

Concussion plus Persisting Concussion Symptoms in Occupants of Motor Vehicle Collisions: An Update

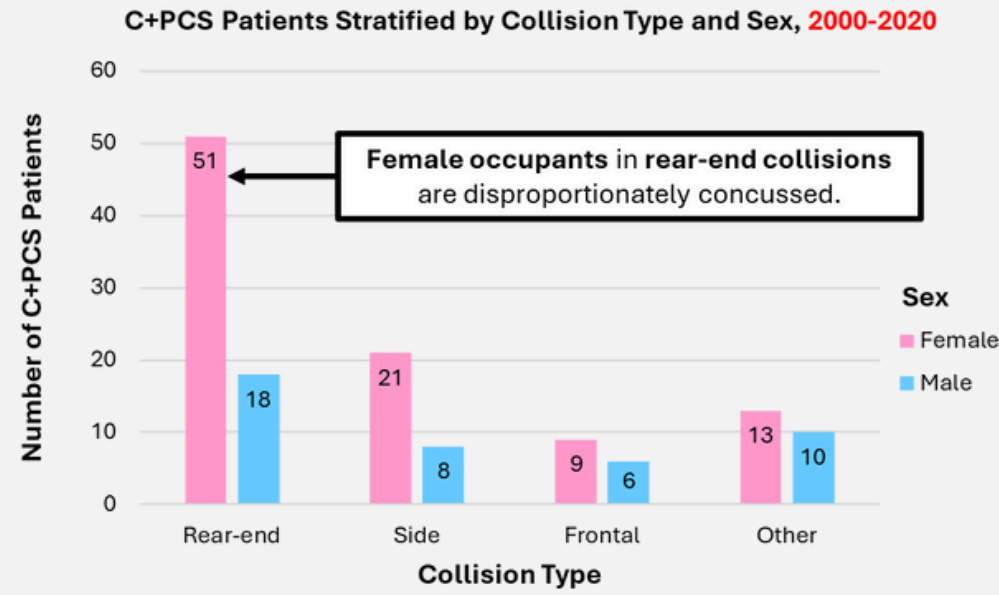
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Background



Motor vehicle collisions cause the **most** persisting concussion symptoms with the **longest** symptom duration.

Tator CH, Moore C, Buso C, Huszti E, Li Q, Prentice EB, et al. Cause of Concussion With Persisting Symptoms Is Associated With Long-Term Recovery and Symptom Type, Duration, and Number in a Longitudinal Cohort of 600 Patients. J. Neurotrauma, 2024.



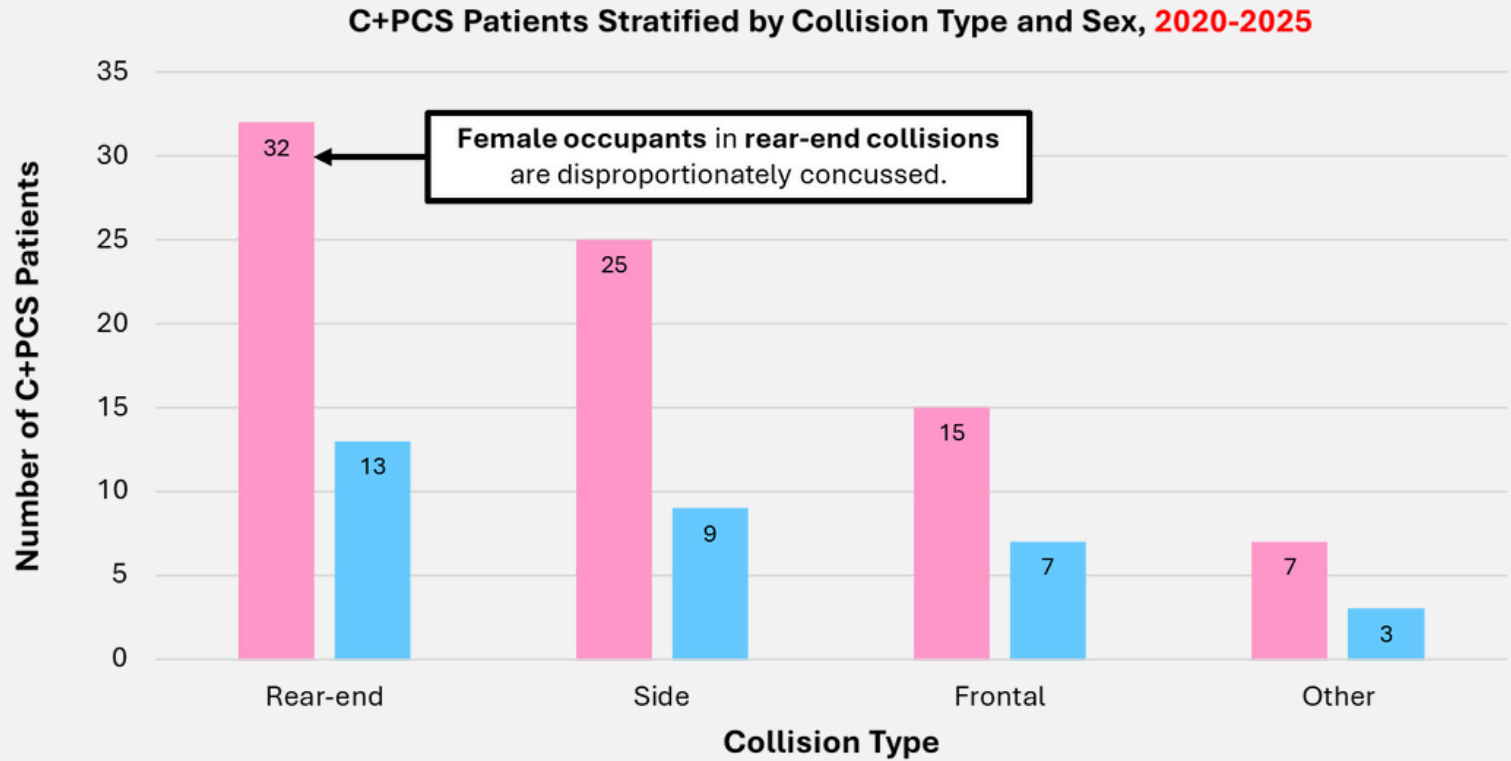
Tator CH, Scott OFT, Elkin BS, Prentice E, Muhammad U, Khodadadi M, et al. Analysis of Concussions with Persisting Symptoms Caused by Motor Vehicle Crashes in 136 Vehicle Occupants Shows that Females Are Vulnerable Road Users. J. Neurotrauma, 2024.

Aims

- 1 Identify **risk factors** and **mechanisms** causing concussion in MVC
- 2 Elucidate deficiencies in **vehicle safety systems** for concussion prevention
- 3 Examine **previous research efforts** and key decisions made in this area

To protect occupants of motor vehicle collisions from concussion.

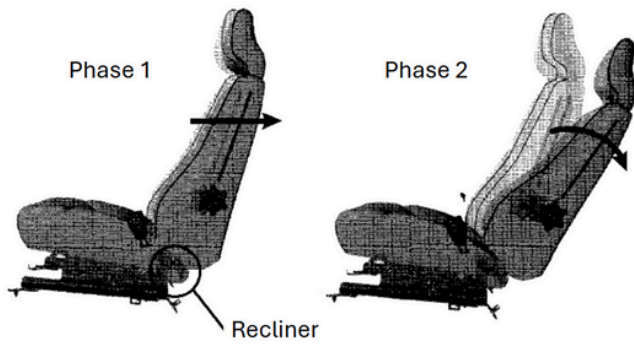
Results



Vehicle Safety Systems

- Seat Belts**
Seat belts were used in **92%** of rear impacts.
- Air Bags**
Air bags deployed in **7%** of rear impacts.
- Head Restraints**
The head struck the head restraint first in **100%** of rear impacts.

Tator CH, Scott OFT, Elkin BS, Prentice E, Muhammad U, Khodadadi M, et al. Analysis of Concussions with Persisting Symptoms Caused by Motor Vehicle Crashes in 136 Vehicle Occupants Shows that Females Are Vulnerable Road Users. J. Neurotrauma, 2024.



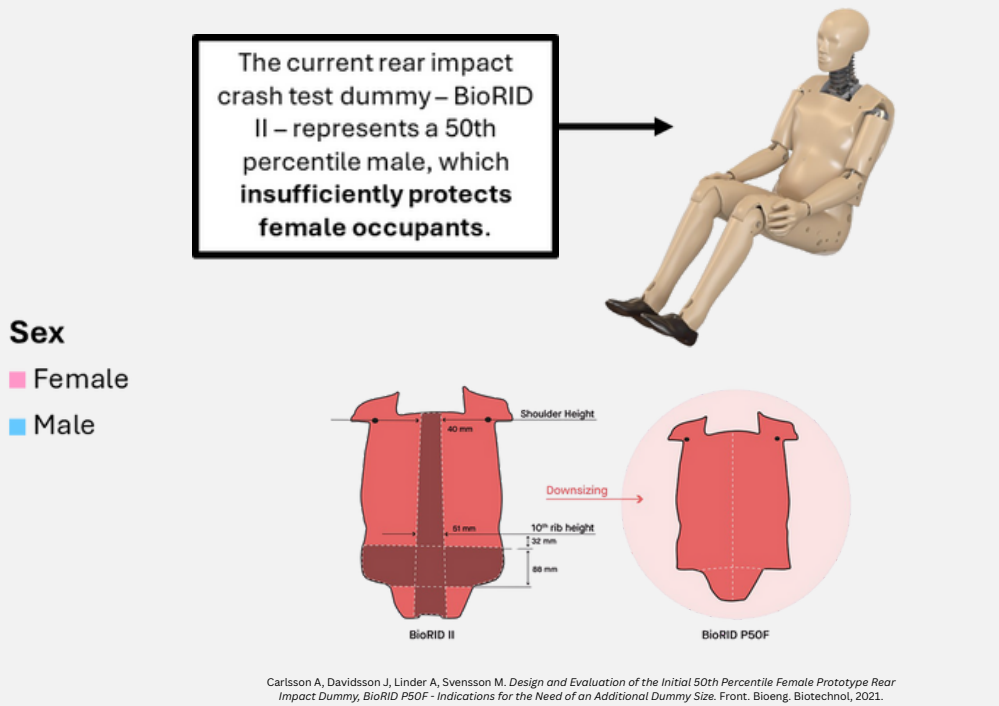
Jakobsson L, Lundell B, Norin H, Isaksson-Hellman I. WHIPS - Volvo's Whiplash Protection Study. Accid. Anal. Prev., 2000.

The WHIPS seat was designed to:

- reduce occupant acceleration,
- minimize relative movements between adjacent vertebrae, and
- minimize forward rebound into the seat belt

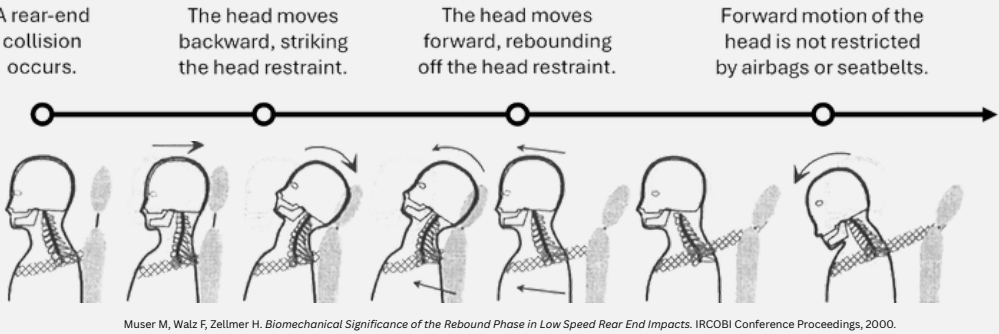
to reduce the risk of neck injury in rear-end impacts of low-to-medium severity.

The Neck Injury Criterion (NIC) was used as the primary outcome measure and **concussion was not considered.**

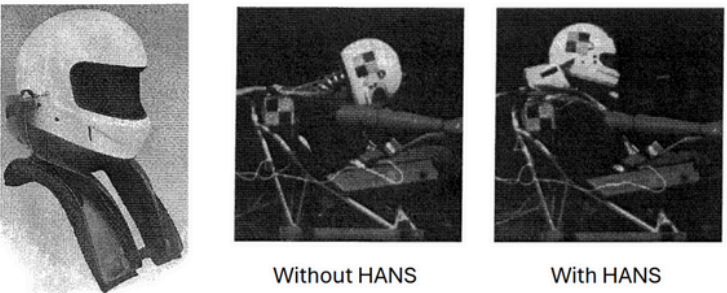


Carlsson A, Davidsson J, Linder A, Svensson M. Design and Evaluation of the Initial 50th Percentile Female Prototype Rear Impact Dummy, BioRID P50F - Indications for the Need of an Additional Dummy Size. Front. Bioeng. Biotechnol., 2021.

Occupant Motion



Muser M, Walz F, Zellmer H. Biomechanical Significance of the Rebound Phase in Low Speed Rear End Impacts. IRCOBI Conference Proceedings, 2000.



Hubbard RP, Begeman PC, Downing JR. Biomechanical Evaluation and Driver Experience with the Head and Neck Support. Motorsports Engineering Conference & Exposition, 1994.

The HANS device was designed to reduce injurious motions and forces of the head and neck during automobile racing.

Used in combination with the head surround, the HANS device is widely adopted in F1, NASCAR, and stock car racing.