Are Drivers With Arthritis More Likely To Be Involved In A Crash?

Mohammed Almanaa
Max Bareiss
Luke Rixinger
Feng Guo
Arthritis

- Inflammation of the joints
- Causes pain and limits motion
- 54 million Americans diagnosed every year
Objective

What is the relationship between crash risk and arthritis in the SHRP 2 NDS population?
SHRP 2 NDS

- ~3,400 drivers
- ~5.5 million trips
Dataset

- 78 Drivers with Arthritis
- 34 Male
- 44 Female
- 414 out of 1836 Crashes
- 20,000 Crashes and Baseline Cases
Model Design

- Random Effects Model
  - Random Effect for Each Driver in SHRP 2

- Variables:
  - Arthritis? Yes/No
  - Middle Aged (45-64)? Yes/No
  - Senior (65+)? Yes/No
  - Male? Yes/No
Was Arthritis Related to Crash Risk?

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Odds Ratio</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-2.68</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>Arthritis</td>
<td>0.69</td>
<td>1.87</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Middle-Aged</td>
<td>-0.41</td>
<td>0.68</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Senior</td>
<td>-0.017</td>
<td>0.98</td>
<td>0.048*</td>
</tr>
<tr>
<td>Male Gender</td>
<td>-0.06</td>
<td>0.95</td>
<td>0.422</td>
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</tbody>
</table>

Drivers with arthritis were **87% more likely to be in a crash** when accounting for age. Gender was not a significant factor. Interaction effects were not significant.
Why was there an Increased Crash Risk?

- Secondary Task Use
- Individual Recklessness
- Strength Loss
Was Arthritis Related to Secondary Task Engagement?

<table>
<thead>
<tr>
<th>Parameter</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.31</td>
<td>-</td>
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<tr>
<td>Arthritis</td>
<td>-0.14</td>
<td>0.300</td>
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<tr>
<td>Middle-Aged</td>
<td>-0.37</td>
<td>0.000</td>
</tr>
<tr>
<td>Senior</td>
<td>-0.72</td>
<td>0.000</td>
</tr>
<tr>
<td>Male Gender</td>
<td>-0.02</td>
<td>0.504</td>
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</table>

Arthritis had no influence on the driver performing secondary tasks. Gender was not a significant factor.
Why was there an Increased Crash Risk?

- Secondary Task Use
- Individual Recklessness
- Strength Loss

NO EFFECT
Sensation Seeking Score

A. There are some movies I enjoy seeing a second or even third time
B. I can’t stand watching a movie that I’ve seen before

A. I often wish I could be a mountain climber
B. I can’t understand people who risk their necks climbing mountains

A. I dislike all body odours
B. I like some of the earthy body smells

Higher score (0 to 40) indicates more of a sensation seeker

Correlated with crash risk (Jonah et. al.)
Was Arthritis Related to Sensation Seeking Score?

<table>
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<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>P-Value</th>
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<tbody>
<tr>
<td>Intercept</td>
<td>15.93 Pts</td>
<td>0.000</td>
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<tr>
<td>Arthritis</td>
<td>-0.59 Pts</td>
<td>0.389</td>
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<tr>
<td>Middle-Aged</td>
<td>-4.65 Pts</td>
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<tr>
<td>Senior</td>
<td>-6.94 Pts</td>
<td>0.000</td>
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<tr>
<td>Male Gender</td>
<td>2.48 Pts</td>
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</table>

Arthritis has no influence on the driver’s sensation seeking score
Why was there an Increased Crash Risk?

- Secondary Task Use
- Individual Recklessness
- Strength Loss
Was Arthritis Related to Grip Strength?

<table>
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<th>Parameter</th>
<th>Estimate</th>
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<tr>
<td>Intercept</td>
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<tr>
<td>Arthritis</td>
<td>-5.58 lbf</td>
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<td>Middle-Aged</td>
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<td>Senior</td>
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<tr>
<td>Male Gender</td>
<td>33.02 lbf</td>
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</table>

**Drivers with arthritis had lower grip strength** as expected indicating an overall loss in body strength
Effect was small
Why was there an Increased Crash Risk?

- Secondary Task Use
- Individual Recklessness
- Strength Loss

NO EFFECT
NO EFFECT
MAYBE
Conclusion

- Drivers with arthritis:
  - Were more likely to be involved in a crash
  - Were no more likely to engage in secondary tasks
  - Had no difference in Sensation Seeking Score
  - Had slightly lower grip strength
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References

### Secondary Task Usage

<table>
<thead>
<tr>
<th></th>
<th>Secondary Task</th>
<th>No Secondary Task</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>Arthritis</td>
<td>171</td>
<td>229</td>
<td>400</td>
</tr>
<tr>
<td>No Arthritis</td>
<td>9,066</td>
<td>8,323</td>
<td>17,389</td>
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<tr>
<td>Total</td>
<td>9,237</td>
<td>8,552</td>
<td>17,789</td>
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</table>

Odds Ratio = 0.69

Only looking at the Balanced-Sample Baseline, there appears to be a decrease in secondary task usage, but this does not account for age.
Drivers with arthritis have an increased risk of crash but this is confounded by age.