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### Trends in seat belt utilization among commercial and non-commercial vehicle occupants in Wisconsin: a comparative analysis of 2018–2019 and 2023–2024 data

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#### Abstract

This study analyzes seat belt use among commercial and non-commercial drivers in Wisconsin using 2018–2019 and 2023–2024 NOPUS data. In both time periods, commercial drivers consistently showed lower seat belt usage (.820 in 2018/2019; .843 in 2023/2024) compared to non-commercial drivers (.862 and .866, respectively). While slight improvements were observed among commercial drivers—especially males, whites, those under 60, and on 55–70 mph roads—usage still lags behind non-commercial drivers. These findings highlight the ongoing hazard of unbelted commercial drivers and underscore the need for targeted interventions, countermeasures, and employer-led safety strategies to improve compliance and reduce crash-related injuries.

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## 1. Introduction

In 2024, almost 40,000 people died in motor vehicle traffic crashes (National Center for Statistics and Analysis, 2025a). For decades, the leading cause of work-related deaths in the United States has continued to be motor vehicle crashes (MVCs) and risky driving behaviors have been identified as contributing factors (Delhomme & Gheorghiu, 2021; NIOSH, 2018; Wingate et al., 2023). In 2022, vehicle transportation accounted for two-thirds of all work-related fatalities, and employment in transportation, specifically couriers and messengers, is projected to grow over the 2022-2032 period (Bureau of Labor Statistics, 2024). A 2011-2014 analysis of fatal work-related MVCs in the United States using matched data from the Census of Fatal Occupational Injuries (CFOI) and the Fatality Analysis Reporting System (FARS) indicated that less than 50% of all fatalities were restrained (Rodríguez-Acosta et al., 2025).

In 2023, fatal and nonfatal preventable injury-related incidents total economic cost was \$1,333.5 billion including employers' uninsured costs, wage and productivity loss, and medical and administrative expenses (National Safety Council, 2023). In this period, motor vehicle crashes were over \$500 billion accounting for 40.9% of the costs (Blincoe et al., 2023; National Safety Council, 2023). Employers and the public bear the burden of these expenditures.

It is estimated that the risk of fatal injury to front-seat passenger vehicle occupants can be reduced by 45 percent, and the risk of moderate-to-critical injury by 50 percent when seat belts are used (National Center for Statistics and Analysis, 2019b; National Highway Traffic Safety Administration, 2019). The benefits of seat belt use, including reduced injury risk, severity, and fatalities, have been documented in numerous studies (Blincoe et al., 2015; CDC, 2025; Goetzke & Islam, 2015; Høye, 2016; Sunshine et al., 2017)

Research has shown that traffic safety countermeasures, including a focus on engineering, law enforcement, and public education, are proven strategies for increasing seat belt use and reducing traffic fatalities (Carter et al., 2014; Dinh-Zarr et al., 2001; Goodwin, 2015; Harper et al., 2014; Hasan et al., 2025; Hezaveh & Cherry, 2019; Shults et al., 2019; Shults & Beck, 2012; Strine et al., 2010; Sung et al., 2017). Other studies reveal how advances in technology increase seat belt use (Høye, 2016; Jermakian & Weast, 2018; Kidd et al., 2014, 2018; Kidd & Singer, 2019; Van Houten et al., 2010, 2011). In addition, the exploration of the psychological constructs related to seat belt use found that gratification delay, life satisfaction, aversion of risk, risk perception, and peer influence resistance are positively connected with belt use (Boakye et al., 2019; Ebert et al., 2025; Sheveland et al., 2020; Usman & Adebosin, 2024).

In July 2009, the State of Wisconsin passed a primary safety belt enforcement law, and annual statewide observation surveys of seat belt use have been conducted by the Wisconsin Department of Transportation since March 1987. Findings of these surveys regularly displayed that women use seat belts approximately 10% more often. (Buchman, 2021; *Field Observation of Safety Belt Use in Wisconsin (July 2016) - Wisconsin Digital Archives - Wisconsin Digital Archives*, n.d.). The influence that seat belt usage by a driver has on seat belt use by other front seat occupants has also been evaluated in several studies (Boakye et al., 2019; Buchman, 2021; Nambisan & Vasudevan, 2007). Seat belt usage rates of passengers are higher when traveling with female drivers who use seatbelts, and when drivers do not use seat belts, seatbelt usage rates of passengers are significantly lower (Buchman, 2021).

In 2024, the national estimate of seat belt use by adult front seat occupants was 91.2%, based on the National Occupant Protection Use Survey (NOPUS), continuing to represent an increasing usage trend over a 14-year period. Notwithstanding recent advancements towards higher national seat belt use rates, daytime unrestrained passenger vehicle occupant fatalities remain around 40% (National Center for Statistics and Analysis, 2025b). The purpose of this comparative analysis was to explore 2018-2019 and 2023-2024 data for seat belt use between commercial and non-commercial occupants in the State of Wisconsin, building upon the Eby, Fordyce, and Vivoda (2002) study. Seat belt use is a critical aspect of workplace occupational safety, and after several years of investing to increase seat belt usage, progress has plateaued in transportation-related workplace fatalities. Camden et al., (2024) identified gaps in published research on Commercial Motor Vehicle (CMV) drivers' seat belt use and occupational safety program qualities targeting seat belt use in the commercial fleets and drivers. This study aims to further address these gaps and highlight the importance of employer-led initiatives to promote seat belt use among employees.

## **2. Materials and methods**

### **2.1 Analytical Approach**

Average levels of seat belt utilization are compared across two main groups of drivers: commercial vehicles, defined as a vehicle used for business purposes as indicated by the existence of commercial logos or lettering, and noncommercial vehicles. These two groups are compared within the combined 2018/2019 sample, then within the 2023/2024 sample, and then each group is compared separately across the 2018/2019 and 2023/2024 periods. For each estimated proportion, the exact 95% confidence interval (CI) is estimated using the method of (Clopper, & Pearson, 1934). Significant differences then exist if the upper bound of one CI is below the lower bound of the other CI or vice versa.

Subsample comparisons are made for each of the four geographic Strata in Wisconsin, for males and for females, for whites and for nonwhites, and whether a passenger was or was not present in the right-hand seat. Further subsample comparisons are made for three categories for age, three categories for the speed limit, and whether the observations were on a weekday or weekend day. Note that some groups, such as female or nonwhite commercial vehicle drivers, tend to have relatively few observations, limiting the power of significance tests. All estimates and CIs were performed using Stata 17.1.

### **2.2 Data Collection**

Data collected during the Wisconsin 2018, 2019, 2023, and 2024 National Occupant Protection Use Survey (NOPUS), which occurred in early June, closely following the *Click it or Ticket* campaign (Nichols et al., 2016), were analyzed for this study. Data were collected by direct observation of all drivers and front passengers and represent field observations at 240 locations across the state of Wisconsin within 48 counties, accounting for 52% of the primary road segments in the state, for each of the years 2018 and 2019. Beginning in 2023/2024, the number of locations was reduced to 160 as a result of a lower Vehicle Miles Traveled (VMT) in the calculations. Assignment of observation times included all days of the week and all daylight hours between 7 am and 6 pm. The schedule included rush hour (before 9:30 a.m. and after 3:30 p.m.) and non-rush hour observations. Data collection was conducted for 60 minutes by one

trained observer at each site, utilizing iPads to document observations. Start times were staggered to ensure that a representative number of weekday/weekend/rush hour/non-rush hour sites were included each day. All passenger vehicles, including commercial vehicles weighing less than 10,000 pounds, were eligible for observation.

### **2.3 Site Selection**

The State of Wisconsin site locations for data collection were selected using the Uniform Criteria for State Observational Surveys of Seat Belt Use, used by the National Highway Traffic Safety Administration (NHTSA) since 2011 (*Uniform Criteria for State Observational Surveys of Seat Belt Use*, 2011). NHTSA survey guidelines (NHTSA, 2011) require a state to sample seat belt use in counties that comprise at least 85% of the state's passenger vehicle occupant fatalities (excluding pedestrian, bicyclist, motorcyclist, moped-user, and commercial vehicle-related deaths). In addition to covering over 85% of the state's occupant fatalities, the selected counties also contain almost 91% of the state's population and 89% of its Vehicle Miles Traveled (VMT).

For this analysis, with the aim of sampling locations corresponding to where VMT in the state is occurring, counties were divided into four strata regions representative of three road types: interstate highways, other highways, which include state trunk highways, and local roads/streets. The Milwaukee Metropolitan Statistical Area, as defined by the US Census, because of its disproportionately high concentration of population and VMT, characterizes Stratum 1. The remaining three Strata are defined by dividing the collective VMT of the other counties into approximate thirds based on the previous year's VMT. As noted, Stratum 1 contains the census-defined Milwaukee Metropolitan Area, Stratum 2 contains the counties having the next largest populations and amounts of VMT per county, and so forth, with Stratum 3 and Stratum 4 having the next downward levels of populations and VMT per county in the state, respectively.

## **3. Results and Discussion**

In the tables below, a "\*" is used to denote cross-sectional comparisons between commercial and noncommercial drivers that are significantly different at the 95% level. In Table 1, for the combined 2018/2019 samples, the statewide rate of seatbelt usage is significantly higher for noncommercial drivers (.862) than for commercial vehicle drivers (.820). For the four geographic Strata, that difference holds for Strata 1 and Strata 4, but not for Strata 2 or 3. The Strata counties are detailed in the notes to Table 1 and reveal that Strata 1 is the most urban of the four, given that it includes Milwaukee County.

Note that for all remaining subsamples, any significant differences are in the direction of commercial vehicle drivers utilizing seat belts less often. That is the case for males and females, whites, drivers with or without passengers, for the age group 30-59 years of age, for speed limits of 25-35 or 40-50, and for weekdays. Even where differences are insignificant, the direction of differences suggests lower seat belt utilization among commercial vehicle drivers, except for non-whites, where the relationship is reversed (but again insignificant).

**Table 1.** Estimated driver restraint use rates, 95% confidence intervals, and unweighted Ns for commercial and noncommercial light-vehicle occupants, 2018 and 2019 (confidence intervals in parentheses)

<i>Variable</i>	Commercial		Noncommercial	
	Percent use	Unweighted N	Percent use	Unweighted N
State of Wisconsin	.8198 (.8095-.8297)	5,693	.8623* (.8588-.8657)	37,993
<i>Strata</i>				
Strata 1	.7979 (.7722-.8219)	1,039	.8635* (.8539-.8726)	5,266
Strata 2	.8483 (.8232-.8711)	901	.8556 (.8463-.8645)	5,809
Strata3	.8492 (.8141-.8799)	484	.8596 (.8470-.8714)	3,197
Strata4	.7730 (.7362-.8070)	564	.8483* (.8366-.8595)	3,844
<i>Sex</i>				
Male	.8203 (.8097-.8305)	5,353	.8486* (.8441-.8531)	25,019
Female	.8589 (.8158-.8952)	319	.9198* (.9149-.9245)	12,433
<i>Race/ethnicity</i>				
White	.8238 (.8132-.8341)	5,205	.8808* (.8774-.8842)	34,759
Non-white	.8319 (.7941-.8652)	452	.8119 (.7963-.8269)	2,563
<i>Passenger presence</i>				
Passenger	.7729 (.7386-.8048)	643	.8965* (.8896-.9032)	7,829
No passenger	.8257 (.8150-.8361)	5,050	.8534* (.8494-.8574)	30,164
<i>Age group</i>				
16-29	.8376 (.7940-.8824)	234	.8811 (.8714-.8903)	4,583
30-59	.8244 (.8136-.8348)	5,023	.8744* (.8704-.8783)	27,450
60-up	.8710 (.8326-.9033)	372	.9021 (.8937-.9101)	5,140

<i>Speed limit</i>				
25-35	.8163 (.8037-.8285)	3,811	.8638* (.8598-.8678)	28,616
40-50	.8413 (.8204-.8606)	1,317	.8720* (.8635-.8802)	6,250
55-70	.7835 (.7478-.8163)	582	.8276 (.8140-.8405)	3,201
<i>Type of day</i>				
Weekend	.8123 (.7628-.8553)	293	.8486 (.8380-.8588)	4,671
Weekday	.8202 (.8097-.8303)	5,400	.8642* (.8605-.8679)	33,322

Notes: Strata 1: Milwaukee, Waukesha, Washington, and Ozaukee counties; Strata 2: Dane, Brown, Winnebago, Rock, Racine, and Outagamie counties; Strata 3: Marathon, Kenosha, Walworth, Fond du Lac, Eau Claire, Jefferson, Columbia, Chippewa, La Crosse, Dodge, Sheboygan, and Sauk counties; Strata 4: Portage, Monroe, Dunn, Manitowoc, Juneau, Barron, Jackson, Marinette, Clark, Wood, Shawano, Oconto, Waupaca, Trempealeau, Lincoln, Calumet, Pierce, Green, Waushara, Vernon, Taylor, Marquette, Adams, Crawford, and Richland counties.  
\* means are significantly higher across rows for a 95% confidence interval.

Turning to Table 2, using the combined 2023/2024 data, we ignore the ‘+’ signs for a moment to focus on results that are parallel to those reported in Table 1. In comparison, the overall pattern is similar. Statewide seatbelt usage is significantly higher for noncommercial (.866) than for commercial vehicle drivers (.843). Significant differences within the four Strata are found for Strata 1, as before, and for Strata 2, and in both cases, the difference favors noncommercial drivers.

In contrast to the earlier results, no significant differences for males or females are found. However, commercial vehicle drivers' rates of seat belt utilization remain significantly lower among whites, drivers with passengers, drivers in the 30-59 years of age category, observations for speed limits of 25-35 miles per hour, and weekday observations. Considering non-significant absolute differences, the pattern for non-whites was again reversed, and that result held for Strata 4, females, driver ages 16-29 years, and speed limits of 55-70 miles per hour.

**Table 2.** Estimated driver restraint use rates, 95% confidence intervals, and unweighted Ns for commercial and noncommercial light-vehicle occupants, 2023 and 2024 (confidence intervals in parentheses)

<i>Variable</i>	Commercial		Noncommercial	
	Percent use	Unweighted N	Percent use	Unweighted N
State of Wisconsin	.8427 (.8295-.8553)	3,135	.8656* (.8620-.8691)	35,629

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<i>Strata</i>				
Strata 1	.8285 (.8048-.8503)	1,096	.9054*+ (.8998-.9109)	10,882
Strata 2	.8523 (.8281-.8743)	948	.8882*+ (.8818-.8944)	9,731
Strata3	.7613- (.7117-.8062)	331	.7891- (.7798-.7982)	7,606
Strata4	.8868+ (.8621-.8683)	760	.8560 (.8478-.8639)	7,410
<i>Sex</i>				
Male	.8557+ (.8424-.8683)	2,918	.8727+ (.8682-.8772)	21,345
Female	.9079 (.8503-.9487)	152	.9139 (.9090-.9186)	13,184
<i>Race/ethnicity</i>				
White	.8590+ (.8459-.8714)	2,929	.8912*+ (.8878-.8946)	32,850
Non-white	.8777 (.8114-.9271)	139	.8368 (.8190-.8536)	1,802
<i>Passenger presence</i>				
Passenger	.8309 (.7809-.8734)	272	.9268*+ (.9200-.9333)	5,987
No passenger	.8439 (.8300-.8570)	2,863	.8532 (.8492-.8573)	29,642
<i>Age group</i>				
16-29	.9630+ (.8956-.9923)	81	.9027+ (.8919-.9127)	3,216
30-59	.8542+ (.8407-.8670)	2,833	.8844*+ (.8806-.8882)	27,048
60-up	.9038 (.8464-.9452)	156	.9100 (.9011-.9183)	4,356
<i>Speed limit</i>				
25-35	.7708 (.7465-.7938)	1,248	.8403*- (.8346-.8459)	16,314
40-50	.8491 (.8199-.8753)	676	.8645 (.8573-.8716)	8,984
55-70	.9133+ (.8960-.9285)	1,211	.9064+ (.9007-.9120)	10,331

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<i>Type of day</i>				
Weekend	.8592 (.7909-.9118)	142	.8878+ (.8793-.8959)	5,661
Weekday	.8420 (.8284-.8549)	2,993	.8614* (.8574-.8653)	29,968

Notes: Strata 1: Milwaukee, Waukesha, Washington, and Ozaukee counties; Strata 2: Dane, Brown, Winnebago, Rock, Racine, and Outagamie counties; Strata 3: Marathon, Kenosha, Walworth, Fond du Lac, Eau Claire, Jefferson, Columbia, Chippewa, La Crosse, Dodge, Sheboygan, and Sauk counties; Strata 4: Portage, Monroe, Dunn, Manitowoc, Juneau, Barron, Jackson, Marinette, Clark, Wood, Shawano, Oconto, Waupaca, Trempealeau, Lincoln, Calumet, Pierce, Green, Waushara, Vernon, Taylor, Marquette, Adams, Crawford, and Richland counties. “\*” means significantly higher across rows for a 95% confidence interval. “-“ (“+”) significantly lower (higher) than the comparable 2018-2019 figure for a 95% confidence interval.

Finally, consider within-group comparisons across the two time periods, where significant differences at the 5% level are denoted by ‘+’ in Table 2 for cases where the 2023/2024 estimate is significantly higher, and with ‘-’ for cases where the more recent figures are significantly lower. There are no significant statewide differences for the two time periods, but noncommercial driver seatbelt utilization was significantly higher in 2023/2024 within Strata 1 and Strata 2, with commercial vehicle driver utilization significantly higher in 2023/2024 using the Strata 4 subsample. Male rates of seat belt utilization were significantly higher in 2023/2024 for both commercial and noncommercial vehicle drivers, and the same pattern holds for white drivers of either type of vehicle, as well as for drivers in the 16-29 and 30-59 years of age categories, and for observations where the speed limit was 55-70 miles per hour. Noncommercial vehicle drivers ranked significantly higher in 2023/2024 if they were carrying passengers, and on weekends. Only one estimate points to a decline in seatbelt usage from 2018/2019 to 2023/2024: noncommercial vehicle drivers in 25-35 mile per hour zones were significantly less likely to wear seat belts in the more recent period.

#### 4. Conclusions and Practical Applications

The findings of this comparative analysis explored the 2018-2019 combined sample and the 2023-2024 combined sample data for seat belt use between commercial and non-commercial occupants in the State of Wisconsin suggests that the statewide rate of seat belt use is significantly higher for noncommercial drivers in both data sets. However, subsample evidence for drivers who were male, white, less than 60 years of age, and where speed limits were 55-70 miles per hour, found rates of seat belt utilization improved significantly over time for both commercial and noncommercial drivers, even though overall rates of seat belt utilization did not improve for either commercial or noncommercial drivers.

In 2014, the United States launched the Toward Zero Deaths National Strategy and in 2016 the Road to Zero Coalition was established in response to sharp increases in roadway deaths, bringing over 650 professional associations, businesses and industry associations, and safety groups together. In 2017, *The Road to Zero: A Vision for Achieving Zero Roadway Deaths by 2050* was the result of stakeholder workshops (National Safety Council, 2018). With the creation of these programs, more research and attention has been given to safety climate (Smith et al.,

2024) and the safe systems approach, similar to a robust “3 E’s” approach, including engineering, education, and enforcement in influencing change (Hasan et al., 2025) and safety interventions (Dyreborg et al., 2022). These fundamental concepts are familiar to occupational safety professionals.

The Federal Motor Carrier Safety Administration’s “Buckle Up” campaign provides outreach resources for employers (Federal Motor Carrier Safety Administration, 2025). Several studies indicate that effective and well-planned media and high-visibility enforcement (HVE) campaigns such as Click it or Ticket (CIOT) can have a significant impact on increasing seat belt usage rates and could be revived for use by occupational safety professionals (Federal Motor Carrier Safety Administration, 2014; Goodwin, 2015; Manlove et al., 2015; National Highway Traffic Safety Administration, 2009; Nichols et al., 2016; Solomon et al., 2004; Thomas et al., 2011; Vasudevan et al., 2009; Williams et al., 2000).

Online social media platforms provide an effective means to target populations with the use of participatory social media utilizing influencers to challenge followers toward modifying behavior (Drake et al., 2017). Hezaveh and Cherry, (2019) and Noar, (2006) also demonstrated successful use of safety campaigns designed to reach targeted geographic areas and groups with lower seat belt usage rates. Behavioral change interventions such as educational, incentive or engineering based or a combination of have also been studied and have shown to increase usage of seat belts (Lourens et al., 2024).

Insignificant improvement is no longer acceptable give the wealth of knowledge known about how to prevent transportation fatalities linked to unbelted occupants (National Safety Council, 2018). The findings in this study will allow employers and occupational safety professionals to utilize a data driven approach to save more lives by increasing the amount of established countermeasures that they implement and further assess strategies and professional partnerships to increase utilization of seat belts among their commercial driver populations.

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