintain a seated posture, thereby enhancing the effectiveness of crashworthy belt restraint. PSDs should not, however, be relied on to provide restraint for wheelchair-seated occupants in crash situations and these should be positioned so that no interference occurs with the proper positioning of lap/shoulder belt restraint systems.

MOBILITY DEVICE SECUREMENT AND OCCUPANT RESTRAINT IN THE VEHICLE

As part of the AT team, you should be aware and educate others about transportation safety. Transportation safety requires a systems approach involving effective wheelchair securement to the vehicle and effective occupant restraint with a three-point (lap/shoulder) or, in the case of a child under 50 pounds, a five-point harness. The following instruction should be provided:

1. Always secure the mobility device to the vehicle facing forward with a crash-tested securement system. Even in large buses, wheelchair securement is needed. During an accident or evasive driving maneuver, an unsecured wheelchair can become an

unstable, moving object causing danger to the user and other passengers. In addition, a passenger seated in a secured wheelchair will have improved seating stability during normal vehicle operation. Many injuries happen because unsecured wheelchairs tip over or passengers slide out of the seat.

2. Secure the mobility device using either a four-strap tie-down system or a wheelchair docking system (see Figures 2 and 3). Systems should be compliant with RESNA WC18, Wheelchair Tie-down and Occupant Restraint Systems for Use in Motor Vehicles. The docking method is used in private vehicles since it requires an adaptor on the frame to engage with the docking device. Docking securement devices allow the rider to secure and release independently. If using a docking system, select a docking system that is compatible and has been successfully crash tested with the mobility device model when possible.

3. Ensure that the securement and occupant restraint systems are installed by an entity knowledgeable and experienced in proper installation of the equipment in accordance with manufacturer instructions, such as a NMEDA-certified supplier (<http://www.nmeda.org>).

4. Always use a crash-tested occupant restraint compliant with RESNA WC18. Being ejected from a vehicle seat is one of the most common causes of death and severe injury to occupants in motor vehicle crashes, occurring even in non-crash events, such as sudden vehicle braking. Pelvic positioning belts are not crash-tested and should not be relied upon for motor-vehicle safety.

5. Improperly positioned occupant restraint belts pose an injury risk in severe crashes. Investigation of crashes involving wheelchair-seated occupants found improper use of safety belts in the majority of cases. Proper positioning of



MOBILITY DEVICE TRANSPORTATION SAFETY
(CONTINUED FROM PAGE 49)



FIGURE 1

Crash tested securement point labeled with hook symbol

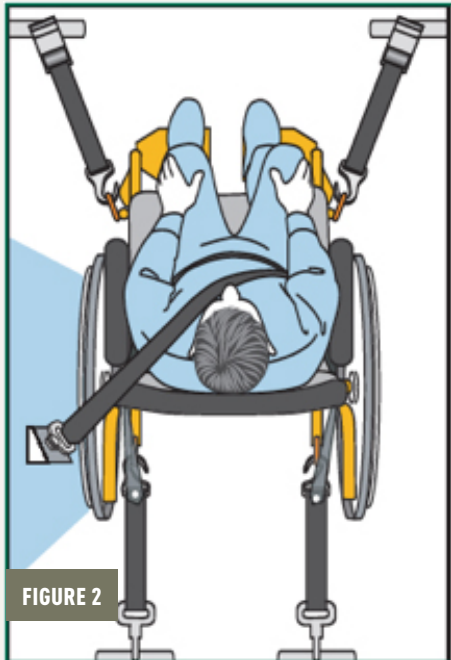


FIGURE 2

4 strap tie down system, attached to securement points

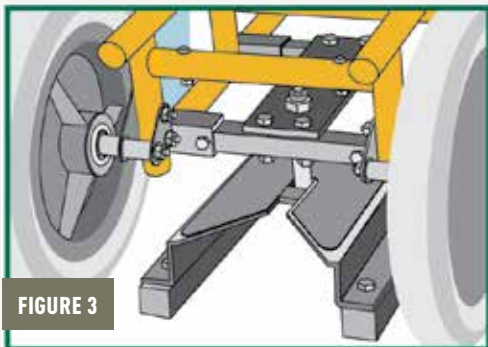


FIGURE 3

wheelchair docking system

the pelvic portion of the occupant restraints is low on the pelvis near the upper thighs. The pelvic belt should not be placed over the soft tissue of the abdomen. The shoulder portion of the restraint should cross the middle of the region between the neck and shoulder, cross the center of the chest, and then connect to the pelvic belt near the hip of the occupant. It should remain in good contact with the shoulder and chest during travel (see Figure 4).

BEST PRACTICES AND SAFETY STANDARDS

General information on best practices for wheelchair transportation safety can be found in the Ride Safe Brochure available at <http://bit.ly/2c170zq>. This consumer education brochure outlines a three-step process for effective wheelchair transportation safety, including choosing the right equipment, securing the wheelchair, and protecting the rider. Safety tips for those driving while seated in a wheelchair can be found at the same site under the Drive Safe Poster link. Another resource is Guidelines for Use of Secondary Postural Support Devices by Wheelchair Users During Travel in Motor Vehicles.³ The first section reviews the basic principles for wheelchair transportation safety, and the second offers specific recommendations for using postural support devices during travel in motor vehicles (e.g., pelvic positioning belts, chest harnesses, headrests, anterior head supports and lateral supports).

RESNA voluntary industry standards related to wheelchairs and transportation are available and demand for products meeting these standards will drive product compliance. The standards are published in RESNA Wheelchair Standards, Volume 4: Wheelchairs and Transportation (2012). Products that comply with the transportation safety standards will display the symbol depicted in Figure 5. A list of compliant mobility products can be found at: <http://bit.ly/2dbw2Iz>.

- WC18: Wheelchair tie-down and occupant restraint systems for use in motor vehicles, which is the update of SAE Recommended Practice J2249 Wheelchair Tie-downs and Occupant Restraint Systems for Use in Motor Vehicles, establishes design and performance requirements for securement and occupant restraints, including procedures for crash testing equipment.
- WC19: Wheelchairs for use in motor vehicles, establishes design and performance requirements for mobility devices, including manual and power wheelchairs and scooters, and procedures for crash testing these devices.
- WC20: Wheelchair seating systems for use in motor vehicles is a newer standard that establishes design and performance requirements and associated test methods for evaluating wheelchair seating systems (i.e., seats, back supports, and attachment hardware) independent of the commercial base frames on which they may be installed, thereby allowing for combining a seating system from one manufacturer with a base frame from another manufacturer to create a safe wheelchair for use as a motor vehicle seat.

WHEELCHAIR TRANSPORTATION SAFETY CAN BE INCORPORATED INTO THE WHEELCHAIR PRESCRIPTION PROCESS WITHOUT COMPROMISING POSITIONING OR FUNCTIONAL NEEDS. THE AT TEAM CAN HELP AVOID TRANSPORTATION MISCONCEPTIONS AND PROVIDE BASIC INFORMATION FOR SAFE TRAVEL.

SUMMARY

A crash-tested WC19-compliant wheelchair with a crash-tested WC18-compliant securement and occupant restraint offers the best protection for individuals who travel in motor vehicles while remaining seated in their mobility devices. The AT team, including the supplier, often provides the first line of information for these individuals. Wheelchair transportation safety can be incorporated into the wheelchair prescription process without compromising positioning or functional needs. The AT team can help avoid transportation misconceptions and provide basic information for safe travel.

CONTACT THE AUTHORS

Gina may be reached at g.bertocci@louisville.edu.

Patricia may be reached at tkarg@pitt.edu.

REFERENCES:

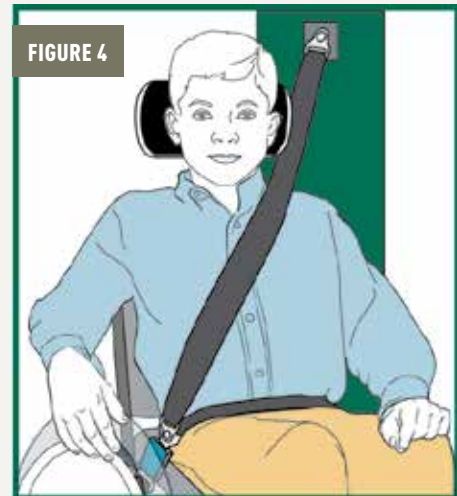
1. BUNING ME, BERTOCCHI GE, SCHNEIDER LW, MANARY M, KARG P, BROWN D, JOHNSON S. RESNA'S POSITION ON WHEELCHAIRS USED AS SEATS IN MOTOR VEHICLES. ASSIST TECHNOL. 2012; 24(2): 132-41. DOI: 10.1080/10400435.2012.659328.
2. ANSI/RESNA. RESNA WHEELCHAIR STANDARDS/VOLUME 4, SECTION 19: WHEELCHAIRS FOR USE AS SEATS IN MOTOR VEHICLES, AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)/REHABILITATION ENGINEERING SOCIETY OF NORTH AMERICA (RESNA), ARLINGTON, VA, 2012.
3. KARG P, COTZIN C, MANARY M, FUHRMAN SI. GUIDELINES FOR USE OF WHEELCHAIR POSTURAL SUPPORT DEVICES DURING TRAVEL IN MOTOR VEHICLES. J PED REHAB MED. 4 (2011); 251-7. DOI: 10.3233/PRM-2011-0182

RESOURCES:

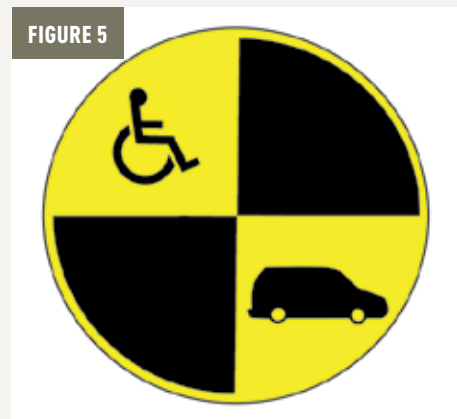
- WHEELCHAIR TRANSPORTATION SAFETY, UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE: [HTTP://WC-TRANSPORTATION-SAFETY.UMTRI.UMICH.EDU](http://wc-transportation-safety.umtri.umich.edu)
- LISTS OF CRASH-TESTED PRODUCTS: [WC-TRANSPORTATION-SAFETY.UMTRI.UMICH.EDU/CRASH-TESTED-PRODUCT-LISTS](http://wc-transportation-safety.umtri.umich.edu/crash-tested-product-lists)
- RIDE SAFE EDUCATION BROCHURE: [HTTP://WC-TRANSPORTATION-SAFETY.UMTRI.UMICH.EDU/RIDESAFE-BROCHURE](http://wc-transportation-safety.umtri.umich.edu/ridesafe-brochure)
- SAFETY TIPS FOR DRIVING WHILE SEATED IN A MOBILITY DEVICE: [HTTP://WC-TRANSPORTATION-SAFETY.UMTRI.UMICH.EDU/DRIVE-SAFE-POSTER](http://wc-transportation-safety.umtri.umich.edu/drive-safe-poster)
- SUGGESTED LANGUAGE FOR LETTERS OF JUSTIFICATION FOR MEDICAL NECESSITY: [HTTP://WC-TRANSPORTATION-SAFETY.UMTRI.UMICH.EDU/CONSUMERS/JUSTIFY-PAYING-FOR-WC19-WHEELCHAIRS-AND-SEATING](http://wc-transportation-safety.umtri.umich.edu/consumers/justify-paying-for-wc19-wheelchairs-and-seating)
- PRESCRIBER RESOURCES: [HTTP://WC-TRANSPORTATION-SAFETY.UMTRI.UMICH.EDU/PREScriBER-RESOURCES](http://wc-transportation-safety.umtri.umich.edu/prescriber-resources)

ACKNOWLEDGEMENT:

THE UNIVERSITY OF MICHIGAN TRANSPORTATION RESEARCH INSTITUTE PROVIDED THE FIGURES FOR THIS ARTICLE AND MAINTAINS THE WHEELCHAIR TRANSPORTATION SAFETY WEB RESOURCES CITED.



Properly positioned occupant restraint belts



WTS symbol, demonstrating compliance with the transportation safety standards