DISTRACTED DRIVING IN YOUNG DRIVERS: BEHAVIOR ANALYSIS AND COUNTERMEASURE EFFECTIVENESS

Final Report

AGREEMENT NO. 30530

WORK ORDER NO. 25-02

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by

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This study investigates distraction-related crashes among young drivers in Oregon using an integrated approach that combines crash data, econometric modeling, and survey evidence. Descriptive analyses show that cell phone use is the dominant distraction, with crashes concentrating in urban corridors and more crashes in perceived safe conditions. Econometric results highlight the influence of driver characteristics, roadway features, and temporal conditions, while accounting for unobserved heterogeneity across gender and seasonal factors. Survey findings reveal near-universal awareness of distracted driving laws but continued engagement in risky behaviors, particularly mobile phone use. The results underscore the need for targeted education, visible enforcement, technological interventions, and roadway design strategies to reduce distraction-related risks among young drivers.</td></tr>
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gal	gallons	3.785	liters	L	L	liters	0.264	gallons	gal
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yd^3	cubic yards	0.765	meters cubed	m^3	m^3	meters cubed	1.308	cubic yards	yd^3
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*SI is the symbol for the International System of Measurement									

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1. INTRODUCTION

Distracted driving remains a critical roadway safety concern in the United States. The National Highway Traffic Safety Administration (NHTSA) defines distraction as any activity that diverts attention from driving, including texting or talking on a phone, eating or drinking, interacting with passengers, or adjusting in-vehicle entertainment or navigation systems, essentially, anything that shifts focus from the task of safe driving (NHTSA, 2025).

The scope of the problem is substantial. In 2023, distraction contributed to 8% of fatal crashes, an estimated 13% of injury crashes, and 13% of all police-reported crashes nationwide (NHTSA, 2025). That same year, 3,275 people were killed and an estimated 324,819 were injured in distraction-affected crashes (NHTSA, 2025). Younger drivers are particularly vulnerable: 7% of drivers aged 15–20 involved in fatal crashes were reported as distracted, and 241 teens aged 15–19 lost their lives in distraction-related crashes in 2023 (NHTSA, 2025).

Oregon faces similar challenges. Between 2017 and 2021, there were 26,264 distraction-related crashes across all age groups, resulting in 194 fatalities and 24,264 injuries. Of these, 2,005 crashes were specifically linked to cell phone use, leading to 15 fatalities and 1,775 injuries (ODOT, 2025). Among the youngest drivers, 125 crashes involving 16–18-year-olds were reported during this period. While no fatalities occurred in these cases, 188 people were injured (ODOT, 2025). These figures underscore that cell phone use remains a pressing concern in Oregon and a major contributor to preventable crashes. Given these risks, younger drivers (ages 16–24) warrant particular attention, as this group is consistently overrepresented in distraction-related crashes due to high levels of technology use and greater risk-taking tendencies.

To address these challenges, this study integrates multiple approaches. First, descriptive statistics of police-reported crashes from 2018 to 2022 are examined to identify temporal, spatial, demographic, and environmental patterns of distraction among younger drivers. Second, econometric models using random parameters with heterogeneity in means and variances estimate how driver, crash, temporal, and roadway factors shape injury severity outcomes. Finally, survey data from the Oregon Public Opinion Traffic Safety Survey (2023–2024) are analyzed to assess awareness of Oregon's distracted driving law, self-reported distraction behaviors, and perceptions of roadway safety.

Together, these complementary analyses provide a comprehensive understanding of distraction-related risks for younger drivers in Oregon. By combining crash outcomes with behavioral and perceptual data, the study offers evidence-based insights to guide education, enforcement, and infrastructure countermeasures aimed at reducing distraction-related crashes and injuries.

2. CRASH DATA DESCRIPTIVE ANALYSIS

For this analysis, historical crash data from 2018 to 2022 were obtained from the Oregon Department of Transportation's (ODOT) Crash Analysis and Reporting Unit. This dataset identified a subset of crashes in which cell phone use was recorded as a contributing factor. These cases included instances documented on Police Accident Reports (PARs), cell phone use observed directly or reported by another party, distractions from navigation or GPS devices, distractions from other electronic devices, and texting.

The analysis focuses on younger drivers aged 16–24, a group consistently overrepresented in distraction-related crashes both nationally and in Oregon. Restricting the data set to this age group yielded 521 crashes over the five-year period. Figure 2.1 shows that annual totals fluctuated, with the highest number in 2018 (148 crashes), followed by a decline through 2019 (112) and 2020 (77, during the pandemic), and a rebound in 2021 (95) and 2022 (109).

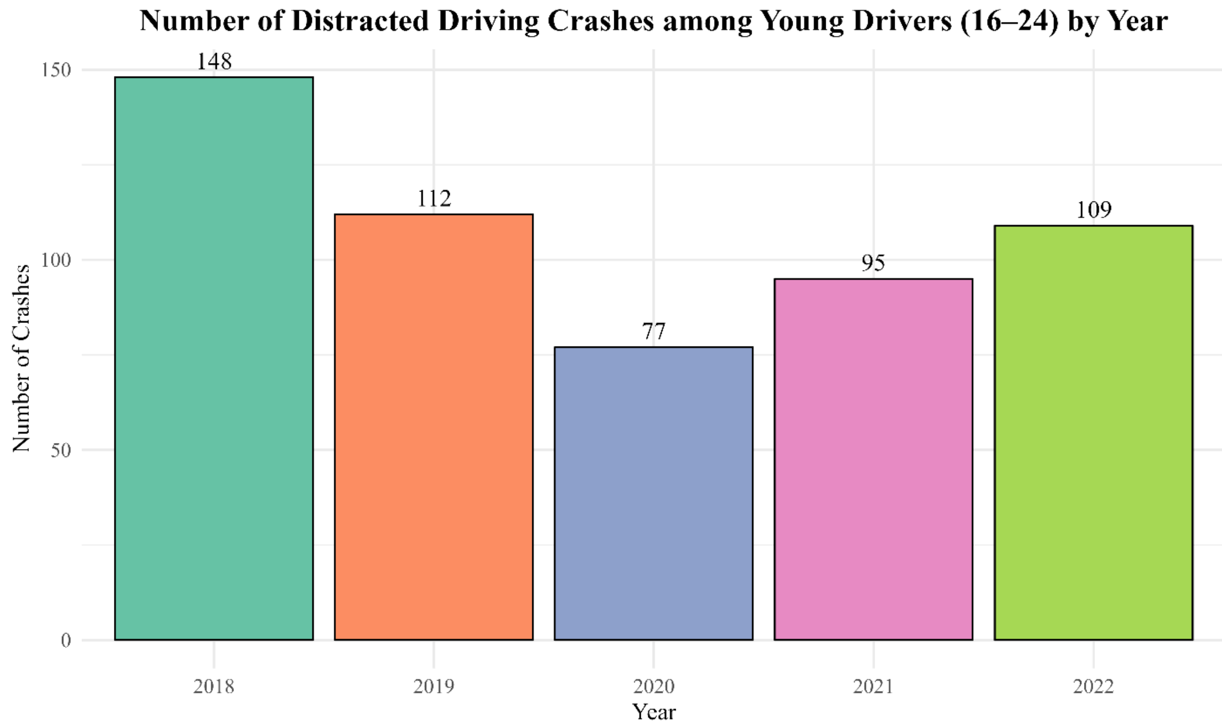

Figure 2.1: Annual number of distraction-related crashes involving young drivers in Oregon, 2018–2022.

Figure 2.2 presents the breakdown of distraction-related crashes by source, highlighting the overwhelming role of direct cell phone use, which consistently accounted for most cases each year. Cell phone use made up 59.5% of distraction-related crashes in 2018, 62.5% in 2019, and peaked at 79.2% in 2020. Although its share declined slightly in 2021 (63.2%) and 2022 (63.3%), it remained the leading source of distraction. Other categories, including navigation or GPS devices, cell phone use reported by another party, and other electronic devices, contributed smaller shares across all years, while texting consistently represented the lowest proportion of crashes. Among these categories, distraction from navigation or GPS devices contributed the second-highest share in most years.

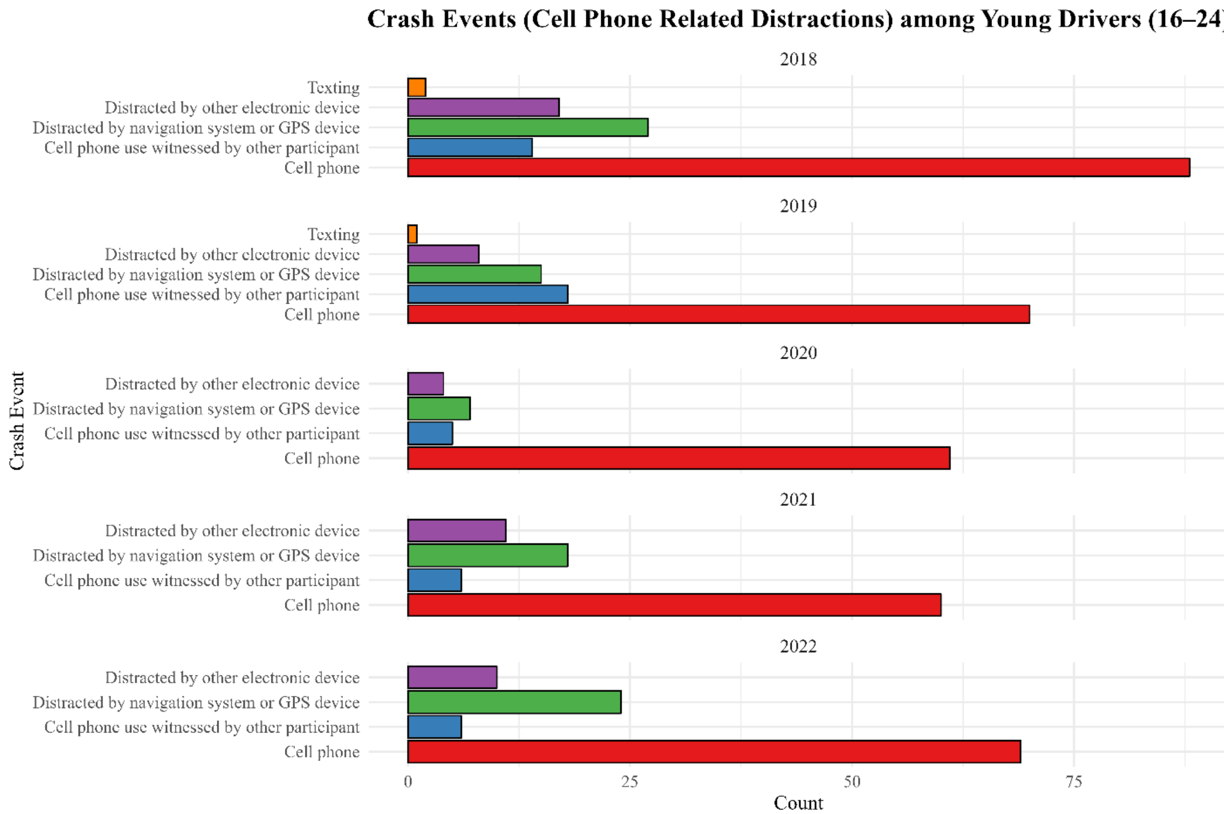

Figure 2.2: Annual distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, by distraction source.

Together, these findings confirm that while multiple forms of electronic distraction are present, cell phone use is by far the dominant contributor to distraction-related crashes among young drivers in Oregon. The following sections examine demographic, spatial, and environmental characteristics of these crashes to provide context for understanding the risks posed by cell phone distraction and to underscore the need for targeted countermeasures.

2.1 Driver and Crash Characteristics

2.1.1 Gender Distribution

Figure 2.3 shows the gender distribution of distraction-related crashes. Male drivers were consistently more involved than females, with the largest gap in 2022 (63 vs. 46 crashes). The difference narrowed in 2019 and 2020, when female involvement approached male levels, but widened again in 2021 and 2022. A small number of cases were reported for non-binary drivers in 2019.

This pattern likely reflects the higher crash exposure and greater propensity for risk-taking among young male drivers. While both genders are represented in distraction-related crashes, males consistently accounted for a larger share, consistent with broader crash risk patterns for this age group.

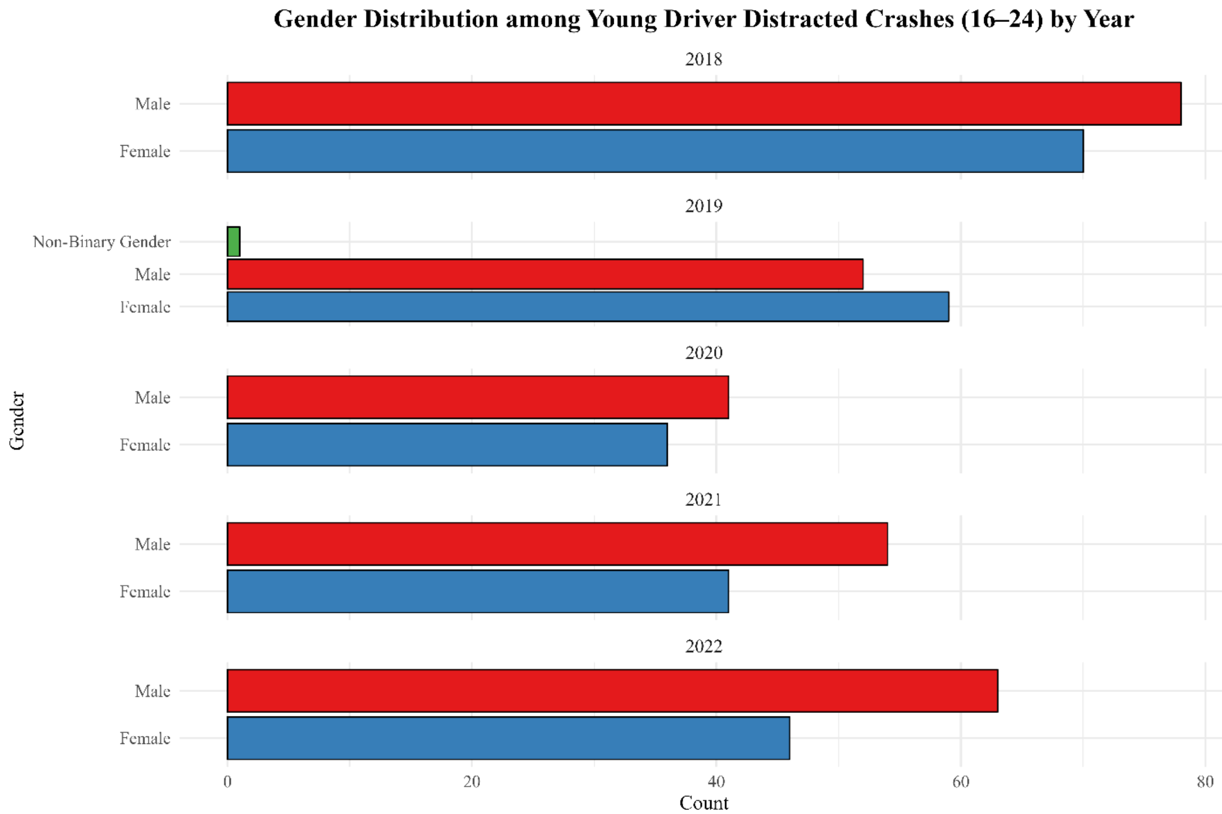

Figure 2.3: Gender distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022.

2.1.2 Injury Severity Distribution (Severe, Minor, No Injury)

Figure 2.4 shows the distribution of distraction-related crashes by injury severity (no injury, minor injury, severe injury). Across all years, minor and no-injury crashes dominated, while severe injuries accounted for only a small share. In 2018 and 2019, no-injury and minor injury crashes occurred in nearly equal numbers, with severe injuries limited to a handful of cases. In 2020, minor injuries (55.8%) slightly exceeded no-injury outcomes (40.3%), and this gap widened in 2021 and 2022, when minor injuries rose to 62.4% compared to 35.8% for no injuries. This shift may reflect lower travel speeds during and after the pandemic, which reduces the likelihood of avoiding injury entirely while increasing the share of minor injuries.

Figure 2.5 summarizes severity outcomes into property damage only (PDO), non-fatal injuries, and fatal crashes. PDO and non-fatal injuries comprised nearly all distraction-related crashes, while fatalities were extremely rare: one case in 2018 and one in 2019, with none recorded from 2020 to 2022. In 2018 and 2019, PDO crashes slightly outnumbered non-fatal injuries, but from 2020 to 2022 non-fatal injuries became more common. This pattern reinforces that distraction-related crashes involving young drivers seldom result in fatalities but frequently lead to non-fatal injury outcomes, which represent an ongoing public health burden. Even when not fatal, these crashes generate significant medical, economic, and social costs, underscoring the importance of targeted countermeasures to reduce distraction-related risks among young drivers.

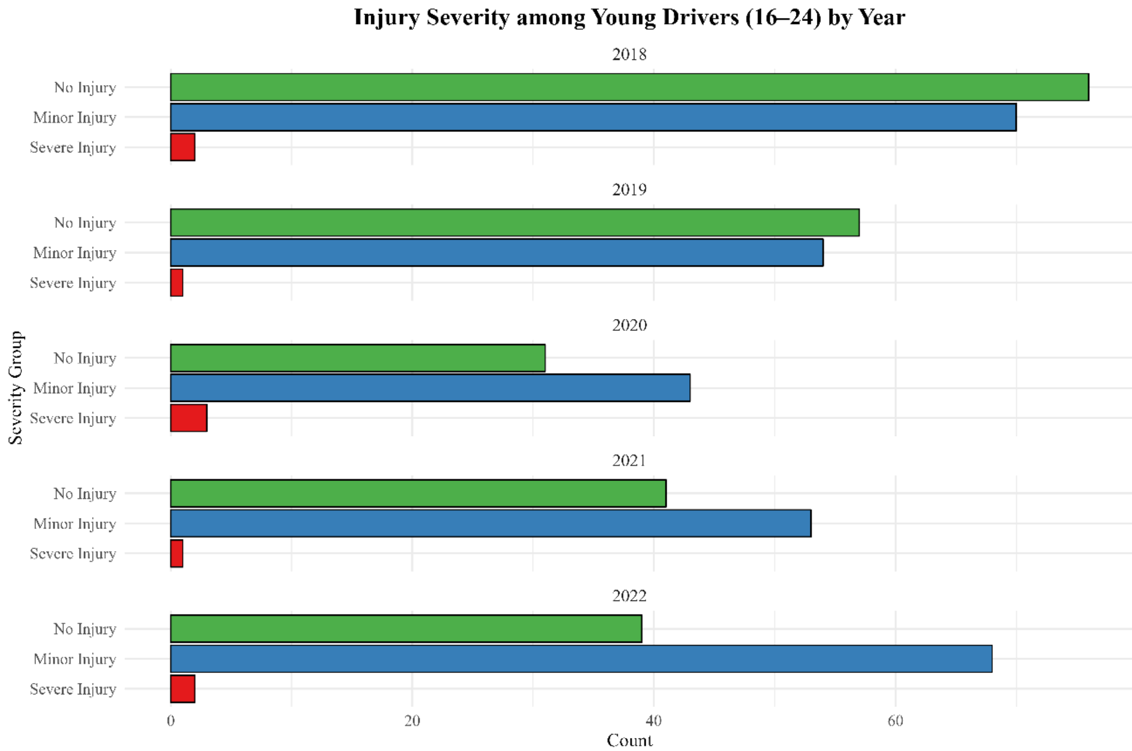

Figure 2.4: Distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, by injury severity level.

Figure 2.6 shows the distribution of distraction-related crashes involving young drivers by vehicle involvement. Each year, multi-vehicle crashes significantly outnumber single-vehicle crashes, consistently making up more than 88% of cases. The proportion of single-vehicle crashes varied slightly, reaching a peak in 2021 (11.6%). This peak may reflect increased traffic volumes after the pandemic, when distraction was more likely to lead to run-off-road or fixed-object crashes rather than collisions with other vehicles.

This pattern shows that distraction among young drivers most often occurs during traffic interactions, where attention lapses lead to crashes with other vehicles. While less common, single-vehicle distraction crashes are still significant because they are often linked to fixed-object or run-off-road events with a higher risk of severe injury. Addressing both types is essential: enforcement and education can focus on the risks of distraction in traffic, while infrastructure improvements and countermeasures can help reduce the severity of single-vehicle crashes.

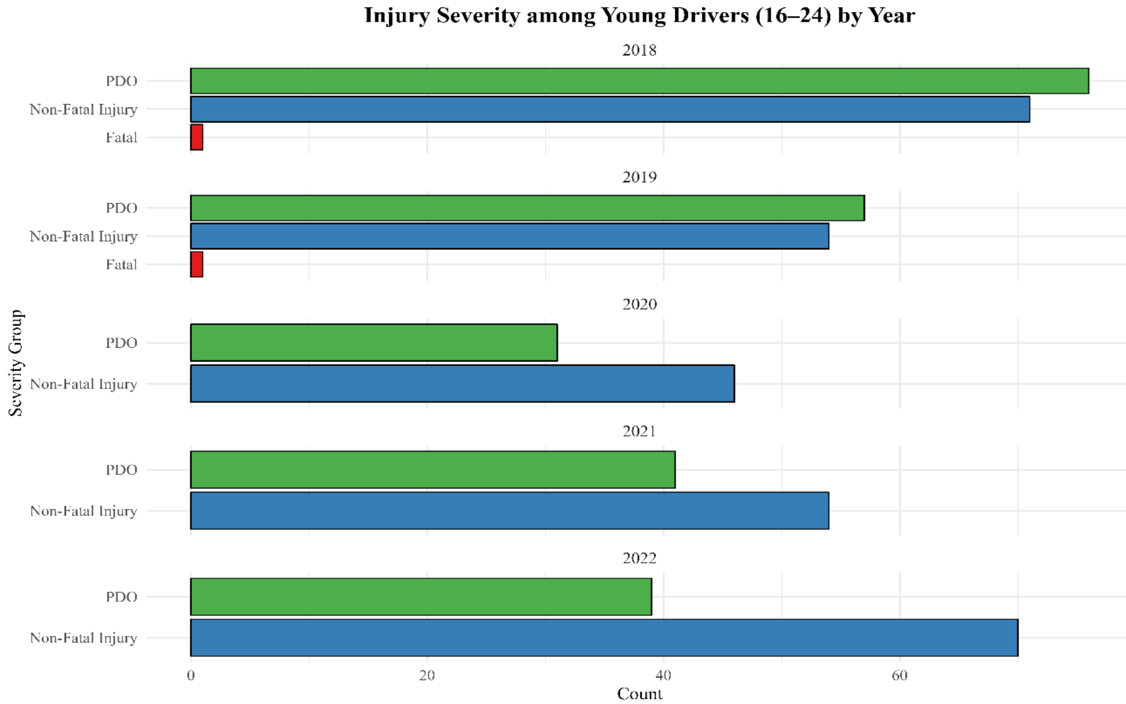

Figure 2.5: Distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, grouped by PDO, non-fatal, and fatal outcomes.

2.1.3 Single- vs. Multi-Vehicle Crashes

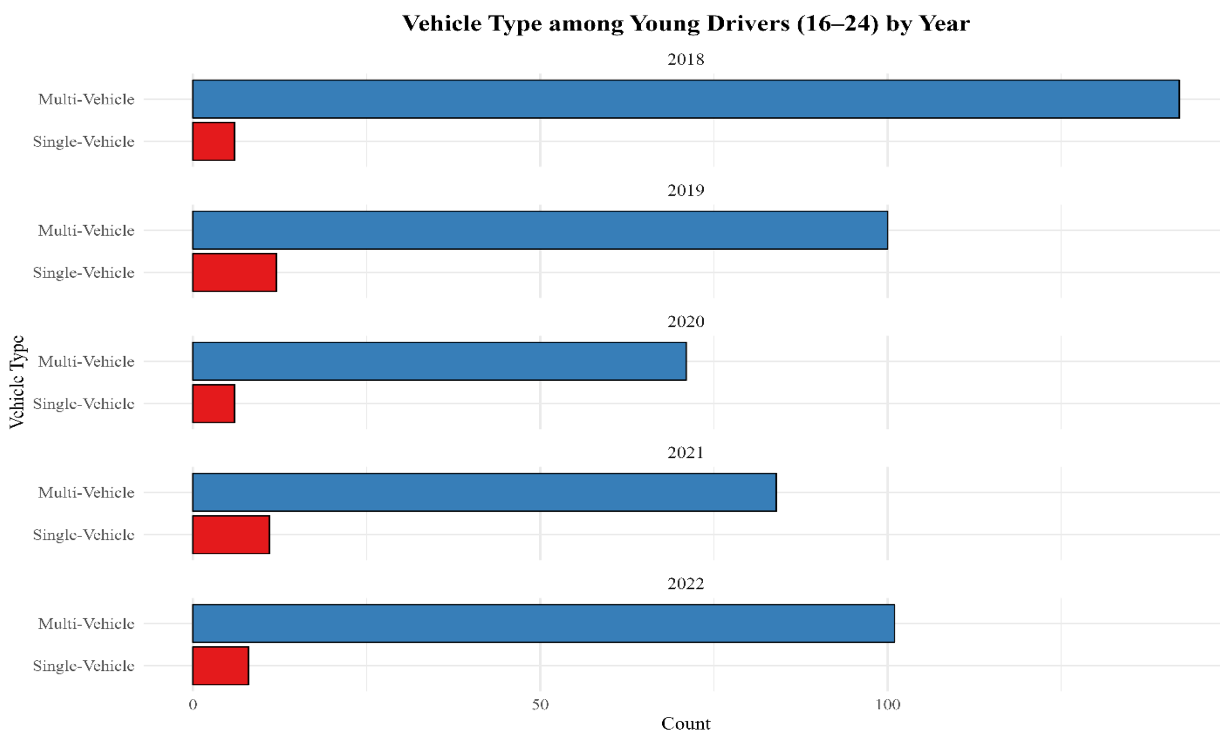

Figure 2.6: Distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, by single- vs. multi-vehicle involvement.

Figure 2.7 shows the types of crashes involving young drivers that are related to distraction. Rear-end crashes consistently made up the largest portion of distraction-related crashes, accounting for more than half of the cases each year, with the highest share in 2018 (64.2%) and the lowest in 2021 (58.9%). Turning movements and angle collisions were the next most common types after rear-end crashes, while fixed-object and non-collision events (such as rollovers) happened regularly but at much lower frequencies Pedestrian, sideswipe, and head-on crashes were rare across the five-year period.

These distributions indicate that distraction among young drivers most often leads to rear-end crashes in multi-vehicle situations, reflecting lapses in attention that reduce following distance and slow reaction times. Single-vehicle fixed-object crashes, though less common, are still concerning because they can cause more severe injuries. Overall, the patterns highlight the need for measures that target both frequent rear-end crashes—through education, enforcement, and in-vehicle alerts—and the smaller but more serious fixed-object crashes, which could be reduced through roadway design and infrastructure improvements.

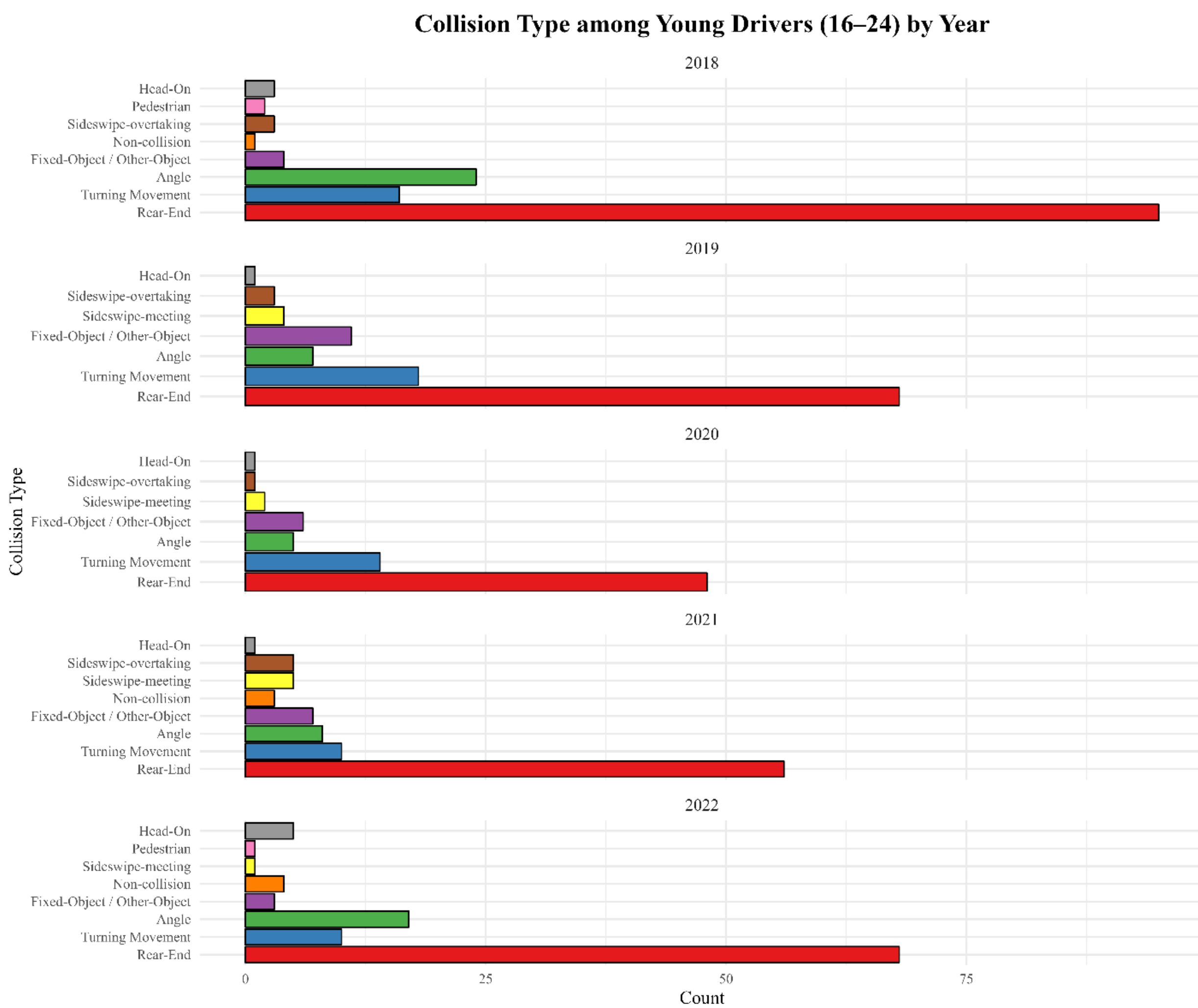

Figure 2.7: Distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, by collision type.

2.2 Spatial and Temporal Distribution

2.2.1 Distraction by County

Figure 2.8 illustrates the county-level distribution of distraction-related crashes involving young drivers from 2018 to 2022. The highest numbers were recorded in Washington (92 crashes), Marion (70), Clackamas (69), and Multnomah (65), which together made up more than half of all cases statewide. These counties include Oregon's major metropolitan areas (Portland metro and Salem), where higher population density and traffic volumes likely contribute to increased crash rates.

Outside the metropolitan region, Jackson (39 crashes) and Lane (33) also recorded relatively high counts compared with other rural counties. Both serve as regional population and activity centers, Medford in Jackson County and Eugene in Lane County, helping explain their greater exposure. Deschutes County, home to the rapidly growing city of Bend, also reported a notable number of distraction-related (27 crashes) crashes, reflecting its role as a central Oregon hub. In contrast, many smaller and less populated counties reported only a few crashes during the study period.

Overall, the spatial distribution indicates that distraction-related crashes among young drivers are concentrated in Oregon's urban counties but still occur throughout the state. This highlights the need for targeted measures both in cities, where higher traffic and congestion increase multi-vehicle risks, and in rural areas, where single-vehicle distraction crashes might be more severe.

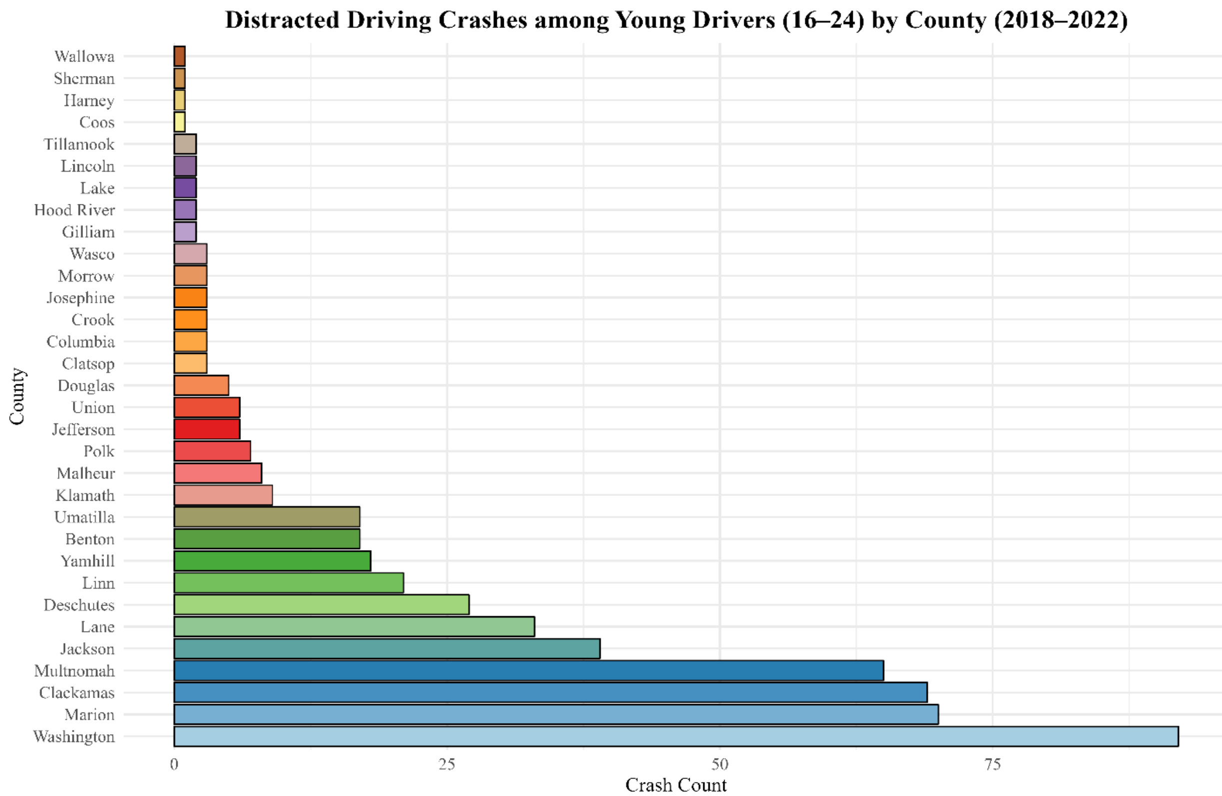

Figure 2.8: County-level distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022.

2.2.2 Urban vs. Rural Distribution

Figure 2.9 shows the distribution of distraction-related crashes among young drivers by roadway environment. In every year, urban crashes far outnumbered rural crashes, with urban areas consistently accounting for more than 80% of cases. For instance, in 2018, 131 crashes (88.5%) occurred in urban areas compared to only 17 (11.5%) in rural areas, and this imbalance persisted throughout the study period.

The higher concentration of urban crashes reflects greater traffic exposure, higher population density, and more complex roadway networks, where lapses in attention are more likely to lead to conflicts with other vehicles. By contrast, rural crashes, though less frequent, are significant because they often occur at higher speeds and in areas with longer emergency response times, raising the likelihood of severe outcomes.

Overall, the distribution shows that distraction-related crashes among young drivers are concentrated in urban environments but carry disproportionately serious risks in rural settings. This underscores the importance of countermeasures that account for both contexts: education and enforcement to address frequent urban distractions, and infrastructure and emergency response improvements to mitigate severity in rural areas.

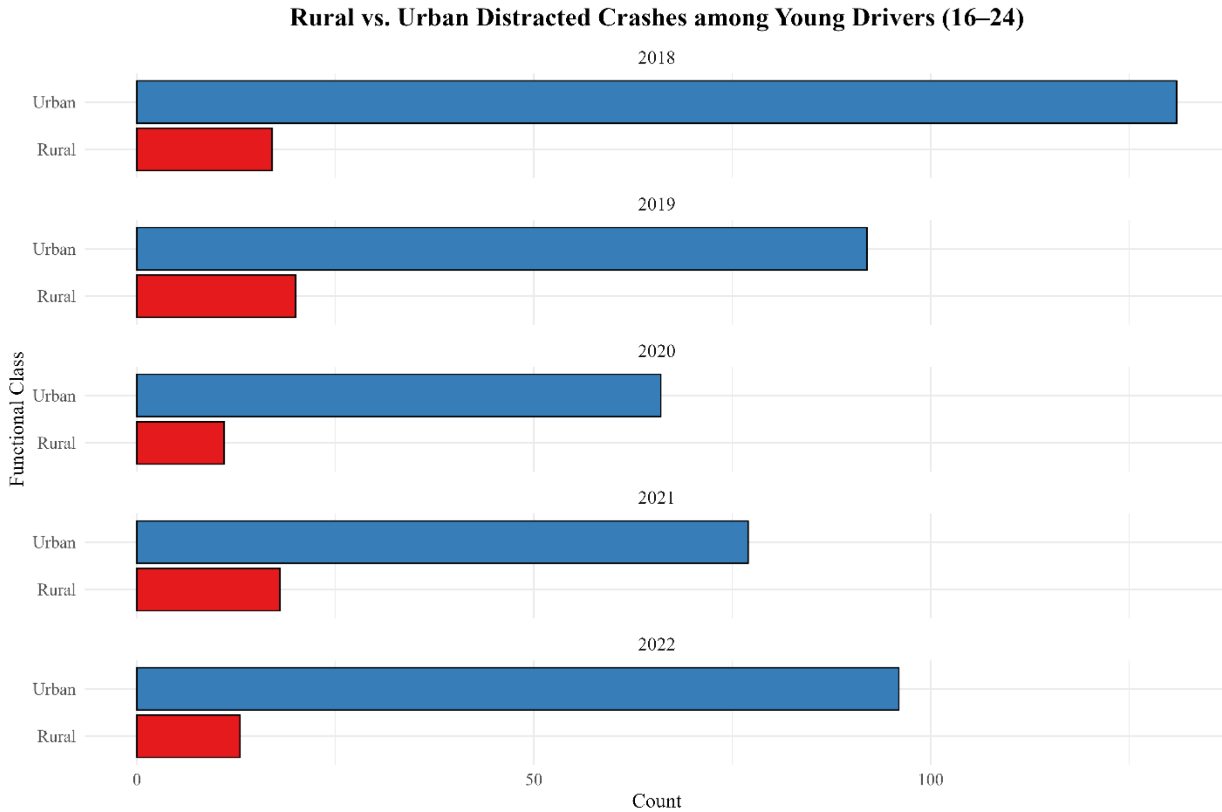

Figure 2.9: Distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, by urban vs. rural environment.

2.2.3 Time of Day Distribution

Figure 2.10 shows the distribution of distraction-related crashes among young drivers by time of day. Across all years, the highest numbers occurred between 10:00 a.m.–3:00 p.m. (midday) and 4:00 p.m.–8:00 p.m. (afternoon/evening), reflecting periods of heavier traffic volumes and higher travel demand. Crashes between 9:00 p.m. and 11:00 p.m. were also common, though at lower levels. Morning crashes (5:00 a.m.–9:00 a.m.) consistently represented a smaller share, while the overnight period (12:00 a.m.–4:00 a.m.) accounted for the fewest distraction-related crashes each year. A dip across nearly all-time groups in 2020 reflects reduced travel during the pandemic.

This distribution indicates that distraction-related crashes among young drivers are most common during daytime and early evening hours, aligning with school, work, and social travel patterns.

These patterns highlight the importance of targeting countermeasures at periods of peak exposure, when the combination of higher demand and distraction elevates crash risk.

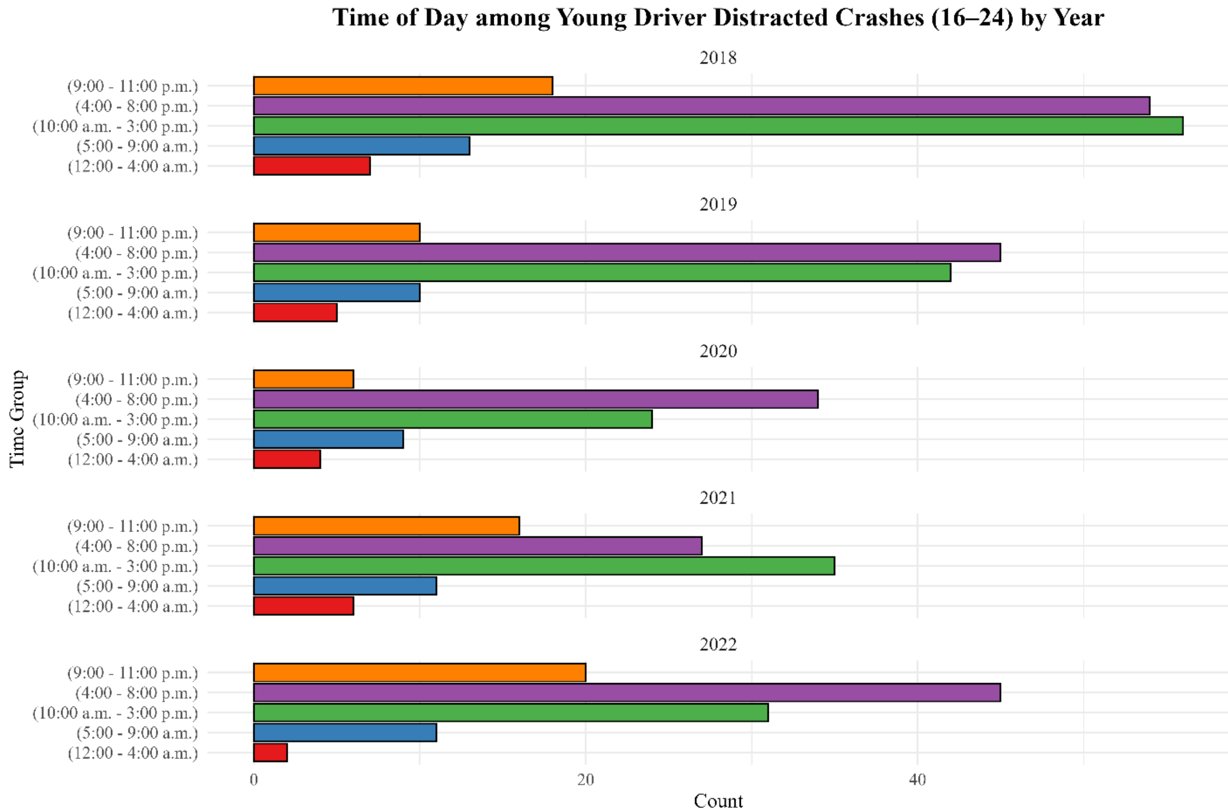

Figure 2.10: Distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, by time of day

Together, the findings show that distraction-related crashes among young drivers cluster in urban counties and during daytime and early evening hours, while less frequent rural and nighttime crashes carry greater severity risks. This dual pattern highlights the need for countermeasures that address both the frequency of urban crashes and the severity of rural ones.

2.3 Environmental and Roadway Conditions

2.3.1 Light Conditions

Figure 2.11 shows distraction-related crashes among young drivers by light condition. Daylight accounted for the majority of crashes across all years, consistently exceeding 65%, followed by darkness with streetlights and darkness without streetlights. Crashes during dusk and dawn were rare. Notably, crashes under darkness with streetlights rose in 2019 (18.2%) and again in 2022 (24.8%), suggesting elevated distraction risks in urban nighttime driving environments.

The predominance of daylight crashes reflects both higher exposure during daytime travel and the likelihood that young drivers are more inclined to use cell phones when visibility is good. At the same time, crashes in dark conditions, while less frequent, may carry higher severity, underscoring the need for countermeasures that address distraction risks across both high-exposure daytime contexts and higher-severity nighttime environments.

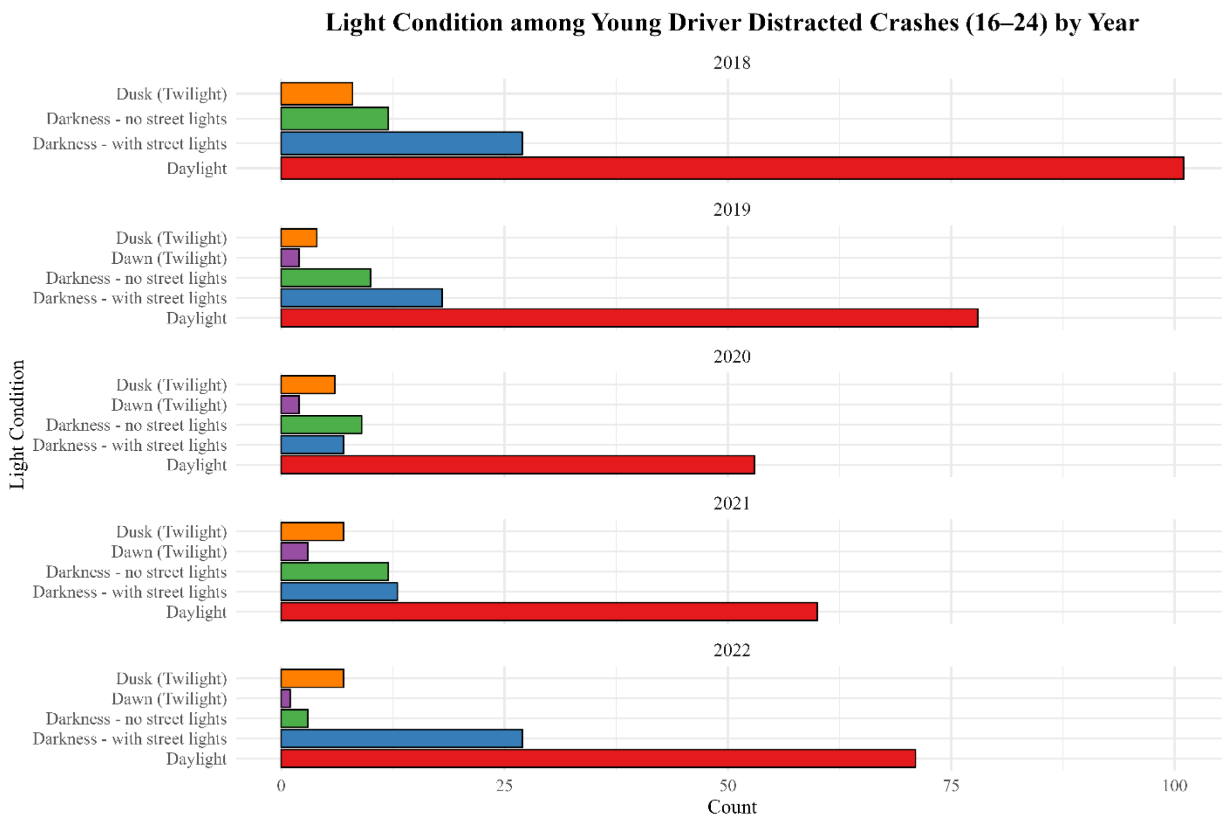

Figure 2.11: Distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, by light condition.

2.3.2 Road Surface Conditions

Figure 2.12 shows the distribution of distraction-related crashes among young drivers by road surface condition. Across all years, more than 80% of crashes occurred on dry surfaces, far exceeding those on wet, icy, or snowy roads. Wet conditions were the second most common category, contributing around 15% annually, while crashes on ice and snow were rare. A modest rise in wet-surface crashes was observed in 2020 (18.4%), likely reflecting shifts in driving patterns during the pandemic.

The predominance of dry-surface crashes reflects both exposure and behavior. Most driving occurs under dry conditions, naturally producing more crashes in this category. At the same time, drivers may develop a false sense of safety on dry roads, perceiving less need for caution and feeling more comfortable engaging in secondary tasks such as phone use. By contrast, in wet or icy conditions, drivers may be more cautious, reducing the likelihood of distraction-related crashes.

Overall, the pattern suggests that distraction among young drivers is most prevalent under seemingly safe conditions, when vigilance is lower. This highlights the importance of reinforcing safe driving practices even in favorable roadway environments.

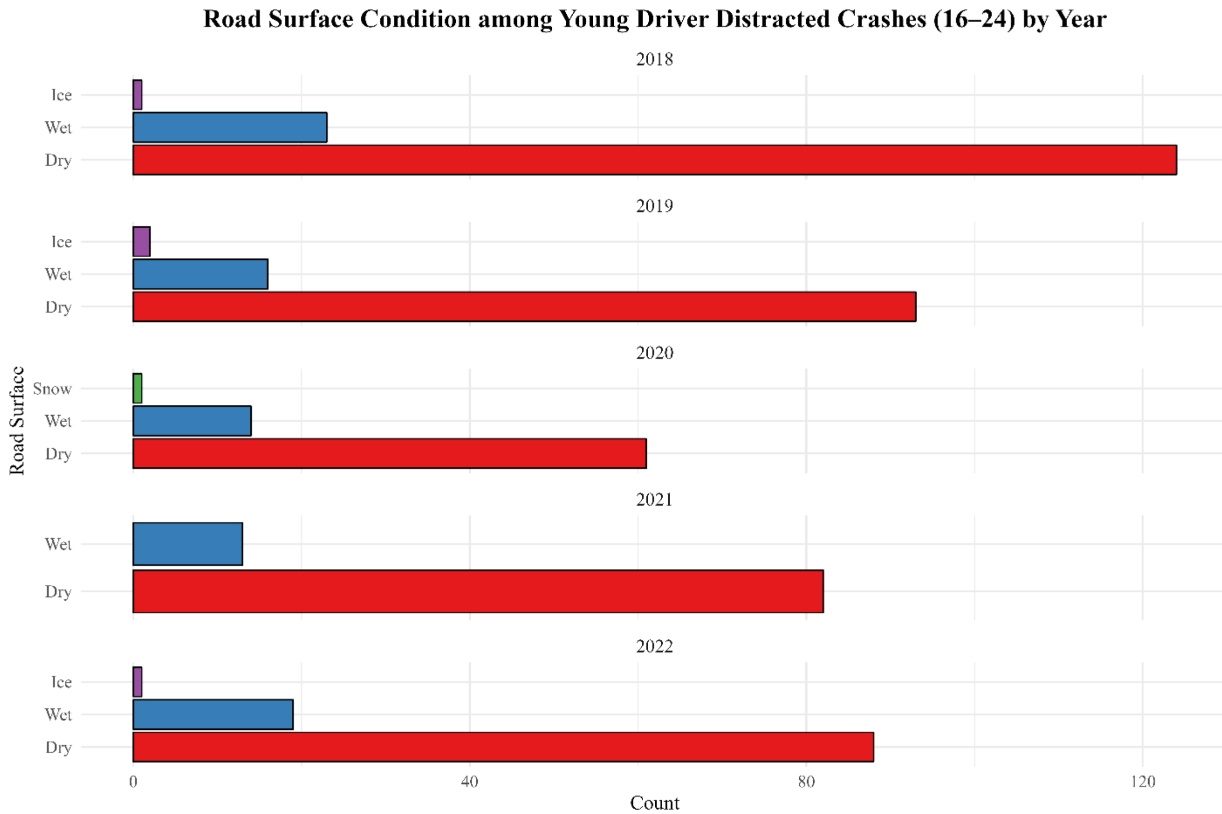

Figure 2.12: Distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, by road surface condition.

2.3.3 Weather Conditions

Figure 2.13 shows the distribution of distraction-related crashes among young drivers by weather conditions. In every year, most crashes occurred in clear weather, ranging from a high of 82.1% in 2021 to a low of 61.8% in 2020, followed by cloudy and rainy conditions. Adverse weather such as fog, snow, ice, or sleet accounted for only a very small share of cases across the five-year period. Cloudy weather was the second most common condition in nearly every year, peaking at 30.3% in 2020 during the pandemic.

The predominance of clear-weather crashes reflects both higher exposure in favorable conditions and behavioral factors. Young drivers may perceive clear weather as safer, which reduces caution and increases the likelihood of engaging in secondary tasks such as phone use. In contrast, rain, snow, or fog tends to heighten driver alertness, making distraction less likely.

Overall, the pattern shows that distraction among young drivers is most common under seemingly safe conditions, emphasizing that the absence of adverse weather does not diminish the risks of cell phone use behind the wheel.

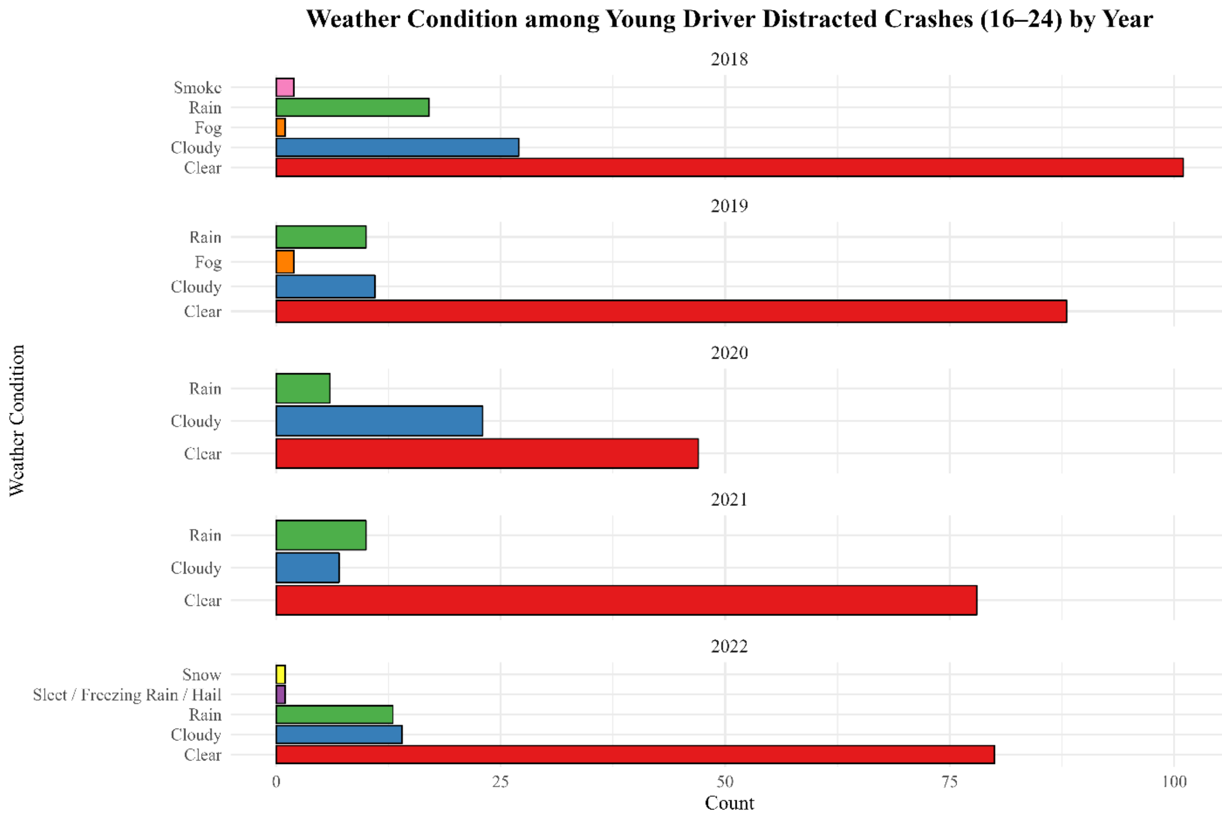

Figure 2.13: Distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, by weather condition.

2.3.4 Roadway Characteristics

Figure 2.14 shows distraction-related crashes among young drivers by roadway characteristics. Across all years, crashes occurred most frequently on straight roadway segments, accounting for 48 - 52% of cases, except in 2018 and 2022 when intersections held the largest share with 52.0% and 51.4%, respectively. Secondary crash locations included driveways or alley access points and horizontal curves, while vertical curves, bridges, and transition sections were rare throughout the study period.

This pattern suggests that distraction among young drivers is most likely to occur in routine roadway environments, where exposure is highest and lapses in attention can quickly result in crashes. By contrast, crashes on curves and grades, while less frequent, may carry greater severity risks due to vehicle control challenges and the potential for loss of control. These findings underscore the need to address distraction not only in high-exposure urban settings but also in roadway contexts where severity risks are amplified.

Overall, environmental and roadway conditions show that distraction-related crashes among young drivers occur most often in favorable settings such as daylight, clear weather, dry pavement, and straight road segments. These are conditions in which drivers may feel secure and therefore more willing to engage in distraction. By contrast, less frequent crashes in more challenging environments, such as darkness without streetlights or horizontal curves, often carry higher severity risks. This dual pattern underscores that distraction remains a serious threat even when conditions appear safe, reinforcing the importance of sustained education and enforcement.

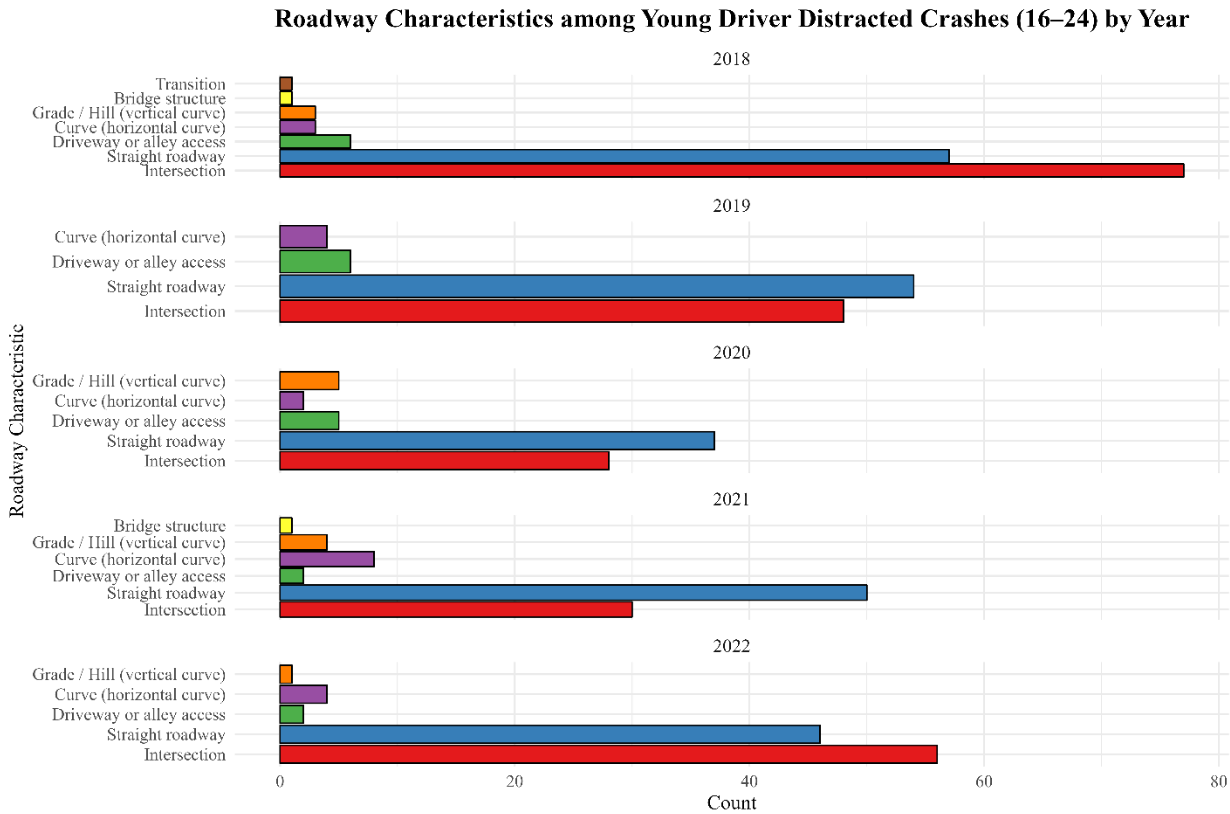

Figure 2.14: Distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, by roadway characteristic.

2.4 Graphical Analysis

Figure 2.15 maps distraction-related crashes involving younger drivers by injury severity. The spatial pattern mirrors the county-level results, with the highest concentrations in the Portland metropolitan area and extending south along the I-5 corridor through Salem and Eugene. Additional clusters are evident in Medford (southern Oregon) and Bend (central Oregon), reflecting their roles as regional population and travel hubs.

Most crashes were classified as property damage only (PDO) or minor injury (MI), while severe injury (SI) crashes were comparatively rare. Importantly, severe injury crashes were not confined to urban centers; they also occurred along major rural highways. This highlights that while distraction-related crashes are most frequent in urbanized corridors, rural contexts carry a disproportionate share of severity risk.

2.4.1 Heatmap of Distraction-Related Crashes

Figure 2.16 presents a heatmap of distraction-related crashes involving young drivers across Oregon from 2018 to 2022. The most intense clusters appear in the Portland metropolitan area, with additional concentrations along the I-5 corridor through Salem and Eugene. Smaller but notable hot spots are visible in Medford (southern Oregon) and Bend (central Oregon), reflecting their roles as regional centers of population and travel activity.

Several factors likely contribute to these clusters. In the Portland metro area, higher population density, complex roadway networks, and heavy traffic volumes increase both exposure and the likelihood of distraction-related conflicts. Along the I-5 corridor, long commutes and recurring congestion may encourage phone use in stop-and-go traffic, contributing to rear-end collisions. In college towns such as Eugene and Corvallis, the presence of a younger driving population may amplify distraction risks. In Bend and Medford, rapid regional growth and expanding travel demand may also help explain the observed hotspots.

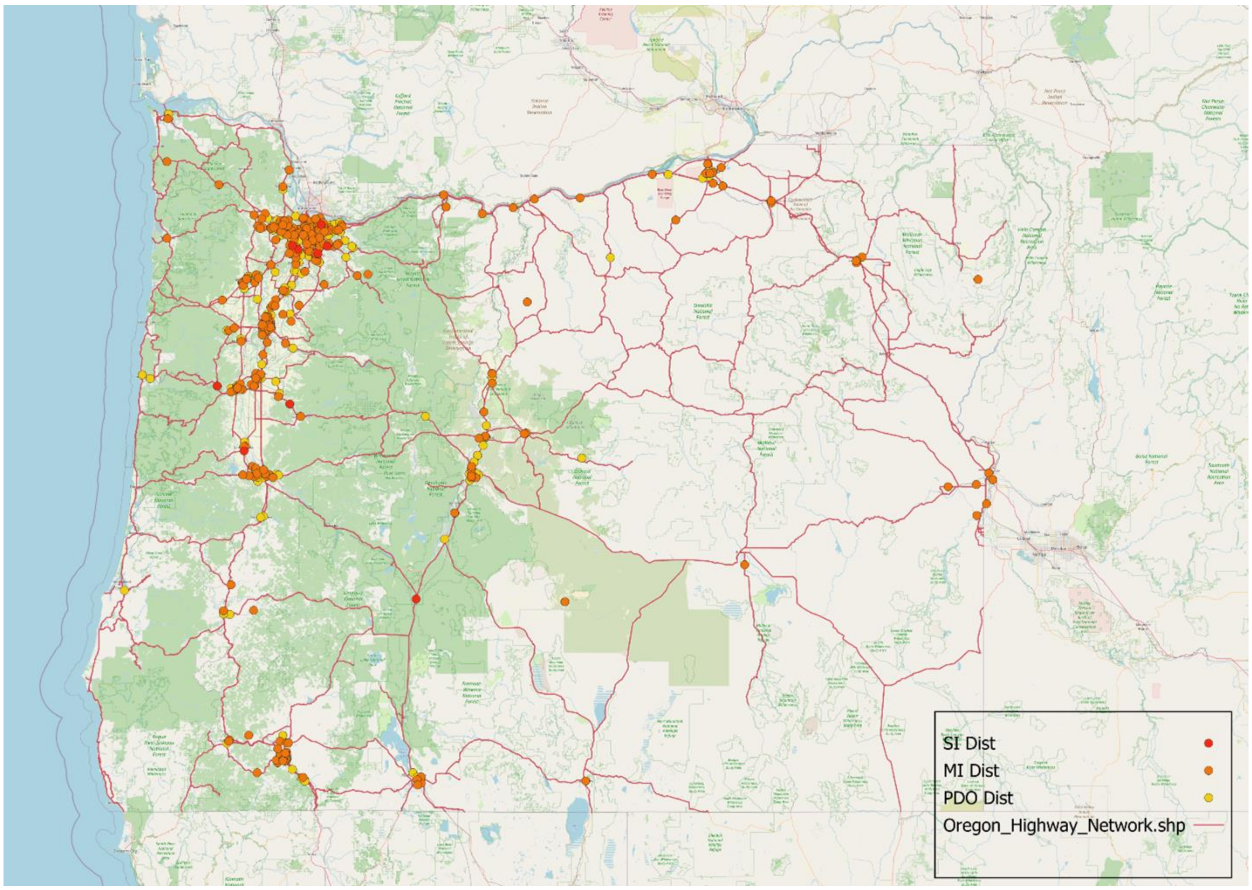

Figure 2.15: Geospatial distribution of distraction-related crashes involving young drivers in Oregon, 2018–2022, by crash severity.

Outside these urbanized areas, crashes are more dispersed but remain visible along state highways and rural corridors, particularly in eastern and southern Oregon. Although less dense, these rural crashes are significant because they often occur at higher travel speeds and on roadways with limited access control, conditions that magnify the severity of distraction-related outcomes.

Taken together, this spatial synthesis reinforces earlier findings: distraction-related crashes among young drivers are most frequent in Oregon's western urban corridors, while rural highways carry disproportionate severity risks. Countermeasures must therefore target both the high frequency of urban clusters and the heightened severity of rural crashes.

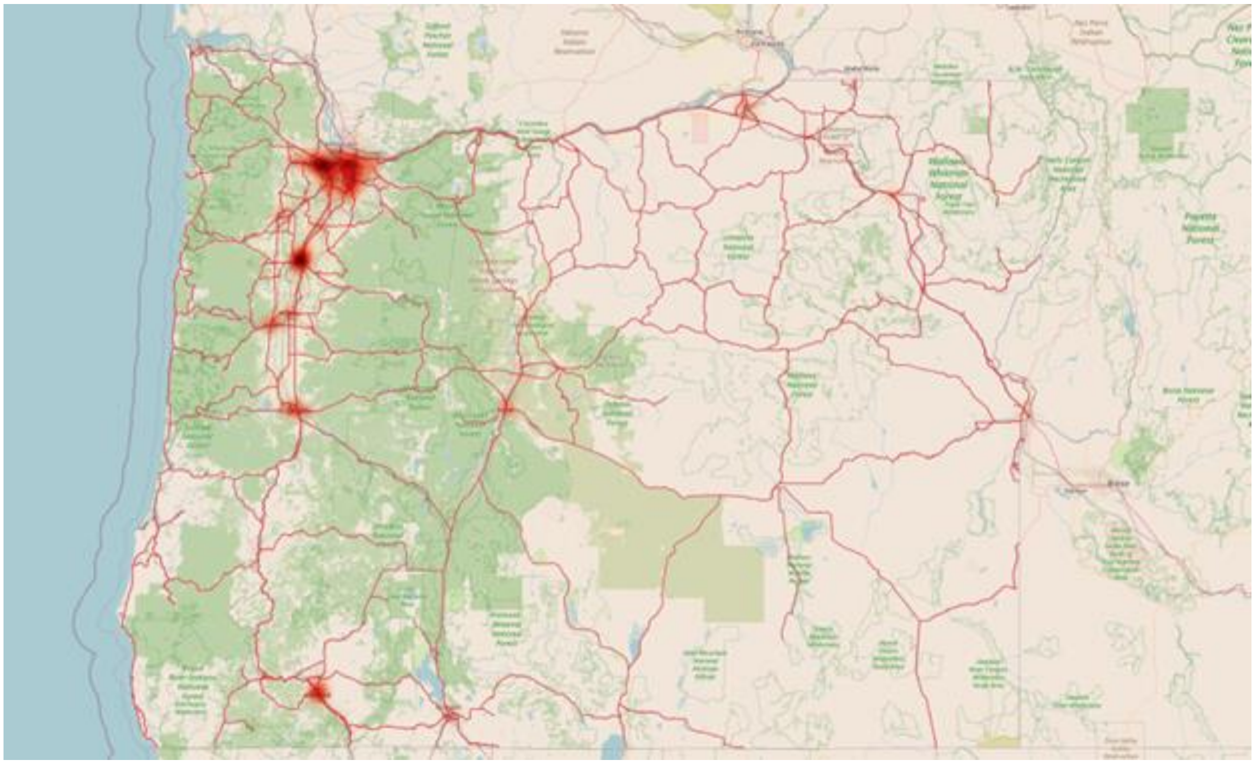

Figure 2.16: Heatmap of distraction-related crashes involving young drivers in Oregon, 2018–2022.

The spatial plots and heatmaps indicate that distraction-related crashes among young drivers are concentrated in Oregon’s western urban corridors, particularly around Portland, Salem, and Eugene, with additional clusters in Medford and Bend. These concentrations reflect higher exposure, heavier traffic, and more complex roadway environments in urban areas. By contrast, crashes on rural highways are more dispersed but often involve higher travel speeds and greater severity risks. Taken together, these patterns underscore the importance of countermeasures that address both the high frequency of urban crashes and the heightened severity of rural crashes.

2.5 Summary

The descriptive analysis revealed several consistent patterns in distraction-related crashes among young drivers in Oregon. Cell phone use was the dominant source of distraction, far exceeding GPS, texting, or other electronic devices. Temporal patterns showed a decline in crash counts during the 2020 pandemic year followed by a rebound, with most crashes concentrated during midday and afternoon/evening travel. Driver characteristics indicated that young male drivers were consistently overrepresented, and while most crashes resulted in property damage only (PDO) or minor injuries, severe injury outcomes remained present.

In terms of crash types, multi-vehicle rear-end crashes dominated, reflecting lapses in attention and delayed reactions, while single-vehicle fixed-object crashes, though less frequent, were linked to higher severity risks. The spatial distribution showed clear clustering in urban counties such as Portland, Salem, Eugene, Bend, and Medford, although rural crashes, while fewer, often occurred at higher speeds and produced more severe outcomes. Finally, environmental and roadway conditions indicated that most crashes occurred in daylight, on dry and clear roads, and on straight segments or intersections - conditions typically perceived as safe, which may lower driver vigilance and increase the likelihood of engaging in risky secondary tasks such as phone use.

2.6 Recommendations

Building on these findings, several countermeasures can be advanced to reduce distraction-related crashes among young drivers in Oregon. The recommendations emphasize a combination of education, enforcement, technology, and roadway design, with the goal of addressing both the frequency of distraction-related crashes and the severity of their outcomes.

i. **Targeted Education and Awareness**

- Target cell phone use as the primary distraction, emphasizing that risks remain high even under clear weather and daylight conditions.
- Tailor messaging for younger drivers (16–24) through the platforms and outreach methods they use most, including social media and peer-led campaigns.
- Highlight the dangers of distraction in seemingly safe environments such as clear, dry, daytime conditions, where most distraction-related crashes occur.

ii. **Enforcement and Policy Support**

- Increase enforcement in high-frequency urban corridors such as Portland metro, Salem, and Eugene, where distraction-related crashes are most concentrated.
- Develop rural-focused enforcement strategies along major highways, where crashes, though less frequent, carry higher severity risks.
- Evaluate the effectiveness of Oregon's distracted driving laws and consider adjustments, such as higher penalties for repeat offenders, to strengthen deterrence.

iii. **Technology-Based Countermeasures**

- Promote in-vehicle technologies and mobile apps that block texting and calling while driving.
- Encourage insurance incentives and fleet policies that reward adoption of distraction-prevention tools.

iv. **Infrastructure and Roadway Design**

- Address rear-end crash hotspots through roadway design improvements such as signal timing, signage, and rumble strips.
- Improve roadside safety features in rural areas to reduce the severity of fixed-object crashes.
- Expand use of intelligent transportation systems (ITS) to manage congestion and limit exposure to distraction-prone conditions.

3. CRASH DATA MODELLING ANALYSIS

This section examines the variables contributing to distraction-related crashes involving young drivers using advanced econometric methods. The analyzed crash events include such as cell phone usage, recorded in a Police Accident Report (PAR) or observed by the driver, instances where another person witnessed the driver using a cell phone, distractions caused by operating navigation systems or GPS devices, distractions caused by other electronic devices, and incidents related to texting while driving. The following parts provide an overview of the empirical setting, a description of the modeling approach, an in-depth presentation of the results, and a concise summary of key findings.

3.1 Empirical Setting

This study used police-reported crash data from ODOT's Crash Analysis and Reporting Unit covering 2018–2022. Particular attention was given to crashes directly linked to cell phone–related distraction. These cases included cell phone use recorded in Police Accident Reports (PARs) or observed directly, instances reported by another party, distractions from navigation or GPS devices, distractions from other electronic devices, and texting while driving. The analysis was restricted to younger drivers aged 16–24, yielding a final dataset of 541 distraction-related crashes. Each observation contained detailed information on the driver, driver's behavior, characteristics, roadway and environmental conditions, temporal factors, and vehicle attributes.

To evaluate the impact of cell phone related distraction on injury severity, the study employed a modified version of the injury severity scale in the dataset. The original five categories were streamlined into three: severe injury (combining fatal and incapacitating outcomes), minor injury (non-incapacitating and possible injuries), and no injury (property damage only). Table 4.1 summarizes the 541 crashes involving younger drivers. Of these, 9 crashes (1.7%) resulted in severe injuries, 288 (53.2%) produced minor injuries, and 244 (45.1%) involved no injuries. Notably, the share of minor injuries has risen relative to no-injury outcomes since the pandemic year (2020). Overall, minor injuries represented the largest share, offering a distinct perspective on the outcomes of distraction-related crashes among younger drivers.

Table 3.1: Injury severity Distribution of Younger Drivers Cell-phone Related Distracted Driving Crashes

Year	Severe Injury (%)	Minor Injury (%)	No Injury (%)	Total (%)
2018	2 (1.4)	70 (47.3)	76 (51.3)	**148 (100)**
2019	1 (0.9)	54 (48.2)	57 (50.9)	**112 (100)**
2020	3 (3.9)	43 (55.8)	31 (40.3)	**77 (100)**
2021	1 (1.0)	53 (55.8)	41 (43.2)	**95 (100)**
2022	2 (1.8)	68 (62.4)	39 (35.8)	**109 (100)**
2018-2022	**9 (1.7)**	**288 (53.2)**	**244 (45.1)**	**541 (100)**

The descriptive statistics of the significant factors in each of the three injury severity models for younger driver cell phone–related distraction crashes are presented in Table 4.2. The variables identified as significant span multiple dimensions, including driver characteristics, crash attributes, temporal and environmental conditions, and roadway features.

Table 3.2: Summary of descriptive statistics of significant variables in cell phone related distracted driving crashes for the younger (16-24 years) driver's

Variables Descriptions	Mean	Standard Deviation
Driver Characteristics		
Female driver indicator (1 if driver gender is female, 0 otherwise)	0.4658	0.4990
Oregon resident indicator (1 if the driver is an Oregon resident with more than 25 miles away from home, 0 otherwise)	0.0998	0.2998
Safety restrain use (1 if seat belt or harness, fastened during crash, 0 otherwise)	0.8688	0.3378
Crash Characteristics		
Airbag deployment indicator (1 if the airbag is deployed during crash, 0 otherwise)	0.3087	0.4621
Rear end crash (1 if the crash type is rear-ended, 0 otherwise)	0.6192	0.4857
Hit and Run indicator (1 if the vehicle hit and run, 0 otherwise)	0.0444	0.2060
Low speed limit (1 if the posted speed limit is 25 or lower, 0 otherwise)	0.0758	0.2647
Vehicle occupancy 2 (1 if two or more occupants, 0 otherwise)	0.2495	0.4329
Temporal and Environmental Characteristics		
Morning indicator (1 if the crash occurred between 05:00 am and 9:59 pm, 0 otherwise)	0.0998	0.2998
Night indicator (1 if the crash occurred between 12:00 am and 4:59 am, 0 otherwise)	0.0555	0.2289
Summer indicator (1 if crash occurred between June and August, 0 otherwise)	0.3031	0.4598
Fall indicator (1 if crash occurred between September and November, 0 otherwise)	0.2662	0.4421
Weekend indicator (1 if crash occurred on Saturday or Sunday, 0 otherwise)	0.2384	0.4263
Roadway Characteristics		
Urban local road indicator (1 if the functional class of the roadway is urban local, 0 otherwise)	0.0481	0.2140
Horizontal curve indicator (1 if crash occurred in Curve (horizontal curve), 0 otherwise)	0.0388	0.1932
Straight roadway indicator (1 if crash occurred in Straight roadway, 0 otherwise)	0.4510	0.4977
Four lane road indicator (1 if there are 4 lanes in the road, 0 otherwise)	0.1442	0.3514

3.2 Methodology

The study is based on Oregon police-reported crash records, described in the previous section. While such data provide comprehensive information on crash events, they often lack detail on certain variables. For example, physical attributes (e.g., height, weight) and subtle variations in environmental conditions (e.g., weather or lighting at the exact time of the crash) are not typically recorded. These unobserved elements can introduce variation in the dataset, commonly referred to as unobserved heterogeneity. If not properly accounted for, unobserved heterogeneity can bias parameter estimates and reduce the accuracy of the model results (Mannering et al., 2016). Different forms of heterogeneity models have been widely applied in crash injury severity research because of their ability to account for unobserved variation in safety outcomes. To address this issue, the present study employs a random parameters mixed logit model with heterogeneity in both the means and variances of the random parameters. Recent studies of injury severity have increasingly adopted this framework, which is regarded as one of the most advanced econometric approaches for capturing unobserved heterogeneity (Alnawmasi and Mannering, 2023; Hernandez and Rahman, 2024; Rahman et al., 2025).

To analyze injury severity outcomes (severe injury, minor injury, and no injury) in younger drivers' cell phone related distraction crashes, the methodology begins by specifying a linear function, as shown in Eqn. (1) (Washington et al., 2020):

$$S_{in} = \boldsymbol{\beta_i X_{in}} + \varepsilon_{in} \tag{1}$$

Here, S_{in} represents the injury severity i for crash n; i denotes the levels of injury severity (severe injury, minor injury, or no injury); X_{in} is the vector of explanatory variables influencing the discrete injury severity outcomes i; β_i is the vector of estimated parameters corresponding to injury severity i, and ε_{in} is the error term accounting for unobserved factors within the model (Washington et al., 2020). By Assuming that ε_{in} follows a generalized extreme value distribution, the probability $P_n(i)$ of a in younger drivers' cell phone related distraction crashes n resulting in injury severity i can be expressed using the standard multinomial logit model, as follows:

$$P_n(i) = \int \frac{\text{EXP}[\beta_i X_{in}]}{\sum_{\forall I} \text{EXP}[\beta_I X_{In}]} \tag{2}$$

A mixed logit model, which accounts for unobserved heterogeneity in the data, is used to estimate injury severity probabilities in younger drivers' cell phone-related distraction crashes, as presented in Eqn. (3) (Washington et al., 2020). This model allows selected parameters to vary randomly, so coefficients differ across observations instead of remaining fixed.

$$P_n(i|\phi) = \int \frac{\text{EXP}[\beta_i X_{in}]}{\sum_{\forall I} \text{EXP}[\beta_I X_{In}]} k(\beta_i|\phi) d\beta_i \tag{3}$$

where $P_n(i|\phi)$ is the weighted outcome probability of injury severity i (severe, minor and no injury) conditional on $k(\beta_i|\phi)$ and $k(\beta_i|\phi)$ is the density function of β_i. By incorporating a weighted probability with an assumed distribution, the density function $k(\beta_i|\phi)$ enables the model to account for variation in parameter estimates (Washington et al., 2020). In this study, the normal distribution was chosen for the density function $k(\beta_i|\phi)$ because it provided a better fit than alternative distributions such as lognormal, triangular, and uniform ((Alnawmasi and Mannering, 2023; Hernandez and Rahman, 2024; Rahman et al., 2025).

To address unobserved heterogeneity in younger drivers' cell phone–related distraction crashes, the model incorporates variability in both the mean and standard deviation of random parameters, denoted as β_{in}. This is done by specifying β_{in} as a function of additional explanatory variables that influence both its mean and variance, as shown in Eqn. (4) (Alnawmasi and Mannering, 2023; Hernandez and Rahman, 2024; Rahman et al., 2025).

$$\boldsymbol{\beta_{in}} = \beta_i + \boldsymbol{\delta_{in} Z_{in}} + \sigma_{in} \text{EXP}(\boldsymbol{\omega_{in} W_{in}}) v_{in}$$

Here, β_i represents the mean parameter estimate across all younger drivers' cell phone-related distraction crashes; Z_{in} is a vector of explanatory variables capturing heterogeneity in the mean that influences injury severity levels i; δ_{in} is the corresponding vector of estimable parameters;

W_{in} denotes the explanatory variables influencing the standard deviation σ_{in}, with ω_{in} as the associated parameter vector; and v_{in} is a randomly distributed disturbance term.

For maximum likelihood estimation, 1,000 Halton draws were employed, given their computational efficiency and improved performance relative to purely random draws (Bhat, 2003). Marginal effects were then calculated to assess the influence of a one-unit change in each explanatory variable on the probability of an injury severity outcome, while holding other variables constant. The marginal effect for the kth explanatory variable associated with injury severity level (severe, minor and no injury) i for driver n, denoted as X_{ikn}, is calculated using Eqn. (5) (Hou et al., 2022).

$$ME_{X_{ikn}}^{P_n(i)} = [P_n(i) = 1 \mid X_{ikn} = 1] - [P_n(i) = 1 \mid X_{ikn} = 0] \quad (5)$$

3.3 Estimated Results

Table 4.2 presents the descriptive statistics of the significant contributing factors in the developed models, including their means and standard deviations. Table 4.3 reports the estimation results for younger drivers' cell phone related distraction crashes in Oregon, along with marginal effects, using the random parameter mixed logit model with heterogeneity in means. The results show that random parameters with heterogeneity in means were identified, as well as one random parameter without heterogeneity.

The estimated model demonstrated strong statistical performance, with a McFadden Pseudo R-squared value exceeding 0.5. The marginal effects for the three injury severity categories, shown in Table 4.3, reflect the change in outcome probabilities associated with a one-unit change in an explanatory variable, holding all others constant. In other words, they highlight the additional influence of each explanatory factor on injury severity outcomes.

3.3.1 ***Random Parameters***

A random parameter captures intrinsic variation in the dataset by allowing the effect of a variable to fluctuate across observations rather than remain constant. All variables were tested for random characteristics, and two were identified as random in the minor injury category: the Female driver indicator (1 if the driver was female, 0 otherwise) and the Fall indicator (1 if the crash occurred between September and November, 0 otherwise).

For the female driver indicator, the parameter displayed random characteristics with a mean of 1.53 and a standard deviation of 4.89, following a normal distribution. This suggests that 62.28% of younger female drivers had a higher probability of sustaining a minor injury in a cell phone related distraction crash, while the remaining 37.72% had a lower likelihood. In other words, although female drivers may be involved in similar distraction-related crashes, the effects are not uniform across individuals. Moreover, the mean of this random parameter increased with airbag deployment, indicating that the probability of sustaining a minor injury rose when an airbag was deployed, rather than resulting in no injury.

For the fall indicator, the parameter also followed a normal distribution, with a mean of –1.37 and a standard deviation of 3.81. This result suggests that 64.04% of distraction-related crashes occurring between September and November were associated with a lower likelihood of minor injury, while 35.96% were more likely to result in minor injury.

Together, these findings highlight heterogeneity in how gender and seasonal factors influence injury outcomes, even within the same severity category. Furthermore, these results underscore

Table 3.3: Estimation results of the model for cell phone related distracted driving crashes of younger drivers (Note: [SI]: Severe injury; [MI] Minor injury; [NI]: No injury)

Variables Descriptions	Model Estimation		Marginal Effect		
	Estimated Parameter	t-stat	Severe Injury	Minor Injury	No Injury
Constant [SI]	-7.84	-4.73			
Constant [MI]	-1.66	-2.90			
Driver characteristics					
Female driver indicator (1 if driver gender is female, 0 otherwise) [MI]	1.53	2.09	-0.0013	0.0267	-0.0254
Standard deviation of female (normally distributed)	4.89	2.11			
Oregon resident indicator (1 if the driver is an Oregon resident with more than 25 miles away from home, 0 otherwise) [SI]	1.58	1.83	0.0051	-0.0022	-0.0029
Safety restrain use (1 if seat belt or harness, fastened during crash, 0 otherwise) [MI]	2.07	3.60	-0.0103	0.2203	-0.2100
Crash characteristics					
Airbag deployment indicator (1 if the airbag is deployed during crash, 0 otherwise) [SI]	2.46	2.74	0.0217	-0.0100	-0.0117
Rear end crash (1 if the crash type is rear-ended, 0 otherwise) [MI]	-1.32	-3.89	0.0030	-0.0948	0.0918
Hit and run indicator (1 if the vehicle hit and run, 0 otherwise) [NI]	-1.72	-2.70	0.0003	0.0091	-0.0094
Low speed limit (1 if the posted speed limit is 25 or lower, 0 otherwise) [NI]	1.40	2.10	-0.0007	-0.0112	0.0118
Vehicle occupancy 2 (1 if two or more occupants, 0 otherwise) [MI]	0.78	2.14	-0.0006	0.0228	-0.0222
Temporal and environmental characteristics					
Morning indicator (1 if the crash occurred between 05:00 am and 9:59 pm, 0 otherwise) [SI]	3.19	2.76	0.0106	-0.0037	-0.0069
Night indicator (1 if the crash occurred between 12:00 am and 4:59 am, 0 otherwise) [NI]	-1.18	-1.66	0.0003	0.0062	-0.0064
Summer indicator (1 if crash occurred between June and August, 0 otherwise) [SI]	4.14	3.18	0.0488	-0.0204	-0.0284
Fall indicator (1 if crash occurred between September and November, 0 otherwise) [MI]	-1.37	-1.82	0.0001	-0.0163	0.0162
Standard deviation of fall (normally distributed)	3.81	1.83			
Weekend indicator (1 if crash occurred on Saturday or Sunday, 0 otherwise) [NI]	0.83	2.21	-0.0014	-0.0237	0.0251
Roadway Characteristics					
Urban local road indicator (1 if the functional class of the roadway is urban local, 0 otherwise) [MI]	2.15	2.14	-0.0002	0.0082	-0.0080
Horizontal curve indicator (1 if crash occurred in curve (horizontal curve), 0 otherwise) [NI]	-1.96	-2.36	0.0008	0.0070	-0.0077
Straight roadway indicator (1 if crash occurred in straight roadway, 0 otherwise) [MI]	1.23	3.48	-0.0024	0.0620	-0.0596
Four lane road indicator (1 if there are 4 lanes in the road, 0 otherwise) [NI]	1.15	2.52	-0.0011	-0.0183	0.0194
Heterogeneity in the Mean of the Random Parameteres					
Female driver indicator [MI]: Airbag deployment indicator (1 if the airbag is deployed during crash, 0 otherwise)	2.69	1.74			
Model Statistics					
Number of observations	541				

Log-likelihood at zero	-594.35
Log-likelihood at convergence	-348.78
McFadden pseudo-R-squared	0.413

that distraction-related crashes among young drivers cannot be explained by only fixed, uniform effects of explanatory factors. Instead, both random variation and systematic heterogeneity play a critical role, with certain crash characteristics shaping the direction and magnitude of effects across observations. These insights emphasize the need for tailored countermeasures that account for the diverse nature of young driver crash outcomes under distraction. Beyond the random effects, several fixed parameters were also found to be significant, which are presented in the following subsections.

3.3.2 ***Fixed Parameters***

3.3.2.1 Driver Characteristics

Beyond the significant random parameter for female drivers, two additional driver-related variables were found to be significant: the Oregon resident indicator (1 if the driver resided in Oregon and was more than 25 miles from home, 0 otherwise) and safety restraint use (1 if a seat belt or harness was fastened during the crash, 0 otherwise).

Drivers traveling more than 25 miles from home were associated with a higher likelihood of severe injury in cell phone related distraction crashes by 0.0051. This may reflect increased exposure to high-speed facilities such as highways or rural arterials, or travel in less familiar environments, where distraction can have more serious consequences due to reduced reaction time and greater crash energy. In contrast, seat belt use was positively correlated with minor injury with a marginal effect of 0.2202. This implies that younger drivers involved in cell phone related distraction crashes were more likely to sustain minor rather than severe or no injury when properly restrained. This result is consistent with the well-documented protective role of restraints, which reduces the risk of fatal and severe injuries by preventing ejection and moderating impact forces, thereby shifting crash outcomes toward less severe categories.

3.3.2.2 Crash Characteristics

Regarding crash characteristics, airbag deployment indicator (1 if the airbag is deployed during crash, 0 otherwise) in severe injury, rear-end crash (1 if the crash type is rear-end, 0 otherwise) and vehicle occupancy 2 (1 if two or more occupants, 0 otherwise) in the minor injury category, hit-and-run indicator (1 if the vehicle was involved in a hit and run, 0 otherwise), and low speed limit (1 if the posted speed limit is 25 mph or lower, 0 otherwise) in the no-injury category were significant for the young drivers' cell phone-related distraction crashes.

For younger drivers, deploying an airbag increased the probability of sustaining severe injuries. The deployment of an airbag during a crash increased the chance of severe injury by 0.0217, with a corresponding decrease in the probability of minor and no injury by 0.0100 and 0.0117, respectively. This reflects the fact that airbags are typically triggered in high-impact crashes, meaning deployment signals a more severe crash environment; while airbags mitigate the most extreme forces, their activation still coincides with injury-causing impacts.

Rear-end crashes were associated with a lower likelihood of minor injury for younger drivers. Specifically, rear-end crashes decreased the probability of minor injury by 0.0948 and increased the chance of severe and no injury by 0.0030 and 0.0918, respectively. This suggests that distracted rear-end collisions are often bifurcated: either producing negligible outcomes when speed differentials are low, or more serious consequences when impacts occur at higher speeds, thereby reducing the likelihood of intermediate outcomes such as minor injury.

Hit-and-run crashes decreased the probability of no injury by 0.0094 for younger drivers, with corresponding increases of 0.0003 and 0.0091 in severe and minor injury, respectively. This underscores the heightened risk of hit-and-run incidents, which often involve reckless behaviors such as speeding or abrupt evasive maneuvers, increasing the likelihood of injury outcomes.

In the case of roadway speed limits, crashes in zones with a posted limit of 25 mph or lower increased the probability of no injury by 0.0118, offsetting the probabilities of severe and minor injuries. This finding reflects the protective effect of low-speed environments, where reduced kinetic energy at impact lowers the chance of serious injury even when distraction is present.

Finally, vehicle occupancy of two or more passengers increased the likelihood of minor injury by 0.0228, while lowering the probabilities of severe and no injury by 0.0006 and 0.0222, respectively. This may suggest that the presence of passengers can serve as a partial protective factor either by encouraging seat belt use or alerting the driver, reducing the likelihood of severe outcomes, though not eliminating the risk of minor injury.

3.3.2.3 Temporal and environmental characteristics

In terms of time of day, both the morning indicator (1 if the crash occurred between 5:00 a.m. and 9:59 a.m., 0 otherwise) and the night indicator (1 if the crash occurred between 12:00 a.m. and 4:59 a.m., 0 otherwise) were significant for younger drivers. Crashes during the morning commuting period increased the probability of severe injury by 0.0106, with corresponding decreases of 0.0037 in minor injury and 0.0069 in no injury. This may reflect commuting conditions where higher speeds on arterials or freeways, combined with fatigue from insufficient rest, compound the risks of distraction and lead to more severe outcomes.

By contrast, crashes occurring at night between 12:00 a.m. and 4:59 a.m. were associated with greater injury risks. Severe injuries increased by 0.0003 and minor injury by 0.0062, while the probability of no injury declined. Nighttime driving often involves reduced visibility, fatigue, and risky behaviors such as drowsy or impaired driving, all of which may heighten the consequences of distraction when a crash occurs.

Seasonal factors also played a role. Beyond the random parameter identified for fall, crashes occurring during the summer months (June to August) were associated with higher probabilities of severe injury, increasing by 0.0488. This corresponds to decreases in both minor and no injury. These patterns may reflect the combination of higher travel volumes, recreational trips, and the tendency for higher speeds on less congested roads, where distraction combined with excess speed raises the likelihood of severe outcomes.

Finally, the weekend indicator increased the probability of no injury by 0.0251, with decreases of 0.0014 in severe injury and 0.0237 in minor injury. This likely reflects lighter traffic conditions on weekends, where reduced congestion lowers conflict intensity, allowing distraction-related crashes to result in less severe outcomes compared to weekday commuting periods.

3.3.2.4 Roadway characteristics

Considering roadway characteristics, several variables were significant for younger drivers in cell phone–related distraction crashes: the urban local road indicator (1 if the roadway was classified as urban local, 0 otherwise) and the straight roadway indicator (1 if the crash occurred on a straight roadway, 0 otherwise) in the minor injury category; and the horizontal curve indicator (1 if the crash occurred on a horizontal curve, 0 otherwise) and the four-lane road indicator (1 if the roadway had four lanes, 0 otherwise) in the no-injury category.

Crashes on urban local roads increased the probability of minor injury by 0.0082, suggesting that distraction-related crashes in these environments are more likely to result in non-severe outcomes. This may be because traffic speeds are generally lower on local roads, reducing crash energy and making injury outcomes less severe even when distraction is involved.

Similarly, crashes occurring on straight roadway segments increased the probability of minor injury by 0.0620. This finding indicates that straight segments may foster a false sense of safety, making younger drivers more likely to engage with cell phones. While crashes in such conditions are less likely to be catastrophic, distraction still elevates the risk of sustaining minor injuries.

In contrast, horizontal curves reduced the probability of no injury while increasing the likelihood of both minor and severe injuries, with the largest effect being a 0.0070 increase in minor injury. This reflects the greater control, and attention demands of curved roadways, where distraction compromises lane-keeping and raises the chance of losing control, more often producing injury outcomes than damage-only crashes.

Finally, crashes on four-lane roads increased the probability of no injury by 0.0194, while decreasing severe injury by 0.0011 and minor injury by 0.0183. This suggests that wider roadways provide additional maneuvering space and recovery opportunities, reducing the severity of distraction-related crashes compared to those occurring on narrower facilities.

3.4 Summary

Overall, the results demonstrate that distraction-related crashes among younger drivers are shaped by a wide range of interrelated factors. Driver attributes such as gender, restraint use, and distance from home played a notable role in determining injury severity. Female drivers and those traveling farther from home exhibited distinct risk patterns, while consistent seat belt use shifted outcomes toward less severe injuries. These findings emphasize that demographic and behavioral characteristics are central to understanding distraction risks.

Crash circumstances also influenced severity outcomes, with factors such as airbag deployment, rear-end collisions, and hit-and-run behavior highlighting the diverse mechanisms through which distraction produces injuries. For example, while airbag deployment signals high-impact crashes that inherently carry greater injury risks, distracted rear-end collisions revealed a split pattern of either minimal consequences or more serious outcomes. These results underscore the interaction between distraction, crash type, and safety system activation.

Temporal and environmental conditions further shaped outcomes, demonstrating when and where crashes occur matters. Morning and nighttime crashes showed elevated risks, likely reflecting commuting pressures, fatigue, and reduced visibility, while summer months amplified severe outcomes due to higher travel volumes and speeds. In contrast, weekend crashes were associated with lower severity, illustrating the role of traffic exposure and congestion in conditioning crash consequences.

Roadway characteristics added another dimension. Crashes on straight and urban local roads were more often associated with minor injuries, consistent with lower operating speeds, but horizontal curves significantly increased the probability of injury, reflecting their greater control demands.

Wider four-lane roads, on the other hand, provided additional maneuvering space, reducing the likelihood of injury even when distraction was present.

Taken together, these findings highlight the complexity of distraction-related crashes among younger drivers. No single factor explains outcomes in isolation; rather, driver attributes, crash circumstances, temporal and environmental conditions, and roadway features combine to shape injury severity. The identification of random parameters for gender and seasonal variation further shows that effects are not uniform across individuals or contexts but reflect deeper heterogeneity. Synthesizing across categories, the analysis demonstrates that understanding distraction among younger drivers requires a holistic perspective that integrates behavioral, environmental, and roadway influences to capture the full scope of risk.

3.5 Recommendations

Based on the results, several countermeasures can be identified to reduce distraction-related crash risks among younger drivers. These recommendations address the most critical factors—driver behavior, travel context, temporal conditions, seasonal exposure, and roadway environments—that were shown to significantly influence injury severity outcomes.

First, reinforcing seat belt use remains essential. The analysis demonstrated that proper restraint uses shifts outcomes from severe to minor injuries, confirming its protective effect. Campaigns should continue to emphasize seat belt use while encouraging passengers to play an active role in reminding and supporting their peers.

Second, promoting safer behaviors on longer trips is necessary. Younger drivers traveling more than 25 miles from home had a higher likelihood of severe injuries, reflecting the challenges of unfamiliar routes, higher speeds, and potential fatigue. Interventions should emphasize hands-free navigation practices and highlight fatigue-related risks during longer-distance travel.

Third, targeted enforcement and awareness campaigns are needed during high-risk times of day. Morning commuting and late-night periods were associated with more severe outcomes. Enforcement strategies and educational messaging in these time windows should stress the compounded dangers of distraction when combined with fatigue, limited visibility, or higher commuting speeds.

Fourth, seasonal safety campaigns should be prioritized in the summer months. Severe injuries were most common during this period, likely due to increased recreational travel and elevated speeds. Outreach campaigns launched ahead of summer should focus on the specific risks of distracted driving under these conditions.

Finally, roadway design improvements can help mitigate risks on curves. Horizontal curves were linked to higher injury probabilities, underscoring their greater attentional demands. Countermeasures such as rumble strips, enhanced curve signage, and improved pavement markings could reduce risks, while reinforcing the importance of attentiveness in these environments.

Together, these recommendations highlight the need for an integrated strategy that combines behavioral, temporal, and roadway-focused approaches. By aligning education, enforcement, and infrastructure-based measures, policymakers and practitioners can more effectively address the diverse risk factors identified in this study. Tailoring interventions to the contexts in which younger drivers are most vulnerable offers the greatest potential for reducing injury severity and advancing overall traffic safety.

4. SURVEY DATA ANALYSIS

4.1 Data Source

The analysis draws on data from the Public Opinion Traffic Safety Survey, conducted by the Oregon Department of Transportation's (ODOT) Transportation Safety Office. The 2023 and 2024 waves were administered by PRR, an independent research firm contracted by ODOT. Both surveys gathered input from Oregon residents on traffic safety topics in Wave 1 such as distracted driving, roadway conditions, and travel behavior. The 2023 survey included about 2,360 respondents, while the 2024 survey included about 1,482 respondents.

Given the focus of this research on distracted driving, it is important to note that not all respondents answered the relevant questions. Specifically, 1,131 respondents in 2023 and 715 respondents in 2024 provided responses to the distracted driving items. These subsets form the analytical base for the comparisons presented in this report.

Figure 4.1 presents the age distribution of survey respondents in 2023 and 2024. The results highlight a critical limitation: the 16–24 age group (younger drivers), which is the primary focus of this research, was substantially underrepresented in both years, with only 10 respondents in 2023 and 8 respondents in 2024. This small sample makes it difficult to generalize about younger drivers distracted driving behavior. Middle-aged and older drivers were represented in much larger numbers, but the shortage of younger participants points to the need for more targeted recruitment in future surveys to capture this high-risk group more effectively.

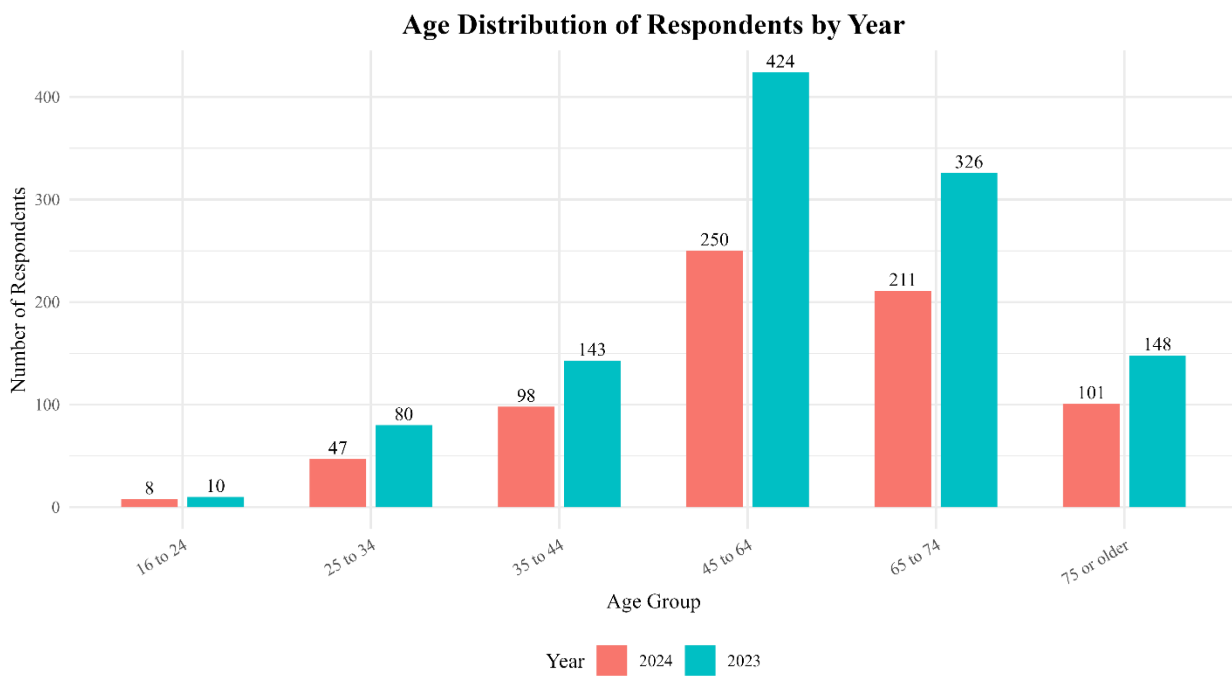

Figure 4.1: Age distribution of survey respondents, 2023 and 2024.

In the near future of this study, the limited representation of younger drivers should be addressed more seriously. Distracted driving is particularly common among this group, especially with the rapid advancement and widespread use of mobile technology and in-vehicle systems. Ensuring that future survey waves include stronger participation from drivers aged 16–24 will be critical to capturing their behaviors accurately and developing effective countermeasures.

Given the limitation, the descriptive analysis in this report uses the full sample across all ages rather than focusing solely on younger drivers. This approach produces more stable estimates, avoids overstating trends based on very few observations, and places distracted driving in the context of the broader driving population, which is essential for policy and countermeasure design. Age-specific patterns are noted when sample sizes allow, but strong inferences about the 16–24 group are avoided until more robust data are available. This broader baseline also provides a reference point for more targeted data collections and analyses in the future.

With the age profile and its limitations established, the next sections turn to descriptive analyses of all respondent characteristics. These are followed by results on awareness of distracted driving laws, self-reported distraction behaviors, and perceptions of roadway safety.

4.2 Demographic Characteristics

This section presents the demographic characteristics of survey respondents, focusing on gender, race/ethnicity, and household income. These characteristics provide important context for interpreting the subsequent analyses of awareness, behaviors, and roadway safety perceptions.

4.2.1 Gender Distribution

Figure 4.2 presents the gender distribution of respondents in 2024 and 2023. In 2024, males made up 53.5%, females 45.3%, and 1.2% identified as non-binary or other. The 2023 sample showed almost the same pattern, with 53.8% male, 44.9% female, and 1.3% non-binary or other. This near-identical split across both years points to a stable gender profile in the survey, which strengthens confidence that any differences observed in distraction-related outcomes are not artifacts of changing gender composition but reflect genuine behavioral shifts.

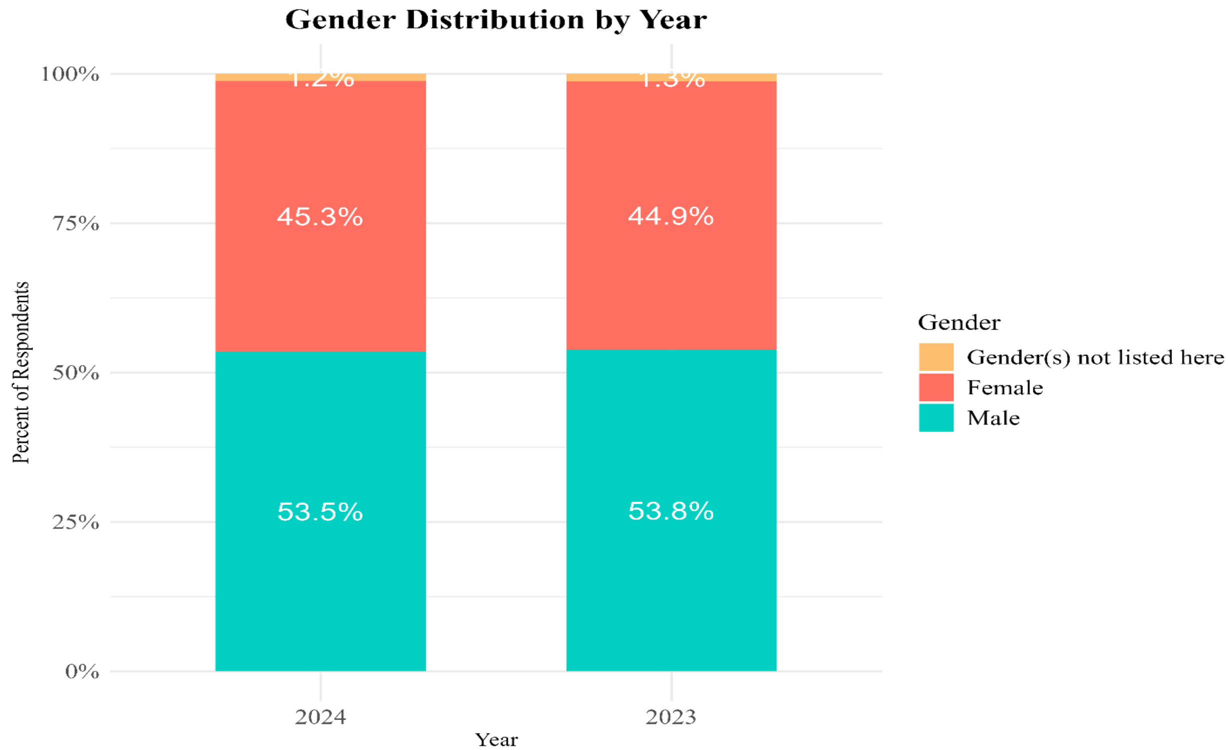

Figure 4.2: Gender distribution of survey respondents, 2023 and 2024

4.2.2 Race and Ethnicity

Figures 4.3 and 4.4 show the racial and ethnic composition of respondents in 2023 and 2024. White respondents made up 83.7% of the sample in 2023 and 76.1% in 2024. BIPOC representation declined from 12.1% in 2023 to 8.5% in 2024, while non-disclosure rose sharply from 4.2% to 15.4%.

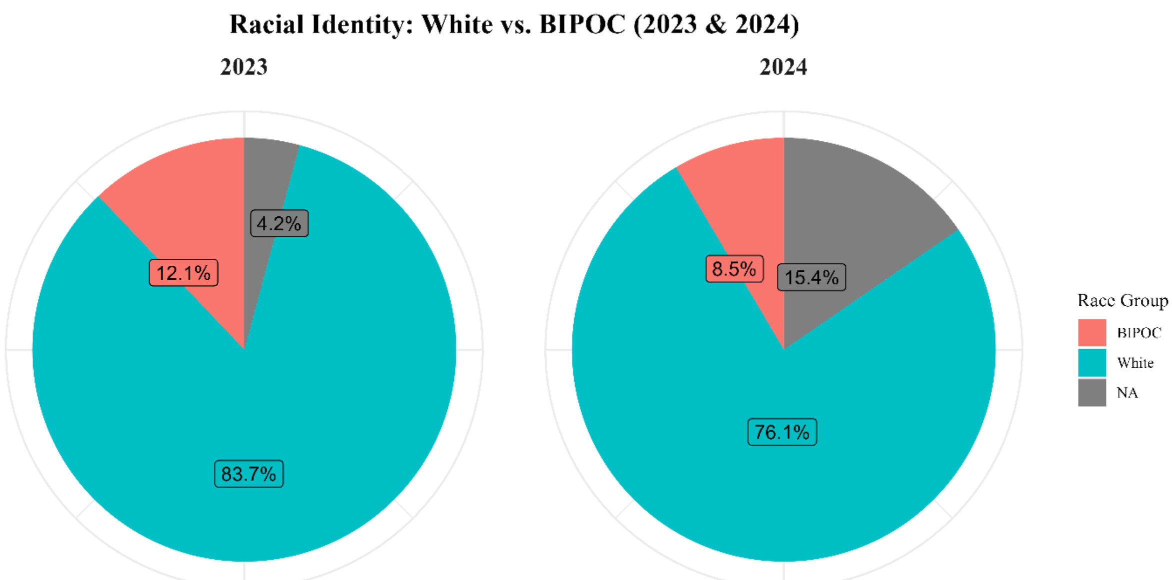

Figure 4.3: Racial/ethnic composition of survey respondents, 2023 and 2024.

Breaking the results down by category, White respondents overwhelmingly dominated the sample. Other groups which include Black or African American, Hispanic/Latino, Asian, Native American, Pacific Islander, Middle Eastern/North African, and "Other/Not listed", each accounted for less than 5% in both years. Hispanic/Latino and Asian respondents appeared slightly more frequently than other BIPOC groups, but still below 5%.

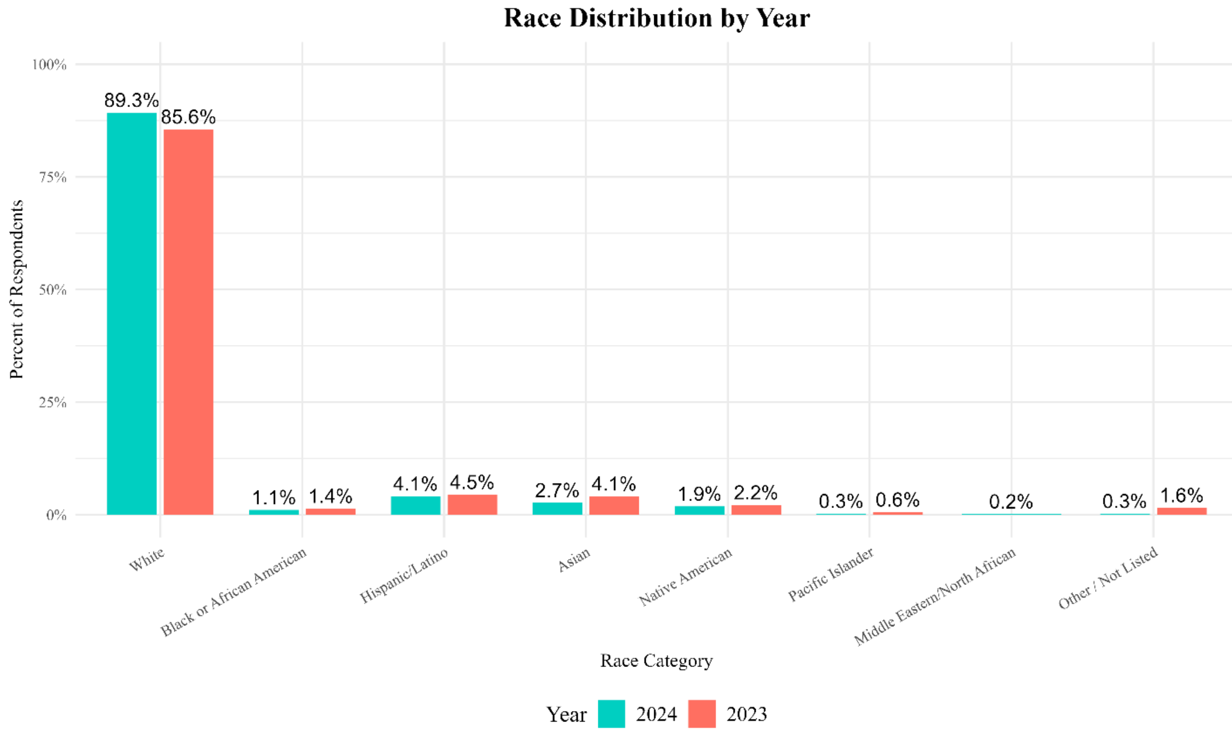

Figure 4.4: Race distributions of survey respondents, 2023 and 2024.

Overall, the racial distribution remained heavily weighted toward White respondents. The decline in BIPOC participation and increase in non-disclosure from 2023 to 2024 points to important limitations in capturing a more representative demographic profile.

4.2.3 Household Income

Figure 4.5 shows the household income distribution of respondents in 2024 and 2023. The \$50,000–\$99,999 range accounted for the largest share in both years but declined slightly in 2024. A similar drop occurred in the \$100,000–\$149,999 group, although it still represented a substantial portion of the sample. In contrast, the share of respondents in the \$25,000–\$49,999 category increased in 2024, pointing to more households reporting lower-middle incomes. The lowest group (<\$25,000) and the highest categories (\$150,000–\$199,999 and \$200,000 or more) showed only minor variation, remaining relatively stable across years.

Overall, the distribution was broadly consistent across the two survey waves, but the decline in middle- and upper-middle income groups alongside growth in the \$25,000–\$49,999 category indicates a slight downward shift in reported household incomes in 2024 compared with 2023.

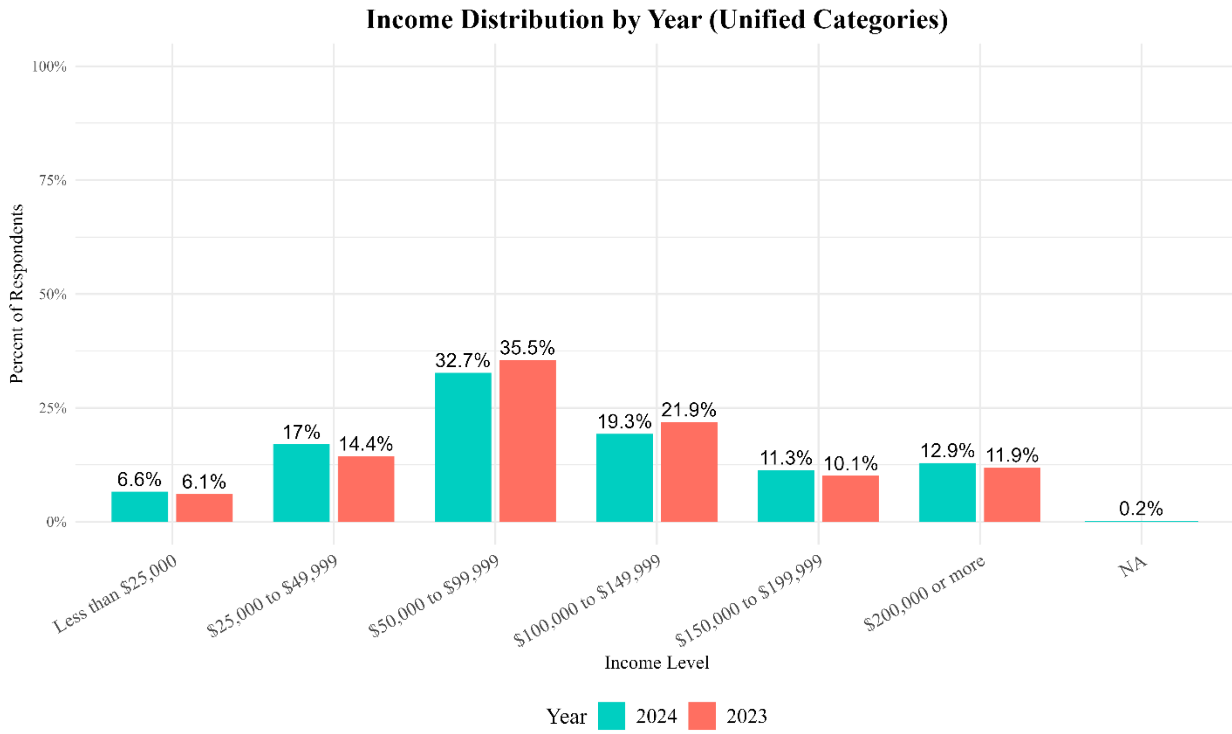

Figure 4.5: Household income distribution of survey respondents, 2023 and 2024

4.2.4 County of Residence

Figure 4.6 shows the distribution of respondents across the top 10 Oregon counties in 2023 and 2024. The Portland metro area (Multnomah, Washington, and Clackamas Counties) accounted for more than half of the sample in both years. Multnomah declined from 21.6% in 2023 to 20.4% in 2024, while Clackamas remained unchanged at 10.2%. Washington County declined slightly (14.9% to 11.5%) but remained a major contributor.

Outside the metro area, patterns were mixed. Lane County and Marion stayed relatively stable with a slight decrease, while Deschutes and Jackson both saw an increase. Benton County decreased from 3.3% to 1.5%, giving it a less prominent presence in 2024. Respondents grouped as “Other” counties rose from 16.3% in 2023 to 22.2% in 2024, reflecting a broader spread of participation across smaller counties.

Overall, the respondent pool remained concentrated in the Portland metro region, but shifts across other counties point to variation in geographic coverage between the two survey years. Decreases in Multnomah and Washington contrasted with increases in Deschutes, Jackson, and the “Other” counties, underscoring uneven regional representation.

Overall, the demographic profile of survey respondents remained relatively consistent across 2023 and 2024, with stable gender representation, a predominantly White racial composition, and income levels concentrated in the $50,000–$149,999 range. Geographic distribution was heavily weighted toward the Portland metro counties, though some shifts in county representation were observed. These demographic characteristics provide important context for interpreting the subsequent findings on distracted driving awareness, behaviors, and roadway safety perceptions. The following section examines respondents’ awareness of Oregon’s distracted driving law and their perceptions of the consequences of violating it.

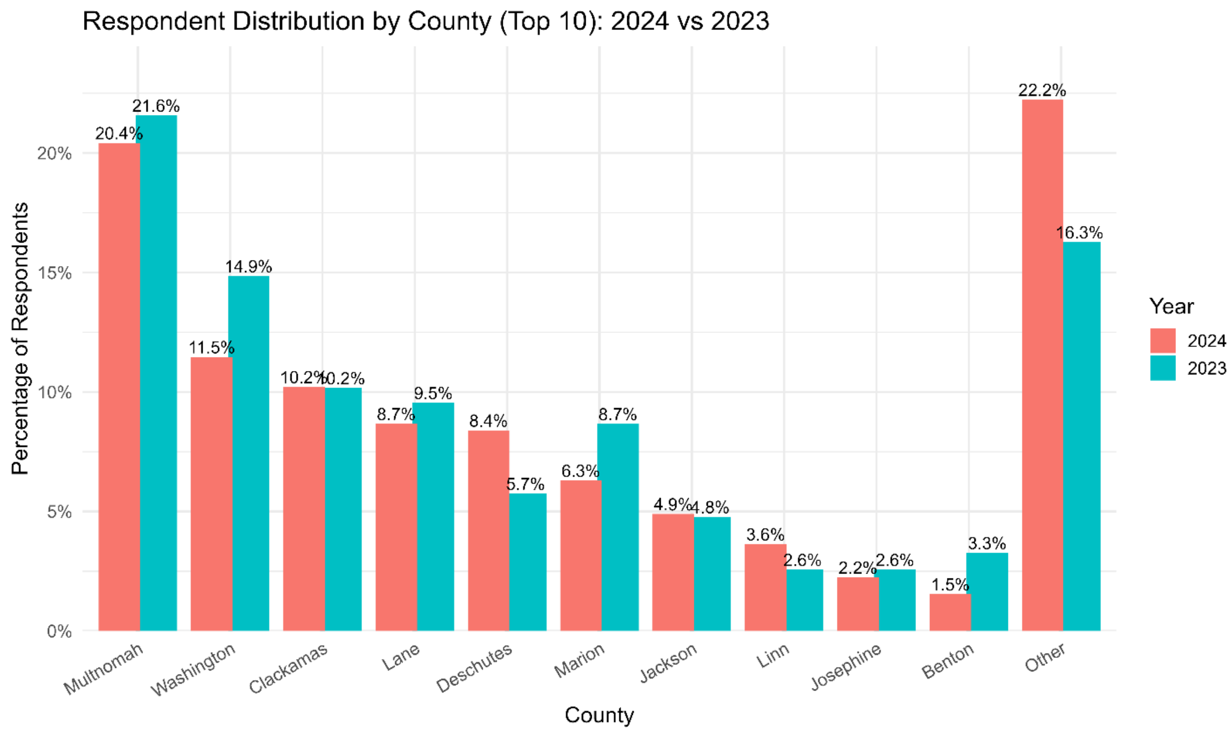

Figure 4.6: Distribution of survey respondents by county (Top 10 counties), 2023 and 2024.

4.3 Awareness and Knowledge

Understanding public awareness of traffic safety laws is critical for evaluating the reach of enforcement and education campaigns. In the case of distracted driving, awareness of Oregon's laws and perceptions of the consequences of violating them offer insight into how drivers assess both risk and penalty. High levels of awareness are expected to deter risky behavior, while gaps in knowledge or misperceptions about enforcement can weaken the effectiveness of the law. This section examines survey respondents' awareness of Oregon's distracted driving statute and their views on the likely consequences of non-compliance.

4.3.1 Orogen's Distracted Driving Law

Oregon has enacted targeted legislation to curb the use of portable electronic devices while driving. ORS 811.507 prohibits holding or using a mobile electronic device while operating a vehicle. Covered devices include cell phones, tablets, GPS units, and laptops (ODOT, 2024).

Several provisions define the scope of this law. A handheld device ban prohibits texting, emailing, or making phone calls with handheld devices while driving. Hands-free use is permitted for drivers 18 and older, provided activation requires only a single touch. Commercial drivers must also comply with federal requirements mandating electronic logging devices. Emergency exceptions apply when immediate use of a device is necessary. While activities such as eating or drinking while driving are not specifically prohibited, they are discouraged due to their potential to divert attention from the roadway.

With this framework in place, the following figures present survey results on respondent awareness of Oregon's distracted driving law and their perceptions of the consequences of violating it.

4.3.2 Awareness of the Law

Figure 4.7 shows that awareness of Oregon's distracted driving law remained consistently high in both 2023 and 2024. More than 92.5% of respondents reported being familiar with the law each year, indicating that outreach and enforcement have been effective in sustaining broad recognition. Only a small share (around 4%) reported being unaware of the law, and a similarly small share indicated uncertainty, with little change over the years. Overall, these findings suggest that most Oregon drivers are well-informed about the state's distracted driving regulations, though a small minority still exhibits gaps in knowledge.

4.3.3 Perceptions of Consequences

Figure 4.8 presents respondents' perceptions of the consequences of violating Oregon's distracted driving law. Receiving a ticket was the most widely recognized outcome in both years, identified by about two-thirds of respondents. Enhanced fines and mandatory courses followed, each cited by roughly four in ten participants, while warnings were noted by a somewhat smaller but steady share. In contrast, license suspension was rarely associated with distracted driving violations, mentioned by fewer than one in ten participants.

Taken together, these findings show that public perceptions of enforcement outcomes were highly stable between 2023 and 2024. Tickets and fines dominated awareness, while more severe consequences such as license suspension were rarely expected. This stability suggests that most drivers have a clear sense of the immediate penalties tied to distracted driving but may underestimate the possibility of harsher sanctions.

Overall, the survey results indicate that Oregon drivers are broadly aware of the distracted driving law and primarily associate violations with tickets and fines. Perceptions of more severe consequences remain limited. Building on this foundation of awareness, the next section turns to self-reported distraction behaviors, beginning with cell phone use and extending to other forms of distraction.

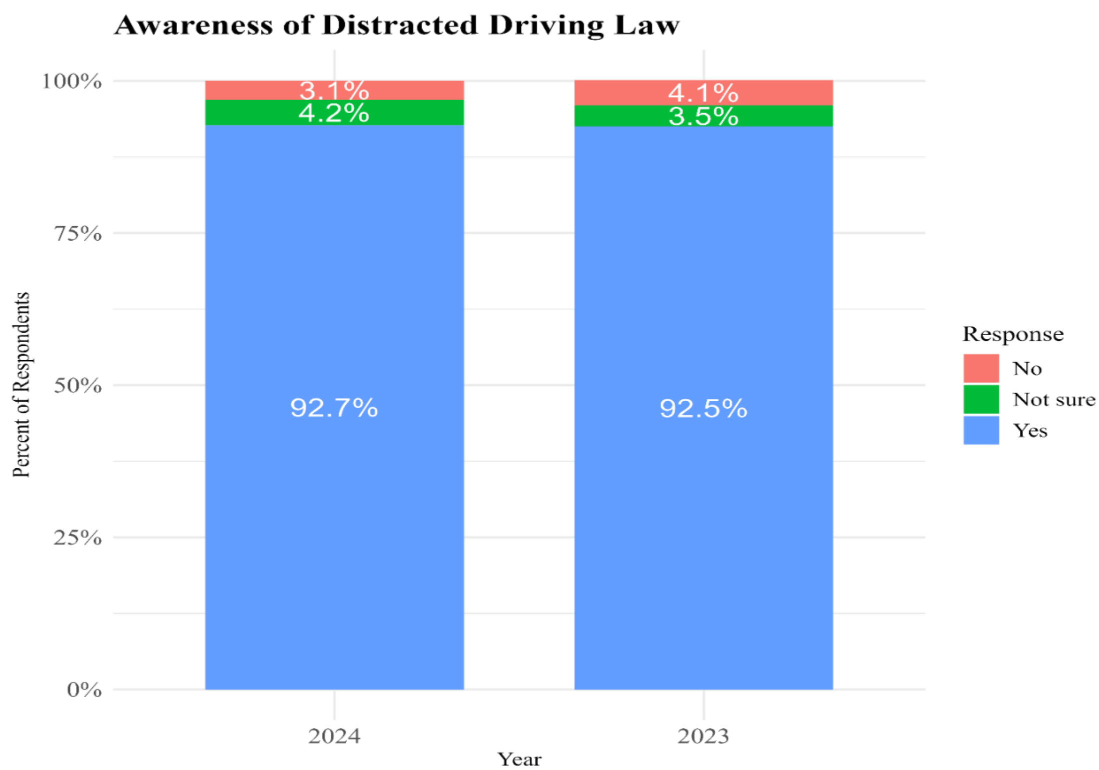

Figure 4.7: Awareness of Oregon's distracted driving law among survey respondents, 2023 and 2024.

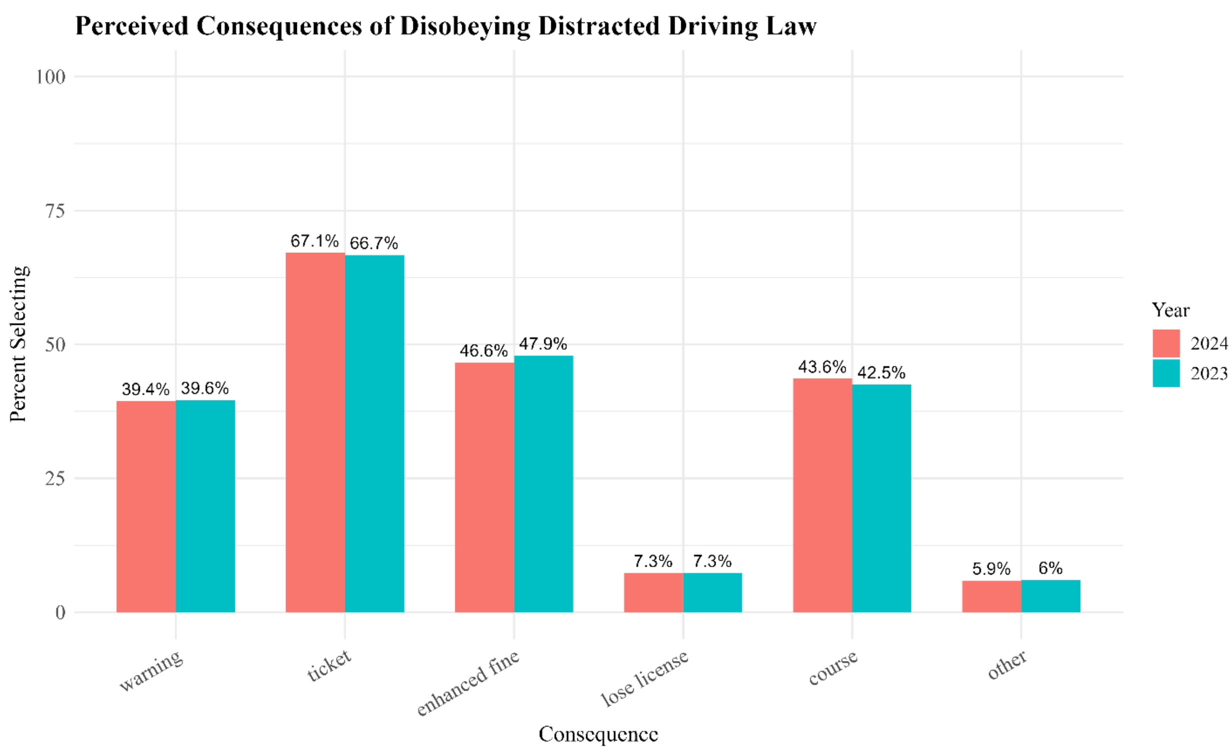

Figure 4.8: Respondents' perceptions of the consequences of violating Oregon's distracted driving law, 2023 and 2024.

4.4 Self-Reported Behaviors

While awareness of distracted driving laws establishes an important baseline, actual driving behaviors determine safety outcomes. Examining how often drivers engage in risky activities such as cell phone use and other distractions highlights the gap between legal knowledge and on-road practice. This section presents self-reported behaviors from the survey, beginning with cell phone use, then other forms of distraction, and concluding with general patterns of transport mode use.

4.4.1 Cell Phone Use

In response to the question on cell phone use while driving in the past 12 months, results were consistent between 2023 and 2024, with only modest variation. Figure 4.9 shows that a substantial share of drivers continue to use cell phones despite widespread awareness of Oregon's distracted driving law. In 2023, just under half of respondents admitted to using a cell phone while driving, and this share rose slightly in 2024, with more than half reporting such behavior. The proportion of respondents who reported not using a cell phone declined modestly over the same period.

These results reveal a clear gap between knowledge of the law and actual driving behavior. Nearly all respondents reported being familiar with Oregon's distracted driving statute, yet many still acknowledged engaging in prohibited activities. The persistence and slight growth of self-reported cell phone use highlight the difficulty of converting legal awareness into safer driving practices.

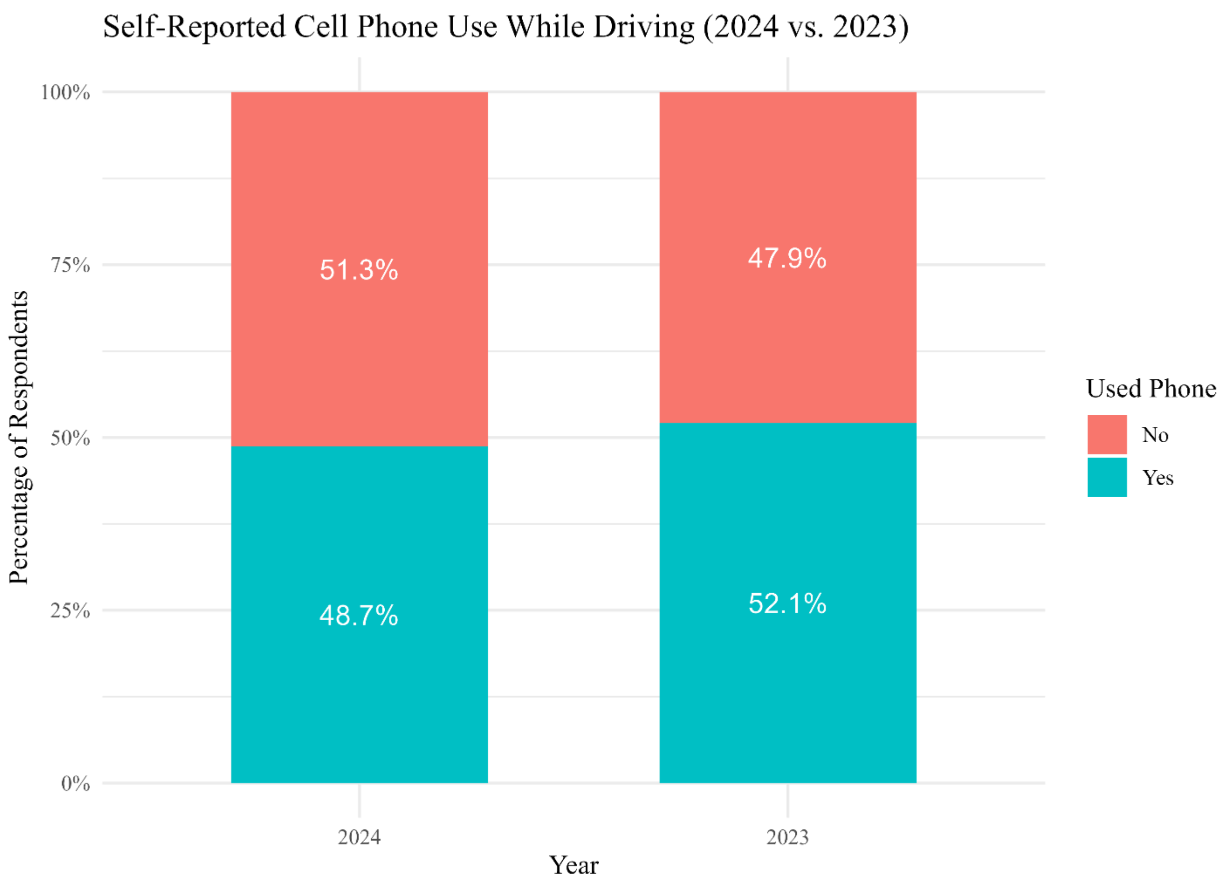

Figure 4.9: Self-reported cell phone use while driving (Yes/No), 2023 and 2024.

4.4.2 Comparison with Other Distractions

To place cell phone use in context, Figure 4.10 compares it with other forms of distraction. Cell phone use remained the most frequently reported behavior in both years, underscoring its continued dominance. Use of in-vehicle technologies, including built-in phones, navigation, and entertainment systems, also increased, reflecting the growing role of integrated electronics as sources of distraction. In contrast, hands-free phone use declined modestly, and reliance on portable navigation devices dropped sharply, likely as drivers shifted to built-in systems.

Together, these findings show that cell phone use and in-vehicle technologies are the leading and growing sources of distraction. This persistence, despite high levels of legal awareness, reinforces the challenge of closing the gap between knowledge of the law and actual driving behavior.

4.4.3 Transport Mode Use

Figure 4.11 compares transport mode use in 2023 and 2024. Driving alone was by far the most common mode in both years, reported by nearly nine in ten respondents, with only a slight increase over time. Riding as a passenger also remained common, showing little change over time.

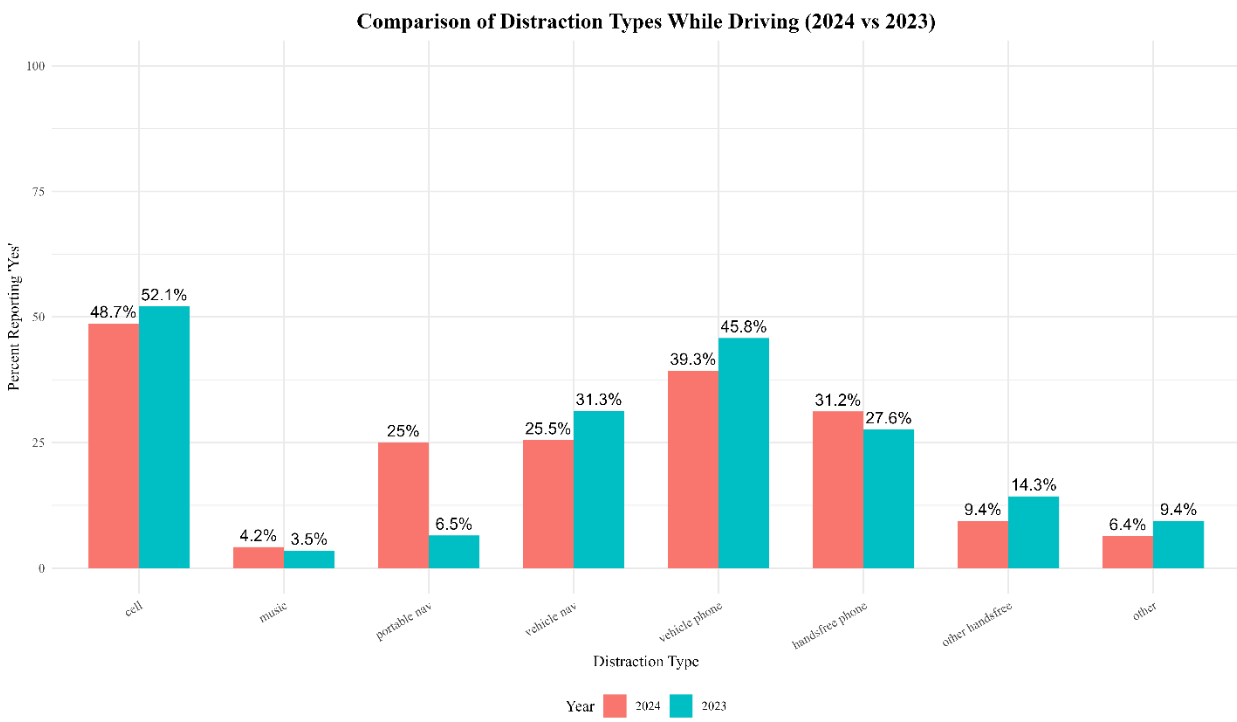

Figure 4.10: Comparison of cell phone use and other types of distraction, 2023 and 2024.

Active modes showed modest growth, with walking increasing slightly and biking registering a smaller but positive shift. Transit use declined, suggesting fewer respondents relied on public transportation in 2024. Motorcycle use rose sharply but continued to represent only a small share. Other modes were rarely reported and showed little change.

Overall, the findings confirm that driving alone dominates travel behavior, while active modes are gradually gaining ground and transit use is weakening. This pattern is important context for distracted driving, as the prevalence of single occupancy driving places responsibilities squarely on individual drivers to avoid risky behaviors.

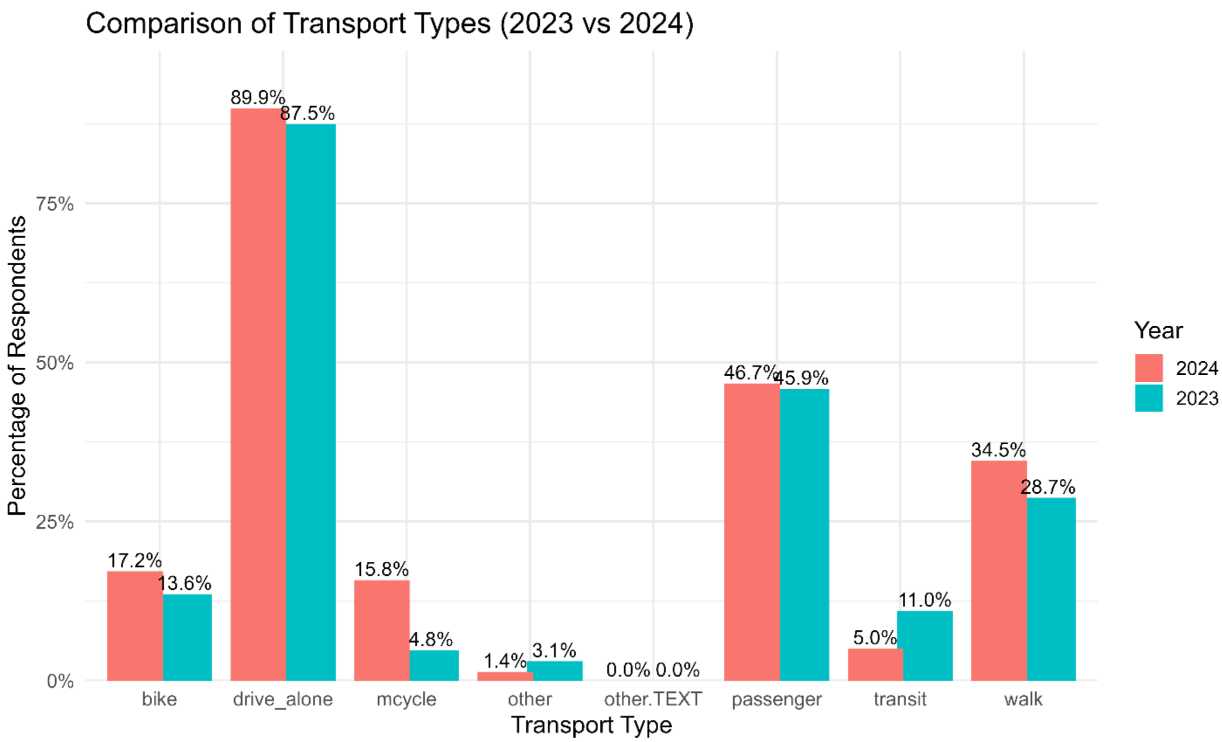

Figure 4.11: Reported transport mode use, 2023 and 2024.

Taken together with earlier results, the behavioral evidence points to a persistent reliance on cell phones and in-vehicle technologies while driving, despite nearly universal awareness of Oregon's distracted driving law. The combination of widespread legal knowledge, high rates of driving alone, and continued engagement in distraction highlights the gap between awareness and practice. This sets the stage for the next section, which examines how respondents perceived roadway safety compared with prior years.

4.5 Perceptions of Roadway Safety

Figure 4.12 shows respondents' perceptions of roadway safety in 2023 and 2024 compared with the prior year. In both surveys, most participants reported that conditions had either stayed the same or became less safe, while only a small minority perceived improvement.

In 2023, about half of respondents felt roadway safety had not changed, and just under half said conditions were less safe. By 2024, the share reporting less safe conditions increased, while the small group reporting improvements declined further. Those who viewed the roads as safer made up only a small fraction in both years.

Taken together, the results point to a prevailing sense of stagnation or decline in roadway safety. The very limited proportion citing improvements underscores the difficulty of shifting public perception, especially against the backdrop of persistent distracted driving behaviors identified in the survey.

Overall, perceptions of roadway safety remained largely negative or unchanged across both years, reinforcing the pattern observed throughout the behavioral findings: drivers continue to engage in distraction despite high levels of legal awareness, and they also recognize broader risks on

Oregon's roads. This alignment between behavior and perception highlights the challenge of translating awareness into safer practices.

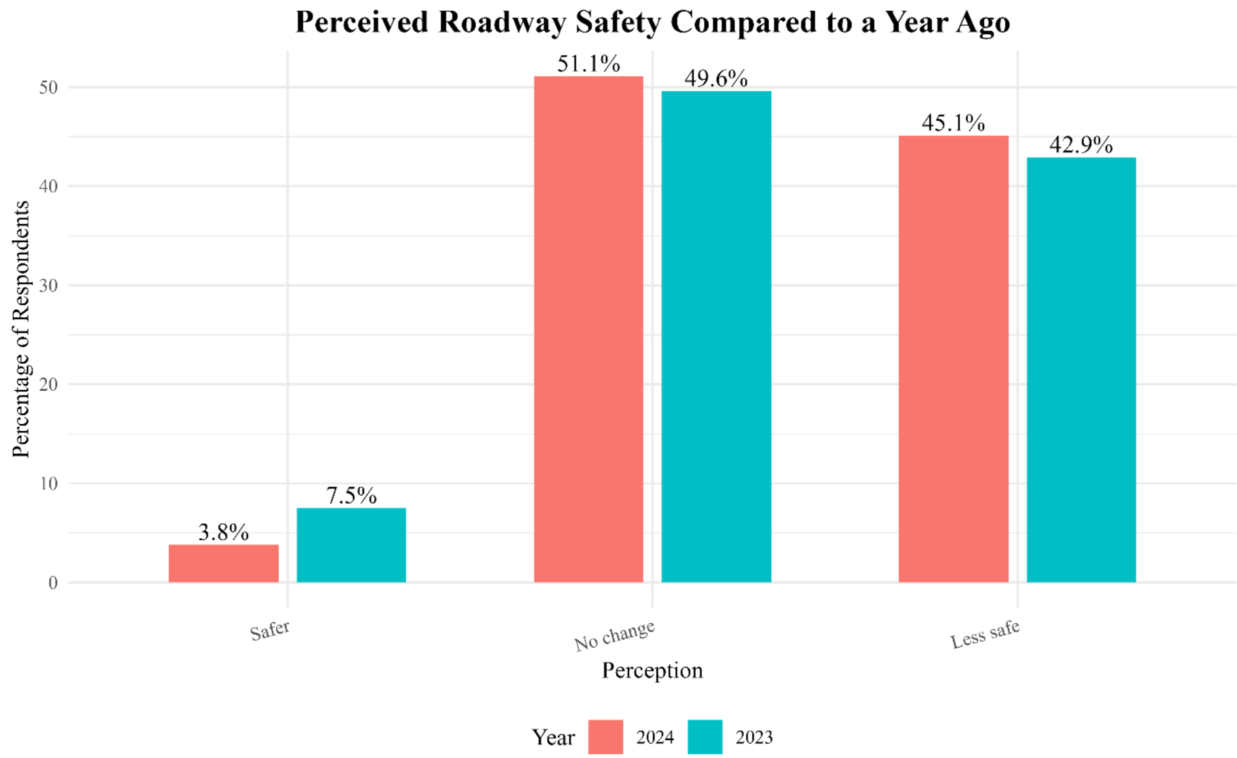

Figure 4.12: Respondents' perceptions of roadway safety compared to the previous year, 2023 and 2024.

4.6 Summary

Taken together, the survey findings provide a broad view of distracted driving within the wider context of traffic safety in Oregon. The demographic profile of respondents was largely stable across 2023 and 2024, with consistent gender and income distributions, a predominately White sample, and strong representation from the Portland metro area. A key limitation, however, was the persistent underrepresentation of younger drivers aged 16–24, the primary focus of this project. Their limited participation restricts the ability to draw robust conclusions for this group and underscores the need for more targeted recruitment in future survey waves.

Despite this limitation, several important patterns emerged. Awareness of Oregon's distracted driving law remained exceptionally high, with more than 90% of respondents familiar with the regulation. Perceptions of enforcement outcomes were also stable: tickets and fines were most often cited, while harsher penalties such as license suspension were rarely mentioned. Yet, despite widespread awareness, a substantial share of respondents continued to report cell phone use while driving, and this behavior showed a modest increase from 2023 to 2024. Other in-vehicle distractions, including navigation and entertainment systems, also grew in prevalence, reflecting the expanding influence of technology on driver attention.

Travel mode choices reinforced the importance of individual driver behavior, with driving alone continuing to dominate. Perceptions of roadway safety aligned with these findings: most respondents believed conditions had stayed the same or become less safe, and very few perceived improvements. This persistent sense of risk mirrors the behavioral evidence, pointing to a disconnect between knowledge of the law and actual driving practices.

In sum, the survey highlights a consistent gap between legal awareness and behavior, with technology-related distractions remaining a prominent concern. While the project emphasizes younger drivers, their limited representation in the survey data presents a significant challenge: those most at risk of distracted driving are not yet adequately captured. Addressing this gap through targeted outreach and expanded data collection will be essential for future analyses and for developing countermeasures aimed at reducing distraction-related crashes among younger drivers.

4.7 Recommendations

Based on these findings, several recommendations emerge:

i. **Enhance outreach to younger drivers:** Younger drivers remain underrepresented in the survey despite their elevated risk of distraction. ODOT should consider targeted recruitment strategies, such as partnerships with schools and universities, social media campaigns, and participation incentives, to ensure their perspectives are better captured in future surveys.

ii. **Strengthen enforcement visibility and communication:** Awareness of the law is widespread, yet self-reported cell phone use remains high. Public campaigns that emphasize fines, penalties, and the risks of distraction could reinforce compliance by making enforcement feel more immediate and visible.

iii. **Address technology-based distractions:** As in-vehicle systems become more common, education efforts should expand beyond cell phones to include navigation, entertainment, and built-in connectivity features that increasingly compete for driver's attention.

iv. **Link perceptions to behavior:** The persistence of negative roadway safety perceptions creates an opportunity for messaging that ties distracted driving directly to broader safety concerns. Framing distraction as a key contributor to unsafe roadways may increase public receptiveness to countermeasures.

Taken together, these recommendations suggest that while legal awareness is already high, sustained behavioral change will require a coordinated approach: targeted outreach, stronger enforcement presence, and messaging that addresses both traditional and emerging forms of distraction.

5. INTEGRATION OF FINDINGS

The combined crash and survey analyses reveal a consistent but complex picture of distraction among younger drivers in Oregon. Crash data showed that distraction was most often linked to cell phone use, which dominated across all years and was strongly tied to rear-end collisions in urban areas. Most outcomes involved property damage or minor injury, but severe injuries were still present, especially in high-speed rural environments or curve-related crashes. The econometric analysis added further detail, highlighting the influence of driver characteristics (gender, restraint use, distance from home), temporal and environmental conditions (summer, morning commutes, nighttime hours), and roadway features (curves, four-lane roads, urban locals) on injury severity. Importantly, heterogeneity in gender and seasonal effects confirmed that risks are not uniform across individuals or contexts.

The survey analysis complements these findings. Awareness of Oregon's distracted driving law was nearly universal, yet self-reported cell phone use remained widespread and even rose slightly from 2023 to 2024. In-vehicle technologies also emerged as growing sources of distraction, while perceptions of roadway safety were largely stagnant or negative. Younger drivers, the group of greatest concern, were severely underrepresented in the survey, limiting direct insights into their behavior. Even so, the broader sample reinforced the disconnect between knowledge of the law and actual practice, echoing the crash data evidence of persistent distraction-related crashes.

Spatial patterns also showed clear parallels across datasets. Distraction-related crashes clustered in Oregon's urban counties, particularly Multnomah, Washington, Clackamas, Marion, Lane, and Jackson. Survey respondents were likewise concentrated in the Portland metro and other large population centers, with rural voices less represented. This overlap suggests that both behavioral evidence and crash outcomes are shaped by urban exposure, while rural risks, even though fewer in number, remain comparatively underrepresented and more severe.

Taken together, the findings show that distraction among young drivers in Oregon cannot be reduced to questions of awareness alone. Crashes occur most often in conditions perceived as safe, such as daylight, dry pavement, clear weather, straight roads, where vigilance is reduced and drivers feel more comfortable engaging in secondary tasks. At the same time, the survey indicates that drivers recognize broader safety risks but still engage in distraction. This alignment across datasets highlights a critical gap between knowledge and behavior that demands targeted, multifaceted countermeasures.

6. CONCLUSION

This project provides a comprehensive examination of distraction-related crashes involving younger drivers in Oregon by combining descriptive crash trends, advanced econometric modeling, and survey-based evidence. Each data source offered distinct strengths and limitations: crash data provided detailed records of outcomes and contributing factors, while survey data captured awareness, behaviors, and perceptions but with limited representation of younger drivers. Taken together, these sources offer a fuller understanding of the risks associated with distraction, while also identifying critical gaps where further data collection is needed.

The crash analysis revealed the consistent dominance of cell phone use as a distraction source, clustering of crashes in urbanized counties, and elevated severity in rural settings. The econometric results underscored the role of driver characteristics, crash circumstances, temporal patterns, and roadway features in shaping injury severity, while identifying heterogeneity across gender and seasonal variation. Survey findings showed that although awareness of Oregon's distracted driving law is nearly universal, actual behaviors remain inconsistent with this knowledge. Self-reported cell phone use persists, in-vehicle technologies are emerging as additional sources of distraction, and perceptions of roadway safety remain largely negative. Yet a key limitation of the survey is that younger drivers, the group most at risk, were severely underrepresented, making it difficult to generalize their perspectives or align them directly with crash data.

Together, these findings make clear that distraction among younger drivers is not simply a matter of legal awareness but reflects deeper behavioral, environmental, and roadway dynamics. Crashes often occur in conditions perceived as safe such as daylight, dry pavement, clear weather, straight segments, underscoring the need for vigilance even when risks appear minimal. At the same time, survey responses reveal that while drivers recognize broader safety concerns, this recognition has not translated into sustained behavioral change.

Moving forward, aligning education, enforcement, technology, and roadway design strategies will be essential to address both the high frequency of urban distraction-related crashes and the disproportionate severity of rural outcomes. Equally important, improving survey recruitment of younger drivers will ensure that future analyses capture the perspectives of those most affected. Strengthening this evidence base will provide a foundation for targeted countermeasures and policies aimed at reducing distraction-related crashes and improving safety outcomes for Oregon's youngest and most vulnerable drivers.

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