Musculoskeletal Disorders II, Spinal Cord Injury, and Commercial Motor Vehicle Driver Safety

Findings of Evidence Report

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Musculoskeletal Disorders and Potential Crash Risk

- Potential risk of a motor vehicle crash among individuals with the following musculoskeletal disorders:
  - Nerve compression syndromes (carpal tunnel, ulnar neuropathies, radial neuropathies, tarsal tunnel)
  - Tendinitis/tenosynovitis
  - Bursitis
  - Plantar fasciitis
Spinal Cord Injury and Potential Crash Risk

• Potential risk of a motor vehicle crash among individuals with the following SCI-related conditions:
  – Paraplegia (complete or incomplete)
  – Tetraplegia (complete or incomplete)
Key Questions

- Key Question 1: Do musculoskeletal disorders of the hand, wrist, elbow, or shoulder (specifically carpal tunnel syndrome, ulnar neuropathies, radial neuropathies, tendonitis/tenosynovitis, and bursitis) increase crash risk and/or affect driving ability?
Key Questions

• Key Question 2: Do musculoskeletal disorders of the foot, ankle, or knee (specifically plantar fasciitis, tarsal tunnel syndrome, tendonitis/tenosynovitis, and bursitis) increase crash risk and/or affect driving ability?

• Key Question 3: Does reduced limb mobility and/or control resulting from spinal cord injury increase crash risk and/or affect driving ability?
Key Question 1:
Upper Extremity Musculoskeletal Disorders and Crash Risk

- No studies included
Key Question 1: Upper Extremity Musculoskeletal Disorders and Crash Risk - Summary

- There is insufficient evidence to determine whether any musculoskeletal disorders of the upper extremities assessed in this report increase crash risk and/or decrease driving performance.
Key Question 2: Lower Extremity Musculoskeletal Disorders and Crash Risk

- No studies included
There is insufficient evidence to determine whether any musculoskeletal disorders of the lower extremities assessed in this report increase crash risk and/or decrease driving performance.
Key Question 3:
Spinal Cord Injury and Crash Risk

- 3 cohort studies included
- No CMV drivers
- Quality = 2 Moderate, 1 Low
**Key Question 3: Spinal Cord Injury and Crash Risk – Study Population**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Year</th>
<th>Comparison</th>
<th>Risk Factors Assessed</th>
<th>Primary outcome</th>
<th>Adapted device used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ku et al. (105)</td>
<td>2002</td>
<td>Paraplegia (thoracic or lumbar cord injury) vs. normal drivers</td>
<td>NR</td>
<td>Driving performance (simulated)</td>
<td>Hand controls for braking and accelerating</td>
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<tr>
<td>Peters (103)</td>
<td>2001</td>
<td>Tetraplegia vs. able-bodied drivers</td>
<td>NR</td>
<td>Driving performance (simulated)</td>
<td>Two hand controls for braking and accelerating</td>
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<tr>
<td>Sivak et al. (106)</td>
<td>1981</td>
<td>Spinal cord injury (undefined) vs. able-bodied drivers</td>
<td>NR</td>
<td>Driving performance (closed and open road driving)</td>
<td>Hand controls for braking and accelerating and (if desired) a steering knob</td>
</tr>
</tbody>
</table>
Key Question 2: Spinal Cord Injury and Crash Risk – Indirect Evidence

- Driving ability/performance (simulator)
  - One moderate-quality study assessed simulated driving ability of 15 individuals with paraplegia (thoracic or lumbar cord injury)

  - Individuals with paraplegia drove at significantly slower speeds than able-bodied individuals. However, no significant differences found for steering stability, centerline violations, traffic signal violations, and driving time.

  - Slower speed is not a surrogate for unsafe driving.
Key Question 3: Spinal Cord Injury and Crash Risk – Indirect Evidence

- Driving ability/performance (simulator)
  - One moderate-quality study assessed simulated driving performance of 26 individuals with tetraplegia (complete or incomplete)

  - This study found significantly slower brake reaction times and workload factors (time pressure, effort) among tetraplegic individuals compared to able-bodied individuals.

  - Whether these differences in simulated driving outcomes have any relationship to safe driving ability remains unclear.
Key Question 3: Spinal Cord Injury and Crash Risk – Indirect Evidence

- Driving ability/performance (on-road driving)
  - One low-quality study assessed closed-course and open-road driving performance of 8 individuals with SCI (type not defined)
  - This study found no statistically significant difference in driving performance measures during closed-course or open-road driving with a specially-modified car between individuals with SCI (type not reported) and able-bodied individuals.
Key Question 3: Spinal Cord Injury and Crash Risk

- Caveats
  - Driving a large truck may require greater functional abilities than driving smaller vehicles
  - Whether the magnitude of difficulty of large truck driving would make the task impractical for individuals with SCI has not been addressed
Key Question 3: Spinal Cord Injury and Crash Risk – Indirect Evidence

• Caveats
  – The requirement to check and adjust loads during a long trip may be beyond the ability of a lone driver with SCI (the exception would be a sealed vehicle that did not require inspection during a trip)
  – Driving a modified CMV with a partner might be a possible option to overcome this problem
Key Question 3: Spinal Cord Injury and Crash Risk – Summary

- Certain individuals with SCI appear to have adequate driving ability in specially-modified cars. Individuals with paraplegia are less likely to have limitations that decrease driving ability than individuals with tetraplegia.
Key Question 3: Spinal Cord Injury and Crash Risk – Summary

• However, certain requirements that CMV drivers must meet (e.g., inspecting and adjusting loads during a long trip) may exceed the capabilities of a lone individual with SCI (the possible exception might be a sealed vehicle that did not require inspection during a trip).