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Affiliée à l'Université de Montréal

**COVID-19 effects on road safety and driving behaviors**

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Mémoire présenté en vue de l'obtention du diplôme de *Maîtrise ès sciences appliquées*

Génie Civil

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# **POLYTECHNIQUE MONTRÉAL**

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Ce mémoire intitulé :

## **COVID-19 effects on road safety and driving behaviors**

présenté par **Reza ZAREI**

en vue de l'obtention du diplôme de *Maîtrise ès sciences appliquées*

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## DEDICATION

*To my family,  
and my friends.*

## ACKNOWLEDGEMENTS

Dr. Nicolas Saunier,

I am deeply grateful for your extraordinary patience, thoughtful guidance, invaluable advice, and support throughout my entire master's journey. As my primary supervisor from the very beginning, you have been an inspiring figure, and I have learned immensely from your profound knowledge and expertise.

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## RÉSUMÉ

Cette thèse examine l'impact de la pandémie de COVID-19 sur la mobilité, les comportements de conduite à risque et la sécurité routière au Québec sur trois périodes, en 2019 (avant la pandémie), 2020 (pendant les mesures sanitaires) et 2023 (après la fin des restrictions) à partir de données auto-déclarées provenant d'un sondage. La mobilité et l'exposition ont chuté brutalement en 2020 et n'ont que partiellement retrouvé leur niveau en 2023. Les comportements à risque et les résultats de sécurité ont suivi une trajectoire en V : la plupart des risques et des quasi-accidents/accidents ont diminué en 2020 avant de remonter en 2023, les distractions technologiques (envoi de textos, regard sur l'écran, conversation mains libres), les excès de vitesse et la conduite en état de fatigue dépassant alors les niveaux avant la pandémie.

Six profils basés sur les comportements à risque ont été identifiés : conducteurs prudents, conducteurs à haut risque, excès de vitesse avec distraction technologique, conducteurs distraits par les écrans, conducteurs bavards au téléphone, et conducteurs texteurs. Tous les profils dangereux présentaient chaque année une probabilité significativement plus élevée de quasi-accidents que les conducteurs prudents, même en tenant compte des variables sociodémographiques, de l'exposition et des attitudes. Les hommes et les jeunes adultes étaient surreprésentés dans les profils les plus risqués. L'acceptabilité des comportements à risque s'est révélée être le prédicteur attitudinal le plus puissant de l'appartenance à un profil, tandis que la propension générale au risque et les orientations libertaires montraient des liens plus faibles ou non significatifs.

La pandémie a temporairement amélioré la sécurité routière en 2020, mais dès 2023, les comportements à risque en particulier les distractions liées aux technologies ainsi que les accidents et quasi-accidents (auto-déclarés) étaient plus élevés qu'avant la pandémie, traduisant un effet rebond accompagné de dégradations persistantes.

## ABSTRACT

This thesis investigates the impact of the COVID-19 pandemic on mobility, risky driving behaviors, and road safety outcomes in Québec across three periods: 2019 (pre-pandemic), 2020 (sanitary restrictions), and 2023 (post-restrictions) using self-reported data from a questionnaire. Mobility and exposure dropped sharply in 2020 and only partially recovered by 2023. Risky driving behaviors and safety outcomes similarly followed a V-shaped pattern: most risks and near-misses/crashes decreased in 2020 but rose again by 2023, with technology-related distractions (texting, screen-looking, hands-free talking), speeding, and fatigue driving exceeding pre-pandemic levels.

Six risky-behavior-based clusters were identified: Safe Drivers, High-Risk Drivers, Tech-Distracted Speeders, Screen-Distracted Drivers, Chatty Speeders, and Texting Drivers. High risk, Texting Drivers, Tech-Distracted Speeders, and Screen-Distracted Drivers exhibited significantly higher likelihood of near-misses and crashes in every year than Safe Drivers, even after controlling for socio-demographics, exposure, and attitudes. Males and younger adults were over-represented in the riskiest clusters. Acceptability of risky driving proved the strongest attitudinal predictor of cluster membership, while general risk-taking personality and liberty orientations showed weaker or no significant links.

The pandemic temporarily reduced participants reporting risky driving behaviours in 2020, but by 2023 risky behaviors particularly technology-based distractions and self-reported crashes and near-misses were higher than before the pandemic, indicating a rebound with persistent negative changes.

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## CHAPTER 1 INTRODUCTION

The COVID-19 pandemic was first identified in late 2019 and declared a global pandemic in March 2020. Governments introduced lockdowns, travel bans, and work-from-home policies to reduce the virus's spread that fundamentally changed daily mobility. Transportation systems were particularly affected, and global road traffic volume dropped sharply during the early lockdowns, with major cities reporting empty highways and roads. These conditions initially suggested that fewer vehicles on the road would likely lead to fewer crashes. Reports from road-safety agencies and empirical studies documented increases in dangerous driving behaviours during early pandemic conditions in Canada and USA, including speeding, distraction (e.g., phone use), and impaired driving, despite reduced traffic volumes (NHTSA, 2021; Vanlaar et al., 2021). Despite the reduction in traffic volume, road fatalities did not fall proportionally and in some cases rose during the pandemic, such as in the United States (Adanu et al., 2021), (NHTSA, 2021). In Canada, national collision statistics and pandemic-era survey evidence also point to persistent road-safety concerns and increases in some risky behaviours during the pandemic (Canada, 2023; Vanlaar et al., 2021). In Québec specifically, road-safety reporting indicates that fatalities did not simply decline in proportion to mobility changes, and pandemic-related conditions form part of the recent road-safety context (SAAQ, 2022; SAAQ, 2024). This thesis examines the impact of COVID-19 on changes in risky driving behaviors and road safety in Québec across key periods. Early investigations by traffic safety agencies, such as the NHTSA, further supported these findings, attributing the spike in deadly crashes to drivers engaging in exceptionally risky behavior under pandemic conditions (NHTSA, 2021). More broadly, national collision statistics show that fatalities and serious injuries remained substantial in Canada in the post-restriction period (Transport Canada, 2023).

While these prior studies have shed light on the pandemic's impact on road safety, important gaps remain. Most existing research focused on the early months of COVID-19 providing only a short-term snapshot. For example, studies by (Katrakazas et al., 2020) and (Wagner et al., 2020) examined data from the spring of 2020 but did not track whether behavioral changes persisted into the later "new normal" period, referring to the phase after initial lockdowns where some restrictions remained or were gradually lifted (2021 and beyond). These analyses quantified changes in crash counts and traffic speeds but did not delve into the reasons drivers took more risks or whether the

patterns persisted once restrictions ended. In Québec, the public health emergency that began in March 2020 was terminated in June 2022. This leaves unresolved questions:

Were certain demographics (young males or experienced drivers) more prone to increased risk-taking behaviors across pre-pandemic (before fall 2019), during the pandemic (fall 2020), and post-pandemic periods (fall 2023 when we start our questionnaire)?

Did drivers' personal attitudes, for instance, a strong desire for personal freedom and general risk-taking personality influence their compliance with traffic laws from before COVID-19 to after?

Crucially, have these risky driving patterns reverted to pre-pandemic levels, or do they represent a more lasting shift in driver behavior?

The lack of comprehensive, long-term, and behaviorally informed analysis is a significant research gap. Various research discussed above showed unexpected outcomes with respect to traffic safety; however, it is not clear whether there was a shift in attitudes and dangerous driving behaviours in Québec as a result. Addressing this gap matters because understanding how the COVID-19 pandemic influenced road safety outcomes in Québec is essential for developing effective road safety policies. This thesis also situates its contribution within current road safety practice, where approaches such as the Safe System and Vision Zero emphasize preventing serious harm through both behavioral and system-level countermeasures; these concepts are reviewed in Chapter 2. In summary, the main research question guiding this thesis is: how did the COVID-19 pandemic influence driving behaviors and road safety in Québec, and to what extent did these changes persist from 2019 (pre-pandemic) through 2020 (during) and 2023 (post)?

The primary objective of this research is to investigate changes in risky driving behaviors in Québec province across three distinct time periods: before the COVID-19 pandemic, during the initial lockdown phases, and in the period following the removal of most pandemic restrictions (following the removal of most pandemic restrictions in Québec by June 2022, when the provincial state of emergency ended and measures like mask mandates on public transportation were lifted). The study also seeks to explore how these behavioral patterns vary across different socio-demographic groups, such as age, gender, income, and employment status, to determine whether certain populations were more prone to increased risky driving. In addition, the research examines the role of attitudinal factors, including general risk-taking tendencies and perceptions of personal liberty, in shaping driving behavior. This involves assessing whether individuals with stronger pro-

liberty views or higher tolerance for risk were more likely to engage in unsafe driving practices, such as speeding or violating traffic rules.

Three specific objectives guide the analyses: 1) Quantify changes in mobility and risky behaviors across Fall 2019, Fall 2020, and Fall 2023; 2) Identify distinct driver profiles and their evolution across these periods; and 3) Determine which socio-demographic and attitudinal factors predict risky profiles and near-misses/crashes.

To investigate the stated objectives, this thesis employs an online survey. Data were collected in Québec about three key periods: 2019 (pre-pandemic), 2020 (during the pandemic), and 2023 (post-pandemic restriction period). The survey captured self-reported information on demographics, mobility frequencies, risky driving behaviors along with attitudinal measures and respondent experiences of crashes/near-misses.

This introductory chapter is followed by a series of chapters that collectively provide a logical progression of the research: Chapter 2 presents the literature review; Chapter 3 describes the methodology; Chapter 4 covers the data analysis; Chapter 5 discusses the results; Chapter 6 examines the clustering; and finally, Chapter 7 provides the conclusion, discussion, and limitations. Statistical analyses include multinomial logit models for cluster determinants (Ch. 6.2) and logistic regressions for near-miss/crash outcomes (Ch. 6.3). Changes in cluster membership over time are visualized using Sankey diagrams (Ch. 6.1.3).

## CHAPTER 2 LITERATURE REVIEW

This literature review examines the existing studies on COVID-19's global and regional impacts, establishing the necessary background and identifying relevant insights that inform the current research objectives.

### 2.1 Introduction to COVID-19's global and regional impacts

In December 2019, the COVID-19 pandemic was formally recognized by the World Health Organization (WHO). Over 3.5 million individuals worldwide have caught the virus in early 2020 and COVID-19 has had a significant impact, fundamentally changing people's daily lives all across the world (Menon et al., 2020; Shaik et al., 2021)

The global economy, healthcare systems, psychological processes, and transportation infrastructure have been significantly impacted by the COVID-19 pandemic. To mitigate the spread of the coronavirus, many countries implemented social segregation policies that restricted population movement, leading to reduced social interactions. These concerns prompted both governmental countermeasures and individual behavioral changes to combat the virus, such as stay-at-home orders to prevent its spread. These changes in societal behavior have had consequences across various domains of daily life during the pandemic, including severe disruptions to transportation systems that led to significant limitations in travel and mobility (Carteni et al., 2020; Cusack, 2021; Katrakazas et al., 2020; Liu et al., 2022; Nouvellet et al., 2021). In response to the lockdowns and stay-at-home directives described above, public authorities, employers, educational institutions, and households rapidly scaled up existing 'non-travel' substitutes like teleworking, online education, and online shopping. Employers shifted eligible tasks to telework on an unprecedented scale (for example, around 39% of EU employees worked from home in April 2020), supported by government guidance and emergent organizational policies (Ahrendt et al., 2020; Belzunegui-Eraso & Erro-Garcés, 2020; International Labour Organization, 2020; Vargas Llave, 2022). Schools and universities closed physical campuses and shifted to remote instruction under national and subnational mandates, as captured by the Oxford COVID-19 Government Response Tracker's school-closure indicators (Hale et al., 2021). Retail restrictions and mobility limits likewise accelerated e-commerce adoption, with transaction-level evidence from 47 economies showing large and persistent shifts toward online retail (Cavallo et al., 2022).

Different modes of transportation saw different degrees of traffic volume reduction because of the COVID-19 epidemic. Demand for public transportation decreased the highest while demand for biking and bike sharing decreased the least, and even increased in some places (Bucsky, 2020). The most significant change in the modal split was the shift from public to private transportation, as evidenced by the rise in cycling popularity and car sales.

### 2.1.1 Canada

The population of Canada on the second quarter of the 2024 is 41,548,787 (Canada, 2020). Canada has a road network of 1,304,100 km with a total number of 26.2 million road motor vehicles registered in 2022 (Canada, 2020), (Canada, 2023). Data from 1999 to 2022 indicate a general improvement in road safety outcomes. Over the period 2010 to 2023, the number of fatalities decreased overall, although some years showed temporary increases and fatalities rose again in 2022 and 2023 (Figure 1).

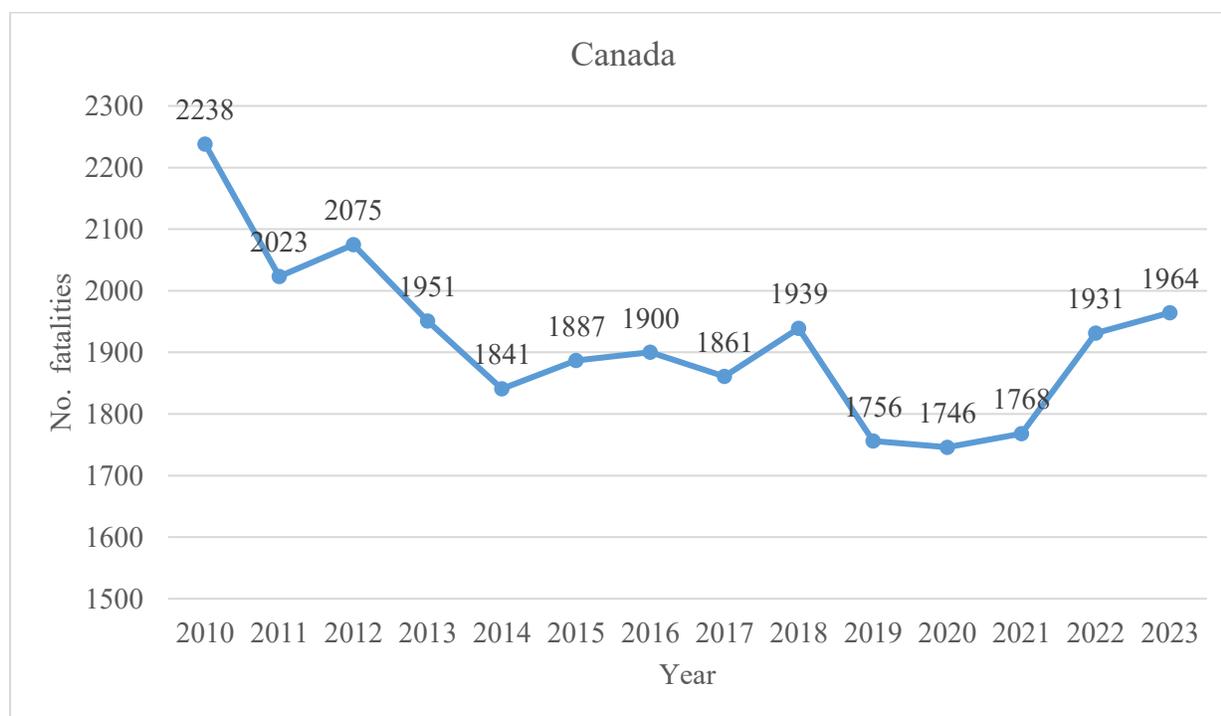


Figure 1 Number of fatalities from 2010 to 2023 in Canada (fatalities include all those who died as a result of a reported traffic collision within 30 days of its occurrence) (Canada, 2023).

The pattern is the same if we look at the total number of injuries in Canada from 2010 to 2023 (Figure 2).

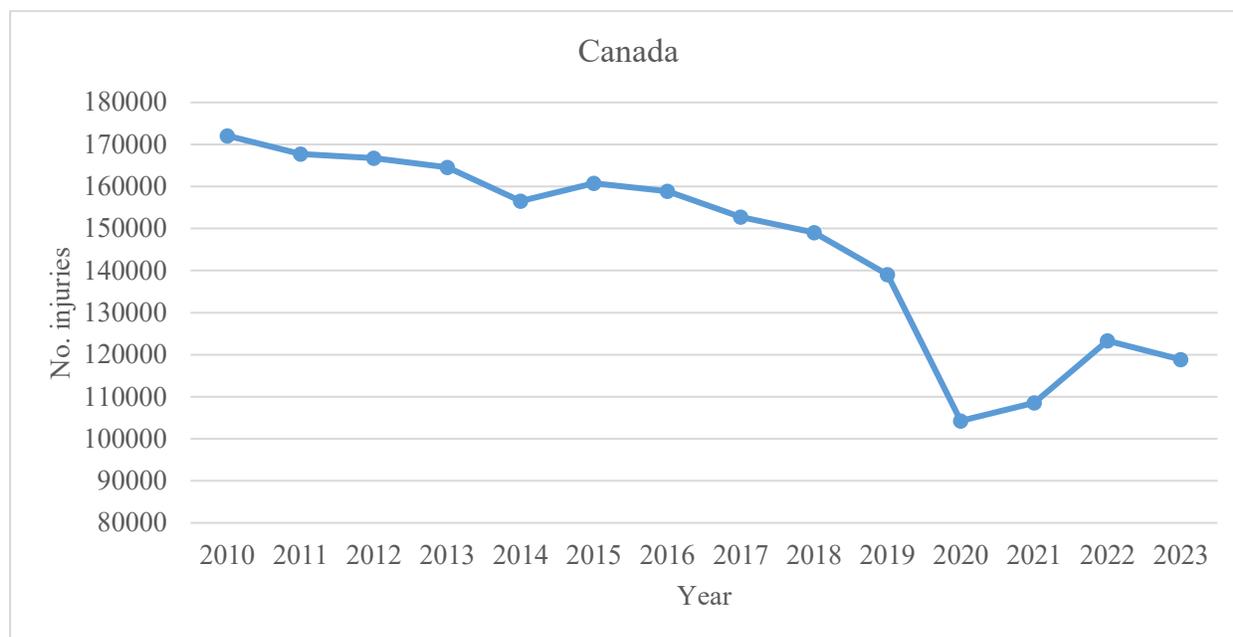


Figure 2 Number of injuries from 2010 to 2023 in Canada (Injuries include all reported severities of injuries ranging from minimal to serious) (Canada, 2023).

Evidence from a Canadian survey found that during the pandemic a minority of drivers reported being more likely to engage in risky driving behaviours such as speeding, distraction and impaired driving compared with pre-pandemic levels (Lyon et al., 2024). In the U.S., the number of fatalities resulting from crashes unexpectedly increased from 36,355 in 2019 to 38,824 in 2020 (a 6.8% increase) during the COVID-19 pandemic. Over the same period, the fatality rate per 100 million VMT went from 1.11 in 2019 to 1.34 in 2020, a 21% increase, even though VMT, trips per day and accident rates decreased ((DOT), 2022). State-level evidence from Utah shows crash frequency fell while severity rose from the lockdown to the ‘new normal’ period (i.e., the phase following the lockdown, beginning after the state-wide mask mandate expired on April 10, 2021, as the state shifted toward living with COVID-19) (Gong et al., 2023).

### 2.1.2 Québec province

Québec’s population reached 9.11 million on January 2025 according to the Institut de la statistique du Québec. (Québec, 2024). Québec has over 325,000 km of roads, including roughly 31,000 km of principal highways managed by the Ministry of Transport and Sustainable Mobility; the rest are

municipal, local, or resource-access routes (durable, 2023). And similar to national Canadian patterns, Québec's trends (Figure 3 and Figure 4) show road fatalities remaining roughly level at first and then exceeding pre-pandemic levels by 2022-2023, while total injuries dropped sharply in 2020 during periods that coincided with COVID-19 restrictions and reduced mobility (Québec, 2024).

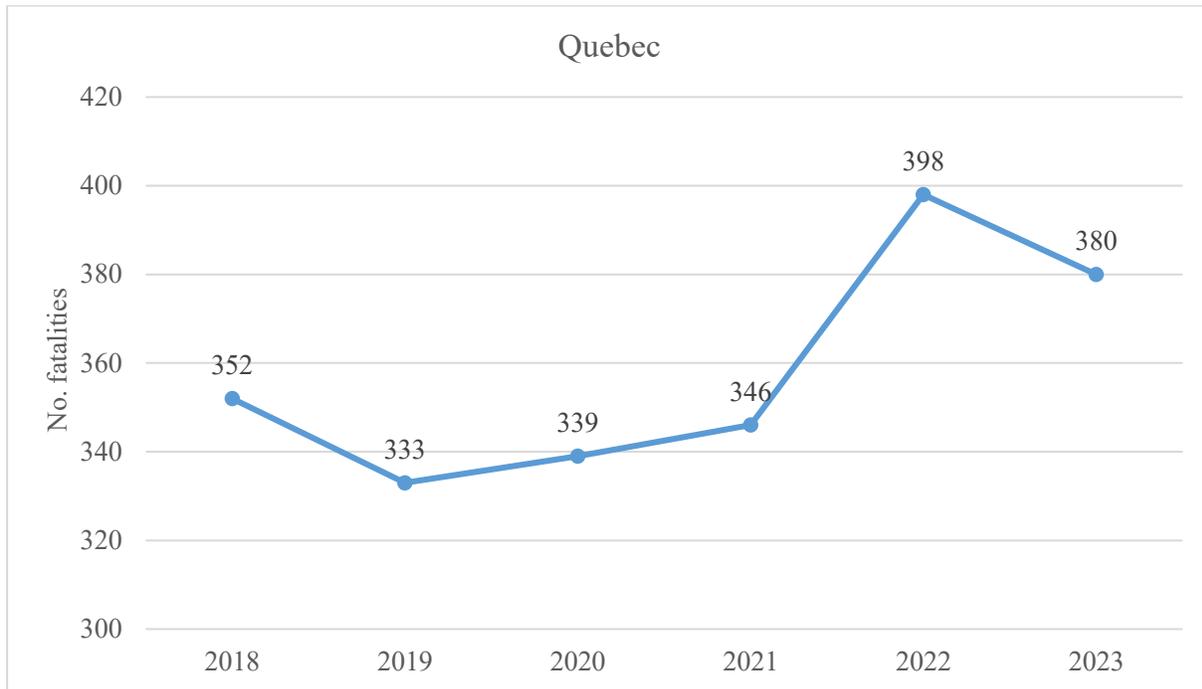


Figure 3 Number of fatalities in the province of Québec

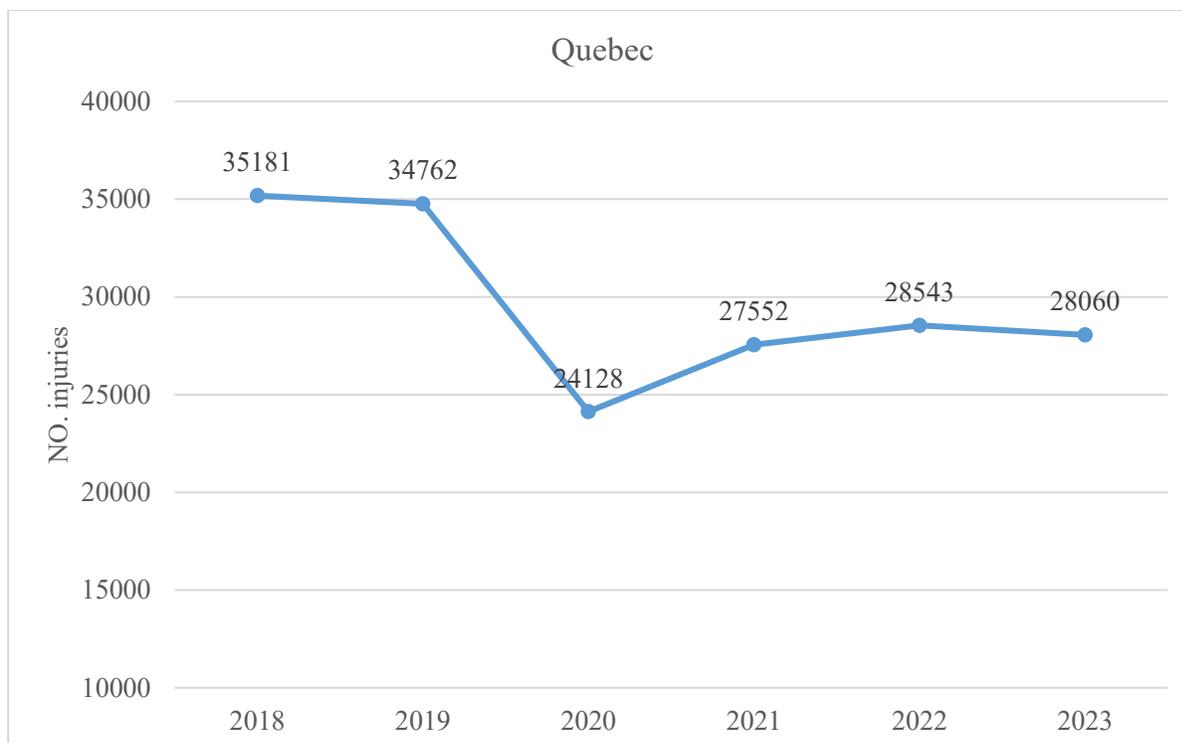


Figure 4 Number of minor and sever injuries in the province of Québec

Overall, the trends in Canada and Québec province highlight shifts in collision patterns during the COVID-19 era that are consistent with changes in exposure (mobility) and risk (behaviours), motivating the present survey-based analysis of behavioural and attitudinal mechanisms.

## 2.2 Impacts on collisions, travel patterns and mobility shifts

### 2.2.1 Changes in travel patterns and mobility shifts

The changes in travel demand, volume and vehicle miles traveled (VMT) as a result of the pandemic had a notable impact on traffic safety. Such decreases in travel lowered exposure to traffic danger on the road. U.S. data showed an increase in the proportion of the population who stayed home, with the highest rates for the year of 2020 being 29% in November and 28.9% in December. During the initial stages of the pandemic, a higher proportion of road users were males and younger individuals, as they were less likely to stay home (NHTSA, 2021). A 2020 study suggested that public transportation might not fully regain its pre-pandemic ridership levels in the United States. However, the data indicated that many respondents wanted to increase their daily use of bicycles and walking. It should be noted that the sample included people who had greater incomes and levels of education than the majority of Americans (Conway et al., 2020). Prior to and

during the COVID-19 pandemic, Canadian respondents were asked to indicate their preferred mode of transportation. Before COVID-19, most employed Canadians (about 80%) usually traveled to work by private vehicle, while roughly 12% used public transit and 7% used walking or cycling. Québec health data also indicate that shifts toward active modes during lockdowns can be associated with increased injury burden. Using Québec hospitalization data (2006-2021) and interrupted time-series methods, Auger et al. (2023) found a marked increase in cycling injury hospitalizations during the first COVID-19 lockdown, and the mechanism profile indicates that these injuries were predominantly falls (single-cyclist events) rather than collision-related injuries. This evidence aligns with the broader interpretation that pandemic-related mobility changes can alter injury outcomes, reinforcing the importance of examining not only total mobility reduction but also shifts in who travels and how (Auger et al., 2023).

During the pandemic (May 2021), public transit commuting fell to 7.8% and driving rose to 84%, with active modes holding at about 6%. Although transit has been regaining (10.1% in May 2023), it remains below pre-pandemic levels (Canada, 2023). Due to the restrictions, the number of trips declined during the pandemic, leading to less congestion and lower traffic flow on streets. The general belief during the pandemic was that roads were safer compared to pre-pandemic times and that drivers' behavior had improved (Vallejo-Borda et al., 2022), (Alhajyaseen et al., 2022) .

### **2.2.2 Impacts on collisions and traffic safety**

The interpretation of road safety in this thesis is informed by Vision Zero and the Safe System approach. Vision Zero sets the ethical goal that deaths and serious injuries are not an acceptable cost of mobility, while the Safe System approach operationalizes this goal by designing a road transport system that anticipates human error and limits crash forces to survivable levels through shared responsibility across road users, vehicles, infrastructure, speeds, and post-crash care. Whereas traditional road safety approaches often emphasize changing individual road user behaviour, Vision Zero and the Safe System approach place stronger emphasis on changing the environment (safe roads, safe vehicles, safe speeds) to reduce risk and injury severity. In Canada, Road Safety Strategy 2025 explicitly adopts a Safe System approach (“Towards Zero”), providing a relevant framework to interpret pandemic-era shifts in exposure and risky behaviours in Québec (Canadian Council of Motor Transport Administrators, 2016).

According to a comparative analysis of U.S. traffic collision data conducted by the National Highway Traffic Safety Administration (NHTSA), there were fewer collisions in 2020 compared to 2019. However, since the onset of the pandemic, there has been a significant increase in highway fatalities per 100 million vehicle miles traveled (VMT). Despite the lower number of collisions (NHTSA, 2021), there was a concerning increase in the number of deadly car crashes from 2019 to 2020 in the United States (U.S. Department of Transportation ((DOT)), 2022 ). There is a clear correlation between VMT and crashes in New York City, where there were significantly fewer collisions as a result of the changes to traffic volume, with about 1.7% fewer collisions for every 1% decrease in traffic volume. Conversely, lower traffic levels were linked to a rise in injuries and fatalities over the relevant range; more precisely, there was an increase in the number of fatalities of 0.003 for every 1% decrease in traffic volume and an increase in the number of injuries of 0.44 for every 1% decrease in traffic volume (Cappellari & Weber, 2022). In Sweden, the significant reduction in crash frequency (reduction in total crashes such as fatal and severe injuries) during the COVID-19 pandemic indicates the importance of the pandemic for traffic safety. The most successful intervention during these periods was the combination of speed limit changes and the introduction of safety cameras, both of which were reported as effective in reducing fatalities and severe injuries (Zheng et al., 2024). The implementation of COVID-19 preventative measures resulted in a reduction of the overall number of road crashes in Greece and Saudi Arabia, according to a study conducted jointly by researchers from both countries (Katrakazas et al., 2020).

The severity of injuries sustained by individuals involved in motor vehicle crashes increased significantly in the U.S. following the declaration of the COVID-19 as a public health emergency in March 2020. This rise in crash severity can be attributed to changes in driving behavior during the pandemic, including decreased seat belt usage, as indicated by increased rates of ejections from vehicles, and higher incidences of drug usage among drivers and motorcyclists. Furthermore, data analysis reveals that traffic speed also contributed to the increased severity of crashes during the COVID-19 pandemic period (NHTSA, 2021). The pandemic is associated with several changes in dangerous behaviors. The decrease in traffic volumes due to lockdowns led to an increase in road speeds along with more frequent instances of harsh acceleration and braking in Greece and Saudi Arabia. Moreover, a 42% increase in mobile phone use while driving per 100 km driven was observed during the peak period of COVID-19 spread (Katrakazas et al., 2020). A reasonable

explanation for the greater fatality rate and rate of slight injuries would be the higher speed, speeding, and harsher braking per distance, all of which were noted in Greece during the lockdown time (Katrakazas et al., 2020). Previous research shows that faster driving speeds is associated with a higher risk of a serious collision (Sekadakis et al., 2021). Studies show that travel for purposes other than work during the pandemic significantly increased the risk of crash-related injuries for drivers, pedestrians, and motorists. The rise in leisure cycling and walking was related to widespread stay-at-home orders and shifts in non-work trips, and changes in these non-work trips were associated with higher crash injuries for drivers, pedestrians, and cyclists. This emphasizes how important it is to monitor driving behaviors and implement speed management strategies during the pandemic's later waves as well as after the end of COVID restrictions to reduce traffic collision casualties (Dong et al., 2022). Because driving environments, enforcement, and mobility restrictions vary substantially across countries, international findings (e.g., Greece, Saudi Arabia) are interpreted here as context-specific illustrations rather than direct analogues to Québec, and the thesis prioritizes Canadian and Québec evidence wherever available.

In Québec, region-level evidence further illustrates how COVID-19 interventions were linked to road safety outcomes. Using interrupted time-series analyses covering 2015-2022 across Québec's 17 administrative regions, a Québec non-pharmaceutical interventions (NPI) index (based on 58 interventions) was constructed by Ignacio Nazif-Munoz et al. (2024) and was then used to assess associations with collisions, light injuries, severe injuries, and fatalities. The index was associated with substantial reductions in collisions and light injuries across all regions, while severe injury reductions were observed in a subset of regions (including Montréal, Laval, Outaouais, Laurentides, Lanaudière, and Montérégie). In contrast, no concomitant changes in traffic fatalities were observed across regions, highlighting that reduced exposure and fewer collisions do not necessarily translate into proportional reductions in fatalities (Ignacio Nazif-Munoz et al., 2024).

Complementing the province-wide analysis, five Québec cities (Montréal, Québec City, Laval, Longueuil, and Sherbrooke) were examined using Poisson interrupted time-series models (2015-2022) to evaluate how (non-pharmaceutical interventions) NPI related specifically to alcohol-related and speed-related traffic injuries, including fatalities and serious injuries (Nazif-Munoz et al., 2025). The results suggested a nuanced pattern; alcohol-related injuries decreased during more stringent NPI periods, particularly in Montréal, Québec City, and Longueuil. In contrast, the patterns for speed-related injuries were not consistent across cities and the study reported increases

in Montréal and Laval, whereas the remaining cities did not show clear changes across the pandemic semesters examined. These Québec findings support the need to consider behavior-specific mechanisms (e.g., impaired driving vs speeding) when interpreting pandemic-era road safety patterns (Nazif-Munoz et al., 2025).

### **2.3 Changes in dangerous driving behaviors**

Drivers were found to engage in risky driving activities during the COVID-19 pandemic. These behaviors include speeding, driving while distracted, driving while under the influence of alcohol or drugs, using multiple substances while driving, and not wearing a seat belt. It is significant that these unsafe driving habits have reportedly increased in frequency compared to before the pandemic. Such actions are likely to raise the risk of traffic accidents, endangering not only the driver but also other road users (Woods-Fry et al., 2021). Traffic violations are not the same as simple mistakes in how people drive. Violations involve deliberately ignoring the rules that keep a dangerous activity like driving safe. Mistakes, on the other hand, arise from cognitive processing limitations and can be mitigated through appropriate training. In short, violations are intentional and shaped by people's attitudes and personality (Oppenheim et al., 2016).

Canadian evidence from large, representative surveys also supports the interpretation that the pandemic affected risky driving for a minority of drivers. Using the Traffic Injury Research Foundation's Road Safety Monitor (RSM) survey administered to representative samples of Canadian drivers (N=1,500) and U.S. drivers (N=1,501), most drivers indicated no change in risky driving during the pandemic compared with pre-COVID, while smaller proportions reported being less likely to engage in risky behaviors (Vanlaar et al., 2021). Importantly, a notable minority reported being more likely to engage in risky behaviors; in Canada, the behaviors most commonly reported as increasing were speeding and distracted driving, with higher reported increases among U.S. drivers overall (Vanlaar et al., 2021). More recently, the Canadian Road Safety Monitor data was used to compare self-reported travel modes, substance use, and risky driving behaviors before and during the pandemic (Lyon et al., 2024). Personal vehicle and pedestrian travel increased along with large declines in public transit use during the pandemic. While most respondents reported no change in risky driving frequency, a minority reported increases; the behaviors most often reported as occurring more frequently during the pandemic included driving when likely over the legal alcohol limit and driving within two hours of using drugs. The regression results further indicated that increasing age was associated with lower odds of reporting increased risky driving during the

pandemic, reinforcing age as an important correlate when interpreting behavioral change (Lyon et al., 2024).

### **2.3.1 Speeding**

According to a survey conducted in Canada, it was found that during the COVID-19 pandemic, a total of 7.4% of Canadians confessed that they were more prone to exceed the posted speed limit by at least 20km/h, compared to their behavior before the pandemic (Woods-Fry et al., 2021). In the United States, a national survey was conducted to assess drivers' attitudes and behaviors towards speeding, revealing that half of the respondents aged 16 to 20 were classified as speeders, in contrast to only 15% of drivers aged 65 or older. The results also showed that younger and male drivers were more likely to speed compared to their older and female counterparts. Furthermore, those who were classified as speeders were found to engage in other risky driving behaviors. The study also found that younger adult drivers and those with a greater tendency for risk-taking and sensation-seeking were more likely to exhibit riskier speeding behaviors. This behavior was exacerbated by the decrease in Vehicle Miles Traveled (VMT) during the COVID-19 pandemic, as open roads provided more opportunities for speeding. Additionally, traffic safety enforcement activities were also limited during this period (Wagner et al., 2020).

### **2.3.2 Distracted driving**

Distracted driving has long been recognized as a prevalent and serious road safety issue, with systematic reviews highlighting high engagement rates in various distracting activities, particularly mobile phone use, and its detrimental effects on driving performance, including increased lane deviations, reduced speed management, and elevated crash risk (Oviedo-Trespalacios et al., 2016). This concern contributes minimally to pedestrian fatalities compared to vehicle-related factors (Ralph & Girardeau, 2020). During the COVID-19 pandemic, these risks appear to have intensified: in a study in 2021, 7.4% of Canadians acknowledged being more likely to engage in distracted driving during the COVID-19 pandemic compared to their pre-pandemic behavior. This represents a significant increase from the 4.2% of drivers who reported engaging in distracted driving in 2020. The rise in distracted driving during the pandemic is concerning, as it can result in more crashes and injuries on the road (Woods-Fry et al., 2021).

### **2.3.3 Impaired driving**

3.8% of Canadians claimed that during the pandemic they were more likely to drive after using alcohol and drugs. 4.1% of Canadians claimed that they were more likely to drive within two hours

of drinking alcohol during the pandemic than they were prior to COVID-19, while for drug use it was 3.7%. The drug positivity for drivers whose blood samples were taken at participating trauma centers and who were critically injured or killed in collisions was examined on a quarterly basis. The overall use of cannabis was much higher compared to alcohol among drivers who had experienced severe or fatal injuries. The overall use of cannabis was much higher compared to alcohol among drivers who had experienced severe or fatal injuries (NHTSA, 2021).

### **2.3.4 Seat belt**

The national seat belt usage rate in the US was 90.7% in 2019 while 43% of passengers who died in crashes in 2018 were not wearing seat belts. According to state-level data in the US, seat belt usage decreased during the second quarter of 2020, with unrestrained fatalities rising by 15.4% percent in Virginia. After the introduction of stay-at-home orders, ejections per 100 crashes when emergency medical services (EMS) were called significantly increased and were higher than during the same period in 2019. Prior to the epidemic, it was known that drivers in rural areas, those who were male, between the ages of 18 and 34, and those who were older had lower rates of seat belt use (Beck et al., 2017; Kargar et al., 2023). Additionally, these motorists are less likely to think that others are required to use seat belts or feel pressure from others to do so (Wagner et al., 2020). 4.2% of Canadians overall reported that they were less inclined to fasten their seats up while driving during the pandemic than they were before COVID-19 (Woods-Fry et al., 2021), and this Traffic Injury Research Foundation (TIRF) Road Safety Monitor survey is used in this thesis as a key Canadian comparator because, like the present study, it relies on self-reported survey data collected during the pandemic (Woods-Fry et al., 2021).

This national study reported that only a minority of drivers indicated increases in behaviours such as speeding, distraction, impaired driving, and reduced seatbelt use. Because both the TIRF study (Traffic Injury Research Foundation, 2024) and the present thesis use self-reported surveys, comparison is mainly interpreted in terms of direction and relative magnitude of change and in how this thesis extends the approach by analysing behavioural profiles (clusters) and linking them to attitudes and outcomes within a Québec sample across 2019-2020-2023.

## **2.4 Psychological, attitudinal and personality factors**

### **2.4.1 Psychological effects**

There is a significant amount of psychological discomfort that is generated by the growth of infectious illnesses in society, which makes individuals more fearful and anxious and less trusting

of mental health services (Fardin, 2020). The COVID-19 pandemic had detrimental consequences on human health, including changes in sleep, mood instability, stress, and anxiety; key stressors were fear of infection, job loss, and social isolation (Panchal et al., 2020). Psychological traits like impulsivity, risk aversion, and risk perception are associated with low seat belt use rates in addition to demographic traits, and non-seat belt wearers are more likely to engage in other risky driving behaviors like speeding, traffic violations, and driving while intoxicated (Wagner et al., 2020)

These psychological impacts were also evident in transportation. Strict lockdown measures and the associated large loss in personal mobility contributed to heightened psychological stress, anxiety, and fatigue among motorists, while reduced traffic volumes created opportunities for risky behaviors such as speeding and distraction, potentially accelerating inattentive and aggressive driving (as discussed in section 2.3). An internet-based survey conducted in Italy asking participants to describe their own and other drivers' driving behaviors was carried out to test this hypothesis (Lopetrone & Biondi, 2023). According to the findings, respondents themselves tended not to engage in reckless driving or other potentially distracting activities, whether for personal or professional reasons. However, compared to the period prior to the epidemic, respondents said they saw more instances of obnoxious and distracted drivers on the road after March 2020 (Lopetrone & Biondi, 2023). For professional drivers, work intensification coupled with work related stress increased their risk of collision (Jakobsen et al., 2023). In one survey conducted in 2020 in Delhi, India, most participants reported having one or more psychological problems. The study also discovered that a large percentage of people are likely to suffer higher levels of stress and anxiety which may have an impact on how they drive (Karras et al., 2022). For instance, most respondents were inclined to drive recklessly, be distracted while using one or more modes of transportation and felt uncomfortable when driving in a vehicle with people (Singh et al., 2022).

#### **2.4.2 Sensation seeking and risk-taking**

Sensation seeking is associated with several dangerous driving behaviours. Sensation seeking is defined as a personality trait characterized by the desire for varied, novel, and complex sensations and experiences and a willingness to take physical and social risks for such experiences (Schmidt et al., 2017). There is a strong association between sensation seeking and risky driving (Bates et al., 2024). High sensation seekers are more likely to commit driving violations, receive higher scores for risky driving and be involved in crashes more often. This includes behaviors like driving while impaired or speeding (Oppenheim et al., 2016), aggressive driving, crash involvement, and

receiving tickets (Bates et al., 2024). As a result, sensation-seeking was found to predict violations such as speeding (Oppenheim et al., 2016), (Delhomme et al., 2012).

### **2.4.3 Attitudes toward acceptability and liberty**

Attitudes toward liberty, reflecting perceptions of personal freedom and resistance to government regulations vary by political ideology and influence the acceptability of traffic rule violations, contributing to risky driving behaviors such as distracted phone use (Irmak et al., 2020). Among conservatives, a stronger emphasis on individual liberty leads to greater psychological reaction against regulatory acceptance such as traffic laws viewed as threats to autonomy resulting in lower obedience and increased risky behaviors like mobile phone usage while driving despite prohibitions by laws (Irmak et al., 2020). In contrast, liberals tend to show less reaction to regulations aimed for safety, displaying higher compliance with traffic laws and reduced propensity for conscious law breaking (Irmak et al., 2020). On the other hand, the acceptability of violating traffic rules is connected with low sensation seeking: risk avoiders who are associated with low sensation seeking show limited tolerance for violations, firmly follow the rules and show little variation in abnormal behaviours like mistakes or inattention errors (Rimmö & Åberg, 1999). Situational Risk Takers may participate in violations on a conditional basis, such as context-dependent mistakes that result in inconsistent and dangerous patterns caused by immediate circumstances such as exposure or cognitive failures, rather than planned thrill-seeking (Rimmö & Åberg, 1999). Sensation Seekers, motivated by thrill and adventure, are highly accepting of deliberate rule violations, pursuing stimulation through actions such as speeding or impaired driving, with correlations to risky behaviours and significantly predicting violations rather than errors (Jonah, 1997).

## **2.5 Demographic influences on driving behavior**

### **2.5.1 Age and experience**

Age and driving experience serve as critical demographic influences on risky driving behaviors with patterns evolving notably during the COVID-19 pandemic due to altered mobility (Aluja et al., 2023). Younger drivers, particularly those under the age of 25, exhibited heightened risky behaviours such as speeding and distractions during the pandemic. With reduced traffic volumes creating a false sense of safety on emptier roads, these novice drivers who often lacked sufficient experience were more prone to dangerous actions, contributing to elevated severe injury risks in crashes, especially in urban areas (Ghosh et al., 2025). For example, in examining self-reported

behaviors, teens and younger adults reported more frequent distractions like cell phone use while driving during lockdowns with teens being particularly vulnerable to crash involvement due to inexperience and underdeveloped risk assessment skills (Javid et al., 2022). This is consistent with pre-pandemic patterns in which younger drivers tend to drive too fast due to inexperience and immature risk assessment, a tendency that was increased by COVID-19 restrictions as empty roads encouraged overconfidence and thrill-seeking (McCarty & Kim, 2024). Sensation seeking increases during childhood and teenage years then drops around age 20 and keeps decreasing consistently afterward, explaining why young drivers engage in more behaviours such as aggressive driving or impaired driving than their older counterparts (Aluja et al., 2023), (Bates et al., 2024). In contrast, experienced drivers, often older, may display higher speeding tendencies due to perceived superior control and underestimation of objective risks from a lack of recent negative experiences; however, during the pandemic older adults (over 65) significantly reduced their driving frequency, trips and overall exposure, leading to fewer incidents, highlighting age-related cautiousness in response to safety concerns (Roe et al., 2022). Overall, the findings highlight that while youth and inexperience increase risks through impulsivity and poor judgment, more experience may lead to more confidence. Pandemic conditions may have increased differences between age groups (Al-Hussein et al., 2022).

### **2.5.2 Gender role**

Gender role is a more valid predictor of driver behavior than biological sex. A person with a more masculine identity is more likely to engage in behaviors considered more dominant, competitive, and autonomous which aligns with risk-taking as a typically masculine behavior (Oppenheim et al., 2016). In contrast, feminine gender roles frequently correlate with greater caution, lower violation rates and reduced accident involvement. Studies show that including gender role measures results in superior predictive models for behaviours like traffic violations and anger expression compared to sex alone (Oppenheim et al., 2022). Cross-cultural research reveals complex interactions in which gender differences in risk attitudes evolve with experience: for example, male drivers' lower perceived behavioural control, higher speeding and stronger intentions to speed and greater acceptance of violations increased risky driving behaviours (Granie et al., 2021), (Oppenheim et al., 2022), (Warner et al., 2009).

## 2.6 Hypothèses

Based on previous research, the following research question and hypotheses are proposed. The main research Question is the following: did the COVID-19 pandemic lead to a shift toward more dangerous driving behaviours and worsened road safety outcomes (increased near-misses and crashes) between the pre-COVID (2019), COVID (2020) and post-restriction (2023) periods in Québec province?

The following hypotheses are made:

- $H_{Covid}$  (COVID): compared with 2019 (pre-COVID), drivers in 2023 have: a higher likelihood of reporting at least one near-miss or at least one crash over the period 2019-2023. (increased near-misses and crashes)?
- $H1_A$  (Age): in 2023, compared with older drivers, younger drivers have higher likelihood of reporting more frequent risky driving behaviours. Older drivers may still have more crash/near-miss involvement because of age-related factors (Cooper et al., 1995).
- $H2_G$  (Gender): for 2023, male drivers have a higher likelihood of reporting more frequent risky driving behaviours than female drivers. Male drivers are more likely to engage in aggressive and risky driving behaviors (e.g. speeding, distracted driving, driving under the influence of alcohol) than female drivers, along with their higher sensation-seeking traits and more self-reported crashes/near-misses (Cordellieri et al., 2016).
- $H3_{Exp}$  (Driving Experience): for 2023, lower driving experience is associated with a higher likelihood of reporting more frequent risky driving behaviours. More driving experience is related to lower involvement in traffic near-miss and crashes and violations. Inexperienced drivers (regardless of age) will be more likely to commit traffic violations or be more involved in crashes/near-misses than drivers with more driving experience (Rowe et al., 2022).
- $H4_{Loc}$  (*Urban vs. Rural*): for 2023, relative to large urban areas, rural/small-town residence is associated with higher likelihood of reporting more frequent risky driving behaviours. Drivers living in rural areas are more likely to engage in risky driving behaviors (such as speeding on empty roads, not wearing seat belts for short trips, and driving after drinking) compared to drivers in large urban areas. This difference may be particularly pronounced for younger drivers in rural communities due to cultural norms and lower perceived enforcement ((NCSA), 2024).

- General risk-taking personality in this thesis refers to a broad tendency to seek or tolerate risk and to disregard social and legal constraints across situations. In line with the E-Survey of Road Users' Attitudes (ESRA) programme, and specifically its third wave (ESRA3), this construct is treated as a road-user related factor that can help explain why some individuals more often place themselves in hazardous situations and experience crashes, alongside exposure and infrastructure effects. ESRA3 emphasises the distinction between subjective safety, risk perception, and risk taking, and highlights the role of internal factors (such as personality and attitudes) in shaping how people evaluate and accept risk in traffic (Meesmann & Wardenier, 2024; Furian et al., 2024). The questions/statements relate to general attitudes are as follows:

- "I consider myself a risk taker."
- "I often do risky behaviour that I know those close to me would disapprove of."
- "The greater the risk, the more fun the activity."
- "I often think about doing risky behaviour that I know society would disapprove of."
- "I do not let the fact that something is illegal stop me from doing it."
- "I feel unsafe when riding with a careless driver."

The six statements used here are intended to capture a general propensity to engage in risky behaviour, rather than transport-specific attitudes. This operationalisation is consistent with previous work that links general risk-taking and deviant tendencies to risky driving and crash involvement (Akbari et al., 2019). Higher scores on this scale are therefore interpreted as indicating a stronger general risk-taking personality, which can then be related to membership in risky driving behaviour clusters and to near-miss and crash outcomes. The corresponding hypothesis is H5GR: in 2023, higher general risk-taking personality scores are associated with a higher likelihood of reporting at least one near-miss or crash in 2023.

- In ESRA3, acceptability of risky behaviour is treated as a distinct component of road safety culture, separate from self-reported behaviour and from risk perception. The ESRA3 includes items that ask how acceptable respondents personally find specific behaviours and how acceptable they think most other people consider these behaviours. These indicators are used to describe national and regional patterns in attitudes toward unsafe behaviour and

to build road safety performance and culture indicators across countries (Meesmann, 2022). The acceptability of risky driving construct in this thesis follows this ESRA3 approach. The statements used directly ask respondents whether they regard common risky driving behaviours as acceptable. Higher scores therefore indicate more permissive personal norms regarding risky driving. Consistent with the ESRA3 logic of linking attitudes, risk perception and behaviour into coherent indicators of road safety culture, these acceptability scores are then related to risky driving behaviour clusters and to self-reported near-miss and crash involvement. The questions/statements are as follows:

- “When driving, traffic rules must be respected”
- “It is acceptable to drive after drinking alcohol or doing drugs”
- “It is acceptable to drive through when traffic lights change from yellow to red”
- “When road conditions are good, and nobody is around, driving at higher speed is ok”
- “If you are a good driver, it is acceptable to drive a little faster”
- “It is acceptable to drive without wearing a seatbelt for short distances”
- “It is acceptable when you need to make an urgent phone call or message someone while driving”
- “It is acceptable to drive and make videos for posting/going live on social media”

The corresponding hypothesis is H6<sub>Acpt</sub>: in 2023, higher acceptability of risky driving behaviours is associated with a higher likelihood of reporting at least one near-miss or crash in 2023.

- The questions on liberty come from the field of social psychology on individual morals. Private vehicles are often associated with concepts such as freedom, and I hypothesize that individuals who believe that individual freedom (versus government control or social norms) will be more likely to engage in risky driving behaviours (van den Berg et al., 2020). The corresponding hypothesis is H7<sub>L</sub>: higher liberty-oriented orientation (preference for individual freedom over rule enforcement) is associated with reporting more frequent risky driving behaviours.

Individuals who strongly believe in personal liberty (over government-imposed safety measures) will be more likely to engage in risky driving behaviors. In other words, a driver who values freedom and dislikes traffic rules is hypothesized to have higher odds of speeding, not wearing seat belts and doing other risky driving behaviors compared to those who prioritize safety and rule compliance. Assuming that some drivers intentionally engage in dangerous behaviours because they do not want to follow rules or be controlled by others and believe in “personal responsibility” over external regulation, such liberty-oriented attitudes may see risky driving behavior as a personal choice, so there might be more rule violations in this group.

- The safety hypotheses outcomes are the following:
  - $H8_{NearMiss}$ : for 2023, higher levels of risky driving behaviours are associated with a higher likelihood of reporting  $\geq 1$  near-miss in 2023 than lower levels of risky driving behaviours, controlling for exposure (driving frequency), age, gender, driving experience, community size, alcohol and cannabis use, general risk-taking personality, acceptability of risky driving and liberty attitudes.
  - $H9_{Crash}$ : for 2023, higher levels of risky driving behaviours are associated with a higher likelihood of reporting  $\geq 1$  crash in 2023 than lower levels of risky driving behaviours, with the same controls as  $H8$ .

## CHAPTER 3 METHODOLOGY

The methodological approach follows a structured sequence from survey development to statistical analysis. The process began by defining the survey objectives and conducting a literature review, which informed the draft questionnaire design and the choice of survey method. The survey was then launched online, after which the data were downloaded, cleaned, and prepared for analysis.

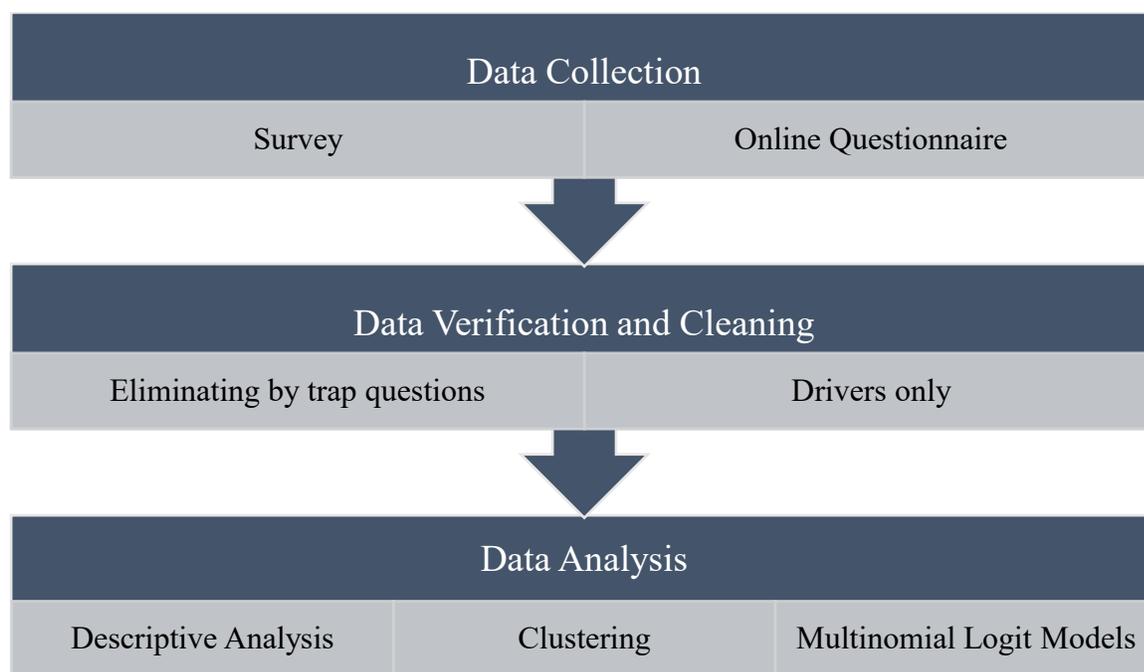


Figure 5 Overview of data collection, processing, and analysis

To summarize the overall workflow from survey development to modeling, Figure 5 presents an overview of the data collection, verification/cleaning, and analysis steps used in this study. It clarifies how the methodological steps connect to the analysis steps used in this study and clarifies how the methodological steps connect to the analyses reported in later chapters. In the Data Collection stage, the study relied on a survey as an online questionnaire. In Data Verification and Cleaning, responses were screened and prepared. The Data Analysis stage then reports results in a deliberate order: descriptive analysis first to document changes across periods, clustering procedures were conducted for risky driving behaviors as well as for risk-taking personality, liberty, and acceptability. Finally, multinomial logit models were used to examine predictors of profile membership.

### 3.1 Survey

To examine how risky driving behaviours have evolved before, during, and post-pandemic restrictions, a survey was developed in 2024. The survey asked respondents to report mobility and driving behaviours for three reference periods: fall 2019, fall 2020, and fall 2023. The data for this study was collected through an online survey.

#### 3.1.1 Target population and sampling method

The context of the dissertation of this study (Figure 6) is the whole Province of Québec which is one of the thirteen provinces and territories of Canada. It is the largest province by area and located in Central Canada. The total area of this province is 1,542,056 km<sup>2</sup> with a population of roughly 9 million in 2025.



Figure 6 Study area

#### *Study Area*

The study included 17 regions: Abitibi-Témiscamingue, Bas-Saint-Laurent, Capitale-Nationale, Centre-du-Québec, Chaudière-Appalaches, Côte-Nord, Estrie, Gaspésie-Îles-de-la-Madeleine, Lanaudière, Laurentides, Laval, Mauricie, Montréal, Montérégie, Nord-du-Québec, Outaouais, and Saguenay-Lac-Saint-Jean.

The target population consisted of Québec residents aged 22 and above, encompassing both drivers and non-drivers. Adults over 22 years old in 2023 were sought for the survey as they would have

been eligible to drive in 2019. Non-drivers were not asked about driving behaviours. The sample was stratified by region, age, and gender to ensure representativeness and to account for potential variations in behavior across these demographic dimensions. A total of 1,941 participants answered the survey.

### **3.1.2 Data collection method, period and distribution:**

The survey was conducted online using the Lime Survey platform, a widely used tool for survey administration. Data collection took place over a three-month period, from July 2024 to September 2024. An online survey method was chosen for its efficiency, cost-effectiveness, and ability to reach a geographically diverse population within Québec. Participants were recruited through Leger Opinion's LEO (Leger Opinion) online and accessed the questionnaire via the LEO platform (web and mobile app). Participants were invited by LEO account notifications, email, and/or app push notifications (Léger Opinion, 2025).

### **3.1.3 Quotas and sample**

To improve representativeness in our questionnaire, sampling was managed using quota targets across geography (region/area), age group, and sex. Our quotas were specified for metropolitan areas and other parts of the province, with targets defined for male/female by age group (22-24, 25-34, 35-44, 45-54, 55-64, 65+). The under-21 category was set to 0 because the target population was 22 years and older. The quota structure used in fieldwork followed the design below: Montréal, Québec City, Gatineau, Sherbrooke, Saguenay, and "Other Areas of the province" (the remaining parts of Québec province in order to have province-level representativeness), each split by sex and the age groups above. During data collection, invitations were distributed so that the achieved sample remained balanced across quota cells. When a quota cell was filled, additional eligible panelists entering that cell were routed to Over-quota termination. This approach supports coverage across key demographic segments and aligns with the study's stratification objectives by region, age, and gender/sex.

Ethical approval was obtained prior to the launch of the survey (CER-2324-65-D). The questionnaire included 53 questions, which were further divided into 179 sub-questions (see Appendix A). The questions were categorized into several key areas:

*Demographic Questions:* These included inquiries about age (categories), gender, education, income (categories), postal code (first three digits only), household composition, and professional status.

*Driving Behavioral Questions:* These focused on mobility and travel patterns across the three time periods (Fall 2019, Fall 2020, and Fall 2023). Individuals were asked about their travel patterns (frequency and mode) in the three time periods. The 11 behaviors were selected because they capture the major modifiable risk factors commonly linked to crash risk and injury severity (speeding, impairment, distraction, non-use of seatbelts, and fatigue), and they align with the risky-driving constructs measured consistently across all three survey waves. Using the same behavior set across 2019, 2020, and 2023, respondents were also asked about their years of driving experience and their navigation habits.

*Risk-Taking and Attitude Questions:* These questions assessed participants' risk-taking personality, acceptability of violation of rules and attitudes toward liberty. The full questions are available in Appendix A. The risky driving behaviors examined in this study include: drink driving (driving under the influence of alcohol), driving after consuming drugs, not wearing a seatbelt, speeding less than 10 km/h over the limit, speeding more than 11 km/h over the limit, running a red traffic light or stop sign, and various forms of distracted driving such as texting, talking while holding a mobile phone, talking hands-free, and looking at a screen while driving.

The general risk-taking attitudes related to self-identification as a risk taker, engaging in behaviors disapproved by others or society, thrill-seeking “greater risk, more fun”, disregarding illegality, and a safety-sensitivity check (feeling unsafe with careless drivers). The acceptability of risky driving contained: respecting traffic rules, driving after alcohol/drugs, running yellow-to-red lights, speeding when road conditions are good or if drivers is skilled, not wearing seatbelts for short distances, urgent phone use while driving, and using social media while driving.

The liberty questions were related to rights of successful people to enjoy wealth, individual responsibility without government interference, excessive government involvement, balancing common good with freedoms, property development rights, personal freedom without infringing others, and choosing group norms/traditions.

*Self-Reported Safety Experiences:* Participants were asked about their feelings of safety as pedestrians and their involvement in road crashes or near-misses. The pedestrian safety perception

questions related to the following key scenarios: at a pedestrian crossing, if cars have a stop sign, with respect to the amount of traffic, on a residential street with a traffic light, and on a busy street with a traffic light. Crashes and near-misses were defined to participants, and respondents were asked separately about the frequency of their involvement in each for the years 2019, 2020, and 2023.

*Confidence in Responses:* As the respondents are being asked to recall things in the past, we included questions related to their confidence in their responses. This question was asked for each year for different questions: trip responses (including travel modes and travel times, driving frequency, car access, and vehicle type), out-of-home trips (including frequency of local and non-local trips), driving responses (including frequency of risky driving behaviors such as driving after drinking or using drugs, driving without a seatbelt, speeding, running red lights or stop signs, texting or talking on the phone while driving, looking at screens while driving, and fatigue driving), and crash/near miss responses (including involvement in road crashes and near misses). The questionnaire also included questions about alcohol and cannabis consumption as these are related to risky driving behaviours. In Table 1, we can see the distribution of the socio-demographic variables in the survey. “Québec Data” column report the corresponding population counts and percentages for Québec province, taken from official provincial statistics (e.g., census/Institut de la statistique du Québec), and are used as benchmarks to assess how representative our survey sample is.

Table 1. Sociodemographic Characteristics of the Survey

<b>Characteristic</b>	<b>n</b>	<b>%</b>	<b>Québec Data</b>
Metropolitan Area <sup>a,b</sup>	Number	Percentage	Percentage
Abitibi-Témiscamingue	17	1.00%	1.70%
Bas-Saint-Laurent	30	1.70%	2.30%
Capitale-Nationale	172	9.70%	9.00%
Centre-du-Québec	54	3.10%	2.90%
Chaudière-Appalaches	73	4.10%	5.10%
Côte-Nord	17	1.00%	1.00%
Estrie	54	3.10%	5.80%
Gaspésie-Îles-de-la-Madeleine	18	1.00%	1.00%
Lanaudière	56	3.20%	6.20%
Laurentides	97	5.50%	7.50%

Table 1. Sociodemographic Characteristics of the Survey (continued)

<b>Characteristic (continued)</b>	<b>n</b>	<b>%</b>	<b>Québec Data</b>
Laval	164	9.30%	5.10%
Mauricie	43	2.40%	3.20%
Montréal	672	38.10%	23.80%
Montréal	190	10.80%	16.80%
Nord-du-Québec	3	0.20%	0.50%
Outaouais	68	3.90%	4.70%
Saguenay–Lac-Saint-Jean	38	2.20%	3.20%
<b>Driving Licence <sup>c</sup></b>		<b>Percentage</b>	<b>Percentage</b>
Yes		97.1 %	93.00%
No		2.9 %	7.00%
<b>Sex <sup>e</sup></b>		<b>Percentage</b>	<b>Percentage</b>
Male	956	49.30%	49.30%
Female	985	50.70%	50.70%
<b>Gender <sup>d</sup></b>		<b>Percentage</b>	<b>Percentage</b>
Woman	965	49.72%	50.50%
Man	962	49.56%	49.20%
Non-binary	9	0.46%	0.20%
Other	3	0.15%	0.10%
Gender neutral	2	0.10%	0.00%
<b>Age Group <sup>e</sup></b>		<b>Percentage</b>	<b>Percentage</b>
22-24 years	113	5.60%	5.40%
25-34 years	341	18.10%	14.00%
35-44 years	329	16.80%	17.30%
45-54 years	298	14.80%	16.80%
55-64 years	344	18.10%	20.30%
65 years and older	516	26.60%	21.10%
<b>Population Size <sup>f</sup></b>		<b>Percentage</b>	
City > 100 000 people	1 230	63 %	60.70%
City or large town 10 000 – 100 000	450	23 %	20.30%
Small town / rural < 10 000	261	13 %	19.00%
<b>Education Level <sup>l</sup></b>		<b>Percentage</b>	<b>Percentage</b>
None	6	0.3 %	11.8%
Primary	17	0.9 %	Assumed as (None)

Table 1. Sociodemographic Characteristics of the Survey (continued)

<b>Characteristic (continued)</b>	<b>n</b>	<b>%</b>	<b>Québec Data</b>
Secondary	242	12.5 %	17.0%
CÉGEP/College	544	28 %	18.9%
Professional	219	1.3 %	18.9%
Bachelor's	631	32.5 %	18.1%
Master's+	282	14.5 %	11.4%
<b>Employment Status 2023 <sup>g</sup></b>		<b>Percentage</b>	<b>Percentage</b>
Unemployed	21	1.2%	4.50%
Self-employed	86	4.9%	7.00%
Looking for job	9	0.5%	0.50%
Part-time	94	5.3%	11.00%
Stay-at-home	29	1.6%	2.00%
Professional occupation	12	0.7%	0.70%
Full-time	874	49.5%	50.00%
Retired	572	32.4%	20.00%
Student	57	3.2%	3.50%
Others	12	0.7%	0.80%
<b>Household Income <sup>h</sup></b>		<b>Percentage</b>	<b>Percentage</b>
\$0 – 5 000	42	2.2 %	1.0%
\$5 000 – 9 000	14	0.7 %	0.6%
\$10 000 – 24 000	116	6.0 %	9.4%
\$25 000 – 49 000	345	17.8 %	21.5%
\$50 000 – 75 000	381	19.6 %	19.2%
\$75 000 – 99 000	324	16.7 %	15.3%
\$100 000 – 125 000	293	15.1 %	11.1%
\$126 000 – 150 000	163	8.4 %	7.5%
\$151 000 – 200 000	167	8.6 %	8.2%
> \$200 000	96	4.9 %	6.4%
<b>Professional Driver</b>		<b>Percentage</b>	
No	1513	85.70%	95.00%
Yes	253	14.30%	5.00%
<b>Clean Driving Record</b>		<b>Percentage</b>	

Table 1. Sociodemographic Characteristics of the Survey (continued)

Characteristic (continued)	n	%	Québec Data
No	181	10.20%	
Not sure	74	4.20%	
Yes	1511	85.60%	
Driving Experience	Percentage		
1 year	24	1.40%	
2	16	0.90%	
3	14	0.80%	
4	16	0.90%	
5	43	2.40%	
6 - 10	175	9.9%	
More than 10 years	1478	83.70%	

Note.(*Fiches démographiques – Les régions administratives du Québec en 2024, 2024*)<sup>a</sup>, (Paquette, 2024)<sup>b</sup>, (*Rapport-Annuel-Gestion-2024.Pdf*)<sup>c</sup>, (Québec, 2025a)<sup>e</sup>, (Government of Canada, 2022)<sup>d</sup>, (Government of Canada, 2025)<sup>f</sup>, (Québec, 2024)<sup>j</sup>, (Government of Canada, 2018)<sup>g</sup>, (Québec, 2025)<sup>h</sup>.

## 3.2 Data verification and cleaning

### 3.2.1 Data cleaning

Survey responses were downloaded from the Lime survey platform and prepared for analysis by standard data cleaning procedures. As the survey is online and respondents receive a small reward for their participation, the survey included four “trap” questions to exclude people not paying attention. The trap questions excluded 3,188 respondents, highlighting the importance of such questions in online surveys where respondents receive some compensation. Respondents were excluded if they failed at least one question. This stage of the cleaning process resulted in 1,941 responses.

Ordinal responses (e.g. Likert-scale items on attitudes) were coded numerically, and continuous fields were checked for plausibility (e.g. trip frequencies and distances across the three periods). The cleaned dataset was then imported into statistical software for analysis.

### 3.2.2 Attribute transformation

Behavioral variables captured self-reported frequencies of specific risky driving acts (speeding, impaired driving, distracted driving, etc.) during each period. Respondents were asked about the

frequency of doing eleven risky driving behaviours for each of the three periods, with response options: “5 or more times a week”, “1-4 times a week”, “1-3 times a month”, “Less than 1 time per month”, and “Never”. To facilitate quantitative analysis, these options were recoded as: 0 for “5 or more times a week”, 1 for “1-4 times a week”, 2 for “1-3 times a month”, 3 for “Less than 1 time per month”, and 4 for “Never”. These recoded variables were classified as continuous or ordinal measures of risk propensity, depending on their response format. This coding implies that higher values indicate less frequent (safer) behaviour; this direction is stated explicitly to avoid misinterpretation in later results.

Attitudinal variables included responses to statements about risk-taking personality, acceptability of risky driving behaviour and liberty. These questions used Likert-type response scales (from “totally disagree” to “totally agree”) and were scaled on Likert-type indices. The responses were treated as indicators of the underlying concepts and were later used for separate clustering analyses (Section 3.3). Safety outcomes include near-miss and crash involvement per year. Respondents reported how many times they had been personally involved in crashes and near misses in each period (2019, 2020, 2023) using ordered categories such as “Never”, “1 time”, “2-3 times”, and “3-4 times”. These categories were recoded to numeric values representing exact counts or midpoints (0, 1, 2.5, 3.5) to obtain approximate average numbers of crashes or near misses per respondent and then coded as binary indicators (0 = no event, 1 = at least one event) for near-miss (0/1) and crash involvement (0/1) in the models. Because the models focus on the presence/absence of events, binary coding is used for regression; midpoint coding is used only for descriptive summaries.

### **3.3 Analytical approach**

To align methods with the thesis objectives, analyses were organized as an exploratory approach and reported in the same order as the results chapters, using descriptive analyses, clustering, and regression modeling to support interpretation while recognizing uncertainty in recall-based measures and that between-cluster variation can be small. Analyses were organized into three steps and reported in the same order as the results chapters:

- 1) descriptive analyses to document changes across periods;
- 2) clustering to identify profiles;
- 3) regression modeling to examine determinants and safety outcomes.

### **3.3.1 Step 1: descriptive analysis (chapters 4-5)**

Chapters 4 and 5 use descriptive statistics (counts, percentages) to document mobility patterns, trip frequencies, and period-by-period counts of 11 risky driving behaviours across the three periods. Associations between selected categorical variables were examined using Pearson's chi-square ( $\chi^2$ ) tests, and the results were interpreted to describe how patterns differed across groups. Chapter 4 provides an overview of mobility patterns and trip frequencies across the three periods. Chapter 5 presents period-by-period comparisons of risky driving behaviours using descriptive comparisons of prevalence/frequency (counts and percentages) and summarizes attitudes, perceptions, and risk-taking personality measures using descriptive statistics (e.g., distribution summaries). These constructs are used in the thesis as explanatory/context variables for the later analytical steps (clustering and regression modeling) and to support interpretation of the behavioral profiles and outcomes. Consistent with the methodological approach and objectives, they are therefore reported primarily descriptively (unless otherwise specified) to document the distribution of these measures in the sample to inform the subsequent profile and modeling analyses.

### **3.3.2 Step 2: clustering analysis (chapter 6)**

The purpose of this clustering analysis is to group respondent-period records into behavioral profiles based on frequencies of 11 risky driving behaviors (driving after drinking alcohol or using drugs, driving without a seatbelt, speeding 10 km/h and 11 km/h and more in built-up areas above the limit, running red lights or stop signs, texting, talking on a hand-held and hands-free phone, looking at a screen, and driving when fatigued) reported for 2019, 2020, and 2023. These profiles are then compared across periods to quantify changes in profile shares and to examine within-person transitions between profiles over time.

To identify behavioral profiles, I applied K-means clustering to the 11 risky-driving behavior variables in Python. The clustering was conducted at the respondent-period level (each respondent contributes up to three records for the three periods), allowing individual transitions to be examined over time. Data preparation was implemented in Python using pandas for reshaping and scikit-learn for clustering. For each year, the 11 behavior variables were mapped to numeric values. K-means was estimated using with the Euclidean distance (default), random initialization controlled by `random_state`, and the library's default settings for the remaining hyperparameters (e.g.,

initialization method, number of initializations). To support interpretability and policy relevance, I evaluated solutions from 2 to 10 groups, using both interpretability and separation diagnostics (average silhouette coefficient table), and retained 6 groups as the most meaningful set of distinct profiles for interpretation and transition analysis.

K-means clustering was also used to identify distinct behavioural profiles based on the risk-taking personality, acceptability, and liberty opinions separately because these constructs rely on different question sets and are interpreted as distinct profile typologies (rather than being combined into a single clustering space). I first interpreted the risky-behavior clusters along with the respondents' demographic and safety-outcome patterns. Second, I defined three sets of attitudinal clusters (risk-taking personality, acceptability, and liberty opinions) and linked them to the 2023 behavioral clusters. Finally, I documented temporal change in behavioral cluster shares and transitions.

### **3.3.3 Step 3: regression modeling (chapter 6)**

Multinomial logit (MNL) models were estimated to predict membership in the identified profiles using respondent characteristics and related measures. I used inferential modeling (multinomial logit) for cluster membership and logistic models for near-miss/crash outcomes.

The cluster-membership MNL analyses are organized into thematic blocks (socio-demographic, mobility, attitudinal, and crashes/substance use) rather than one fully saturated specification. This structure was adopted to (i) align each model block (a separate MNL specification estimated using one thematic set of predictors at a time) with specific hypotheses and constructs, (ii) limit sparsity and loss of precision that can occur when many categorical predictors are included simultaneously, and (iii) improve interpretability by allowing effects to be read within coherent domains. Estimating these domains in separate blocks improves interpretability and reduces over-parameterization that can arise when many categorical predictors and levels are entered simultaneously, which can inflate standard errors and complicate cross-year comparison. For completeness, the detailed coefficient tables for each block are provided in Appendix B, and cross-year summary tables are used in the main text to synthesize the key patterns.

For each period, I estimated separate binary logistic regression models for near-miss (0/1) and crash (0/1) outcomes. In all models, the dependent variable is the safety outcome (near-miss or

crash), and the main predictors are the behavioural cluster indicators. Behavioural clusters are represented by dummy indicators, and all other predictors (socio-demographic, mobility, substance-use, and attitudinal variables) are coded in the same way as in the previous MNL models. Two sets of models are estimated for each outcome and year: one including only behavioural clusters and period indicators, and one including the full set of mobility, socio-demographic, mobility, substance-use, and attitudinal covariates. Unlike the descriptive/characterization purpose of the previous MNL models, the outcome models (i.e., they include the behavioural clusters and the main exposure and covariate variables in the same model) because the goal is to estimate the association between cluster membership and near-miss/crash outcomes while controlling for potential confounders (Hosmer et al., 2013).

The modelling strategy differs between the safety outcome models (Section 6.3) and the cluster-membership MNL models (Section 6.2) because the research purpose differs. For near-miss and crash outcomes, the objective is to estimate the association between behavioural cluster membership and safety outcomes while adjusting simultaneously for exposure and key confounders; therefore, predictors are integrated in a single specification. In contrast, the MNL models in Section 6.2 are used primarily to characterize and interpret cluster membership across conceptually distinct domains (socio-demographics, mobility, attitudes, crashes/substance use) and to link each domain to the corresponding hypotheses.

Categorical variables (e.g., age group, gender, income, education, region, community size, mobility variables, and attitudinal clusters) are represented using K-1 dummy variables, with one category designated as the reference; coefficients are interpreted relative to this reference category. When behavioural clusters are later used as explanatory variables, they are similarly represented by dummy variables. The MNL model compares, for each non-reference cluster the log-odds of belonging to a cluster versus the reference cluster. To address model validity concerns, correlation screening and multicollinearity diagnostics (e.g., variance inflation factors) were conducted for regression models where applicable, and results were interpreted accordingly.

## CHAPTER 4 DESCRIPTIVE ANALYSIS

This chapter examines shifts in vehicle ownership and everyday travel in Québec from 2019 to 2023. Using survey counts and shares by year, we track changes in vehicle type, driving frequency, walking, cycling, car time, bus and rail use, and other micromobility, as well as the balance of local vs. non-local trips. Together, the figures and tables highlight who changed, how travel patterns shifted across modes, and the implications for safety and planning.

### 4.1 Vehicle type

To support interpretation beyond descriptive patterns, associations between SUV switching (i.e., moving from not owning an SUV/crossover in 2019 to owning an SUV/crossover in 2023; switcher vs non-switcher) and socio-demographics are tested using Pearson's chi-square tests, and standardized residuals are used to identify categories driving significant associations. Figure 7 shows vehicle type by year.

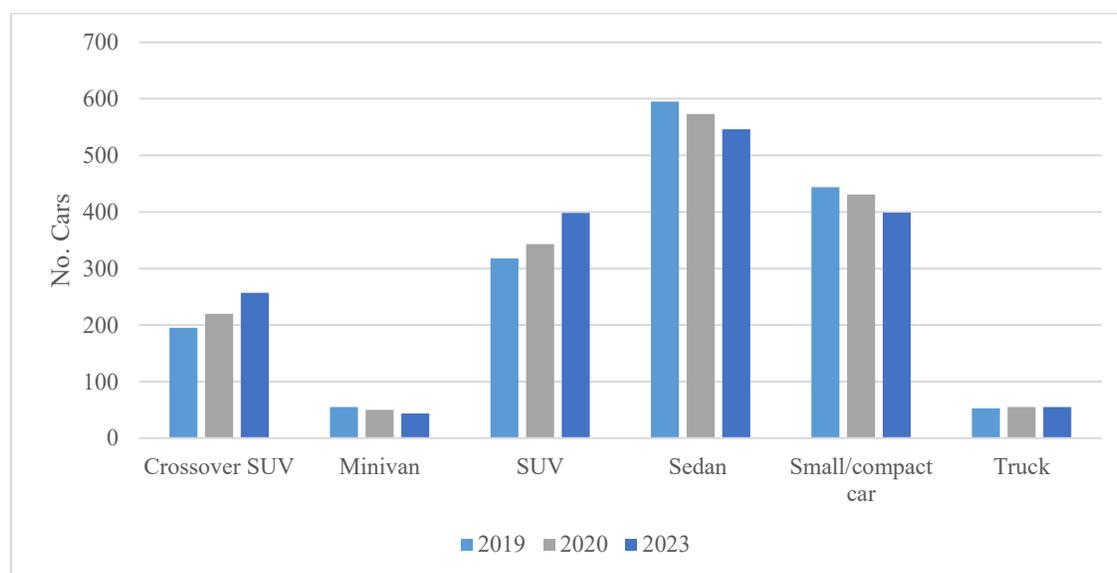


Figure 7 Vehicle Type numbers for each vehicle/year

Based on Figure 7, there was a clear shift to SUVs and crossover SUVs away from sedans and smaller cars over time. The relationship between switching to SUVs and socio-demographic characteristics is shown in

Table 2. People who became new owners of these vehicles between 2019 to 2023 represent 10.6 % of all respondents. Switchers are defined as respondents who in 2019 either had no car or owned a non-SUV vehicle, and who reported owning an SUV/crossover in 2023.

Table 2. The percentage of respondent's groups who changed to SUVs

Characteristic	Groups that changed to SUVs (switchers)	Notes
Age	25-34 yr (14.1 %), 35-44 yr (12.8 %), 45-54 yr (12.6 %)	14.1 % of all 25-34-year-olds bought an SUV/Crossover  The share of $\geq 65$ yr who bought an SUV/Crossover is lower (6.8 %).
Household Income	\$151-200 K (15.6 %), \$126-150 K (14.1 %), \$50-75 k (12.1 %)	Higher income households are most likely to change to SUVs,  <\$50 k generally under 6 %.
Community size	Rural <10,000 population (12.3 %)	Rural residents are more attracted to change their car to SUVs than those who live large city areas (10.4 %).
Employment	Full-time workers (13.6%), Part-time workers (9.6 %), Retired (7.5%)	Retirees and Full-time workers are (86%) of all switchers but we had more of them in our survey too as respondents.
Education	Primary education 21 %, Professional training (13.4 %) and Highschool graduates (11.1 %)	70% of the switchers had CEGEP or higher education.
Region	Capitale-Nationale (16.3 %), Outaouais (16.2 %), Lanaudière / Laurentides (14 %)	Montréal sits below average at 8.6 %; some northern regions spike but with <20 respondents.
Gender	Men: 11.4 % vs Women: 9.9 %	Difference is around 1.5 percent but still men more prone to own SUVs.

To test if these differences are statistically significant,  $X^2$  tests of independence between SUV switching status (switcher vs non-switcher) and each socio-demographic variable were used for the 1,766 respondents and the summary results are shown in Table 3 with details of the changes for statistically significant measures shown in

Table 3, and standardized residuals for significant associations are presented in Table 4. The significance level was set to  $\alpha = 0.05$ .

Three variables showed significant associations: employment status  $\chi^2(9) = 27.80$ ,  $p = 0.001$ ; age group  $\chi^2(5) = 14.64$ ,  $p = 0.012$ ; and household income  $\chi^2(9) = 20.23$ ,  $p = 0.016$ . Region, community size, education level, and gender were not significant (all  $p > 0.05$ ).

Table 3 Chi square test of independence

<i>Chi<sup>2</sup> (test)</i>	$\chi^2$	<i>df</i>	<i>p-value</i>
<i>Employment status 2023</i>	27.80	9	0.0010
<i>Age group</i>	14.64	5	0.0120
<i>Household income</i>	20.23	9	0.0165
<i>Region</i>	21.29	16	0.1675
<i>Education level</i>	4.38	5	0.4960
<i>Community size</i>	0.92	2	0.6326
<i>Gender</i>	2.30	4	0.6800

For each significant association, we examined the standardised residuals (z-scores), which measure how much each cell's observed count differs from the count expected if SUV switching was independent of that variable.

Cells with standardised residual  $\geq 1.96$  (approximately  $p < 0.05$ ) were flagged as contributing disproportionately to the overall  $\chi^2$  statistic. Positive values mean more switchers than expected under independence (over-representation), and negative values mean fewer switchers than expected (under-representation).

Interpretation residuals (Table 4) indicate that full-time workers and those in professional occupations were substantially more likely to upgrade to an SUV/Crossover SUV (+2.75 and +2.42 SDs above expectation), whereas retirees were markedly less likely (-2.26 SDs). By income, the \$25 000-49 000 bracket was under-represented among switchers (-2.55 SDs), while for \$126,000 to 200,000 were markedly more likely to switch (+1.96 and +1.35 SDs) to bigger car types. Age-wise, adults 65 years and older switched significantly less often (-2.52 SDs below expectation), while the 25-54-year group showed modest positive deviations (=1.96SD).

These patterns suggest that vehicle switching is concentrated among economically active, mid-career households with higher incomes, whereas lower-middle-income and retired households remain attached to their previous vehicle types.

This growing preference for SUVs has implications for traffic safety, as collisions involving SUVs are associated with a higher likelihood of serious injuries and fatalities, particularly for pedestrians and cyclists, compared with those involving passenger cars (Robinson et al., 2025), because larger vehicles with taller, more vertical front ends are associated with increased pedestrian injury severity and fatality risk in the event of a collision (IIHS-HLDI crash testing, 2023).

Table 4 Variables of drivers switching to SUVs

Predictor	Subgroup Category	Std. residual
Employment status 2023	Full-time worker	+2.75 ↑
	Professional occupation	+2.42 ↑
	Retired	-2.26 ↓
Household income	\$25 000 – 49 000	-2.55 ↓
	\$151,000 - 200,000	+1.96 ↑
	\$126,000-150,000	+1.35 ↑
Age group	25-34 years	+1.91 ↑
	65 yrs +	-2.52 ↓

## 4.2 Driving frequency

Figure 8, shows driving frequency by year.

The proportion of respondents driving on most or all days fell from 67.8% in 2019 to 60.6% in 2020, then increased to 65.1% in 2023. Weekly driving increased in 2020, particularly in the “1-2 times per week” category, suggesting a shift from daily to weekly patterns during the pandemic.

Very occasional driving (1-2 times per month) remained low. In 2023, the combined share reporting “Never” or “1-2 times per year” driving was under 6%, compared with 7.4% in 2019.

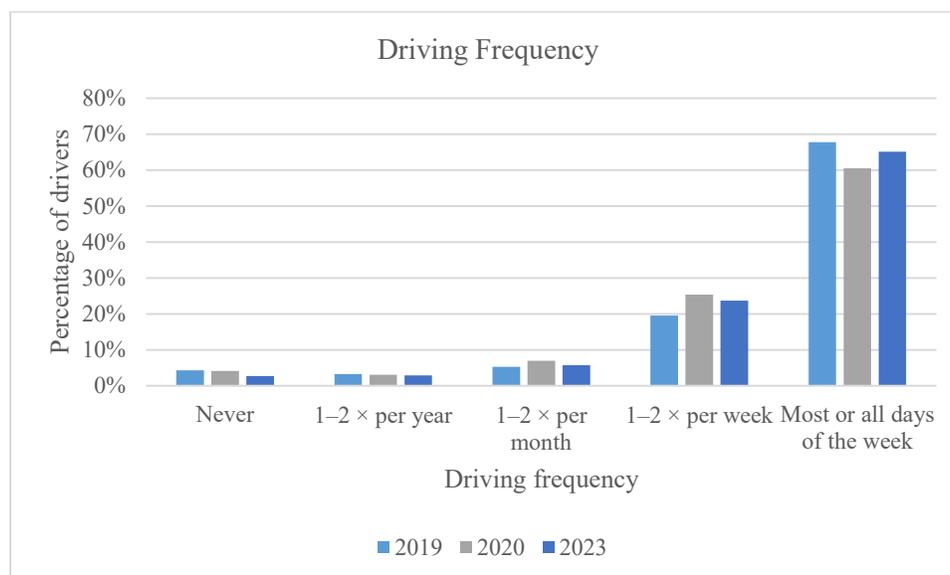


Figure 8 Driving Frequency

The next sections focus on time spent on each mode. For each mode, respondents reported their usual travel time in broad duration categories (no use, short, moderate, long), allowing comparison of exposure time across 2019, 2020, and 2023.

### 4.3 Walking

Based on Figure 9 and Table 5, we can see some changes between 2019 and 2023.

More people took a medium range walk (15-29 minutes) and 567 respondents did so in 2023 with 33 more than in 2019 (+6 %). Short walks (< 15 minutes) and long walks (60 minutes +) stayed almost level where both rose by only about 1 % compared with 2019. 30-59 min walks slipped a little, down 4 % relative to 2019. “I didn’t walk” fell sharply.

Non-walkers dropped from 196 to 173; a -12 % change suggesting people walked more in 2023.

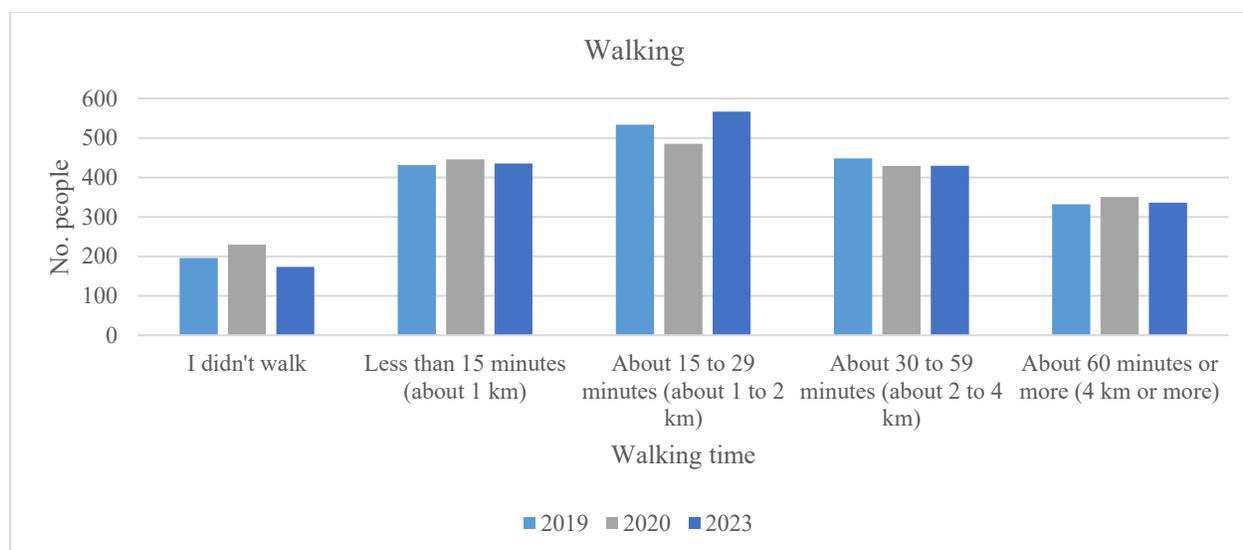


Figure 9 Walking frequency

Table 5 Percentage of changes in walking frequency

Walking (n= 1 941)	% Change 2019 → 2020	% Change 2019 → 2023
Less than 15 min ( ≤ 1 km)	+3 %	+1 %
About 15-29 min ( 1–2 km)	-9 %	+6 %
About 30-59 min ( 2–4 km)	- 4 %	- 4 %
60 min + ( ≥ 4 km)	+6 %	+1 %
Didn't walk	+ 17 %	-12 %

#### 4.4 Bike usage

Based on Figure 10 and Table 6, short to medium duration cycling (30-60 minutes) fell almost 7% in 2020; by 2023 only a third recovered and many who stopped during COVID did not start back up after COVID. Long distance trips also dropped almost 4% from 2019 and remained well below pre-pandemic levels.

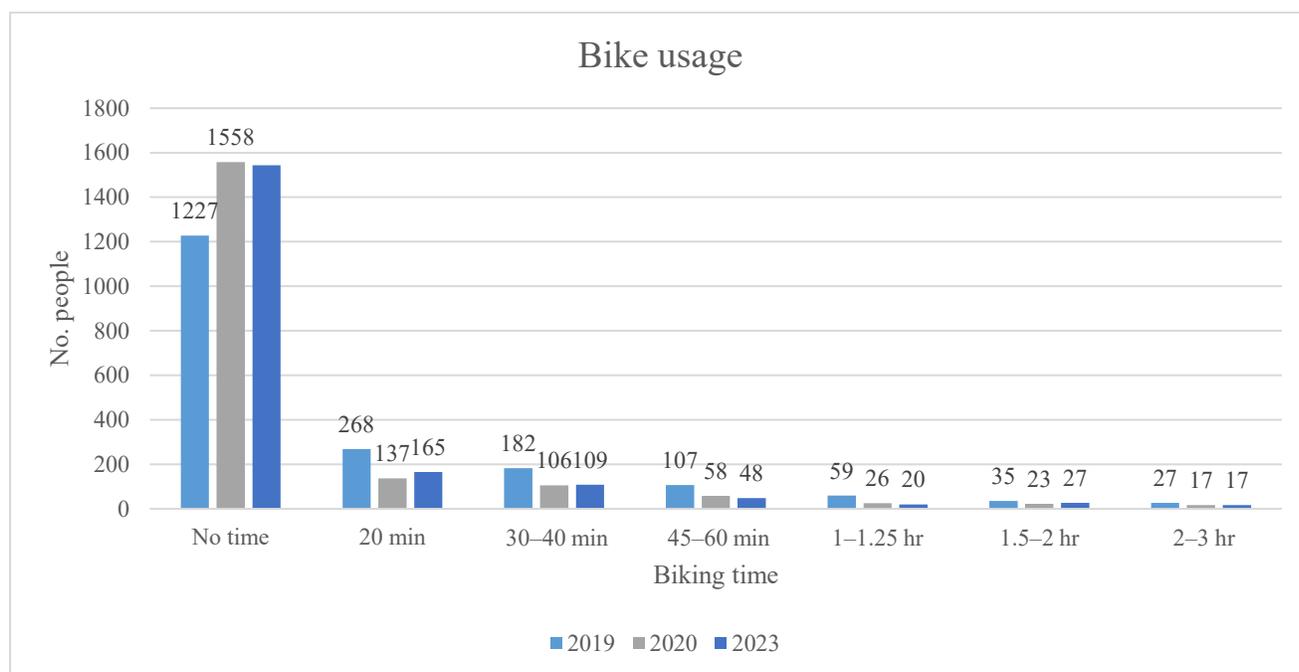


Figure 10 Bike usage counts for each year

Table 6 Bike usage share for each year

Bike (n=1,941)	% Change 2019 → 2020	% Change 2019 → 2023
No bike use at all	+17	+16
Short trips (20 min)	-7	-5
Moderate trips (30-60 min total)	-7	-7
Long trips (> 1 hr)	-3	-4

#### 4.5 Car usage

To capture exposure time by car, respondents were asked how much time they typically spent travelling by car, using multiple categories: did not use a car, short trips ( $\leq 30$  minutes), moderate trips (30-60 minutes), and long trips ( $>1$  hour). The number of respondents in each category is shown in Figure 11, and the corresponding percentages are presented in Table 7. This car-usage measure complements the driving frequency question: driving frequency describes how often people drove in a typical week, whereas the car-usage categories describe how long they spent in a car.

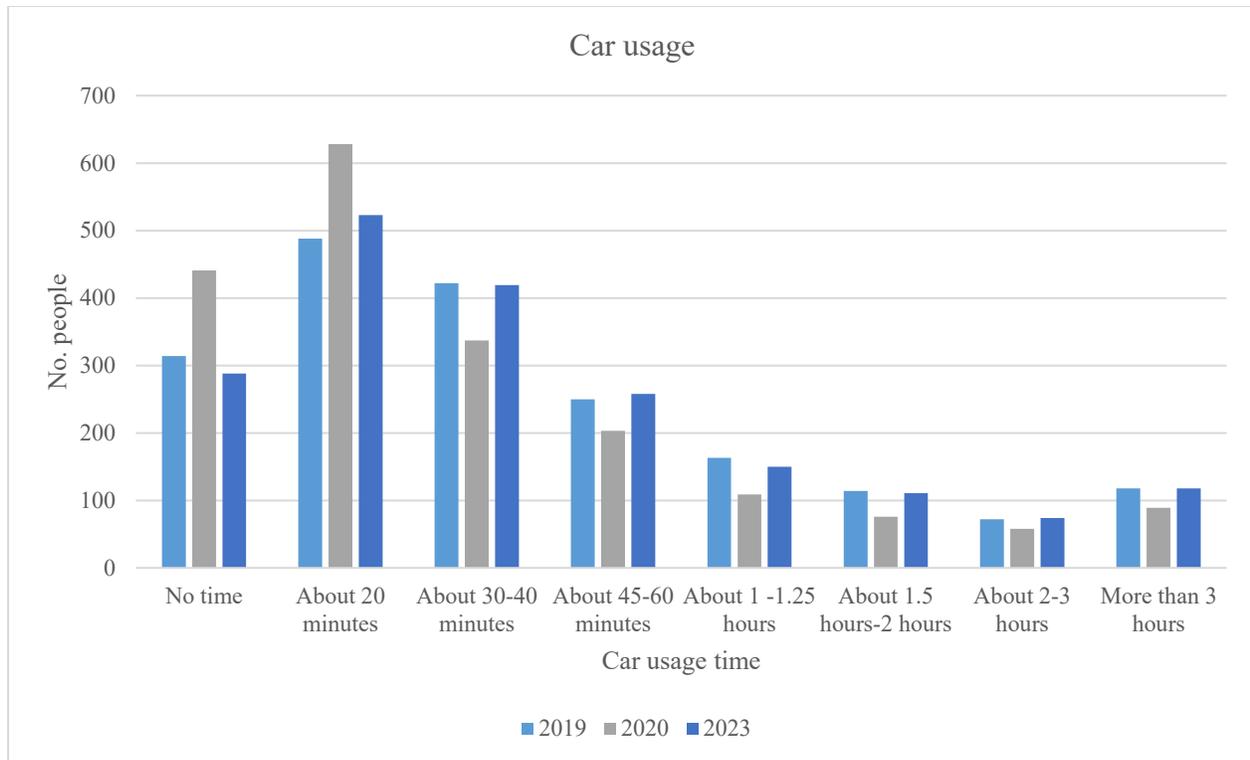


Figure 11 Car usage counts

Table 7 Car usage shares

Travel-time	2019	2020	2023
Didn't use a car	16.2 %	22.7 %	14.8 %
Short trips ( $\leq 40$ min)	46.8 %	49.8 %	48.5 %
Moderate trips (45 - 75 min)	21.3 %	16.1 %	21.0 %
Long trips ( $> 75$ min)	15.7 %	11.5 %	15.6 %

Based on Table 7 and Figure 11, we can see how car usage changed through 2019 to 2023:

1. Pandemic spike in people not driving (2020): “No time” jumped from 16 % in 2019 to nearly 23 % in 2020, which is clear evidence of reduced car use during the first COVID year. Short errand-length trips (“about 20 minutes”) also rose sharply (25 %  $\rightarrow$  32 %), suggesting people who did drive tended to keep trips brief.

2. Return toward pre-COVID patterns by 2023: The share with “no time” in a car fell back to 15 %, slightly below the 2019 level. Mid-range trips (30-60 min) recovered to roughly their 2019 shares.
3. Long-duration driving remains unchanged: Trips over an hour never fully bounced back to pre-pandemic levels, e.g., 1-1.25 h is 7.7 % in 2023 versus 8.4 % in 2019, and 1.5-2 h is 5.7 % versus 5.9 %. The very longest category (> 3 h) returned exactly to its 2019 count.

## 4.6 Bus usage

To capture bus usage, respondents were asked how much time they typically spent travelling by bus, using multiple categories: no time, about 20 minutes, 30-40 minutes, 45-60 minutes, 1 - 1¼ hours, 1½ - 2 hours, 2-3 hours, and more than 3 hours. The frequency of bus usage shown in Table 8:

Pandemic impact (2020): The share of respondents who didn’t ride the bus at all jumped to 84 %.

Post-pandemic (2023): “No time spent” dropped back toward the 2019 level, and short trips (about 20 min) surpassed pre-COVID levels, suggesting a partial recovery especially for quick errands or first/last-mile hops.

Long commutes ( $\geq 45$  min): These remain below 2019, hinting that some longer bus journeys may have been replaced by remote work, mode shifts, or route changes.

Table 8 Shares of bus usage

Typical daily bus time (n=1941)	2019 (%)	2020 (%)	2023 (%)
No time spent on the bus	74.9 %	83.8 %	75.5 %
About 20 minutes	7.4 %	5.4 %	9.0 %
About 30-40 minutes	6.4 %	4.8 %	5.8 %
About 45-60 minutes	4.9 %	2.1 %	3.8 %

Table 8 Shares of bus usage (continued)

Typical daily bus time (n=1941)	2019 (%)	2020 (%)	2023 (%)
About 1 - 1¼ hours	2.5 %	1.6 %	2.2 %
About 1½ - 2 hours	1.6 %	1.0 %	1.9 %
About 2-3 hours	0.9 %	0.6 %	1.1 %
More than 3 hours	1.3 %	0.6 %	0.8 %

Taken together, car and bus usage show a consistent pattern: in 2020, both modes had higher shares of respondents reporting no use and lower shares of longer trips, followed by a partial recovery by 2023, with short trips bouncing back more strongly than long-duration travel. This pattern is consistent with broader Canadian evidence that urban transit ridership in 2023 had not fully returned to pre-pandemic levels (Government of Canada, 2024).

#### 4.7 Rail/subway usage

Table 9 shows rail/subway time categories. The share reporting no rail/subway use increased in 2020 and decreased in 2023 (though remaining slightly higher than 2019), with short trips recovering more than longer trips. In Montréal specifically, STM reported a marked ridership return in 2023 relative to 2022, consistent with a partial post-pandemic recovery (*STM 2023 Annual Report*, 2024).

Table 9 Count and shares of rail/subway usage

Time spent on rail/subway (n = 1,941)	2019	2020	2023
No time	1 600 (82.4 %)	1 735 (89.4 %)	1 635 (84.2 %)
About 20 minutes	103 (5.3 %)	81 (4.2 %)	109 (5.6 %)

Table 9 Count and shares of rail/subway usage (continued)

Time spent on rail/subway (n = 1,941)	2019	2020	2023
About 30-40 minutes	109 (5.6 %)	58 (3.0 %)	92 (4.7 %)
About 45-60 minutes	55 (2.8 %)	27 (1.4 %)	41 (2.1 %)
About 1-1.25 hours	23 (1.2 %)	15 (0.8 %)	25 (1.3 %)
About 1.5-2 hours	19 (1.0 %)	15 (0.8 %)	18 (0.9 %)
About 2-3 hours	13 (0.7 %)	3 (0.2 %)	10 (0.5 %)
More than 3 hours	19 (1.0 %)	7 (0.4 %)	11 (0.6 %)

#### 4.8 Other modes (scooter, skateboard, etc.)

Between Fall 2019 and Fall 2023, most respondents (over 90 %) reported no travel time on other modes, but that proportion reduced modestly by 2 % from 93.94 % in 2020 back down to 91.90 % in 2023 suggesting a slight uptick in usage of these modes. The small but consistent rise in “Any time” (from 6.06 % in 2020 to 8.10 % in 2023) points to growing even if still small engagement with scooters, skateboards, and similar modes for both short and occasional longer trips.

#### 4.9 Local vs non-local trips

In this survey, we defined local trips as any trips less than about 2 km or a 20 to 30-minute walk (Table 10). Non-local trips were considered as any trips where the destination is more than 2 km or more than a 30-minute walk (Table 11). Respondents were given these definitions when making relevant responses. Two points can be made based on Table 10 and Table 11:

Local trip frequency saw a notable shift in 2020 with a higher proportion of infrequent trips and fewer moderate and frequent trips; likely due to external factors such as the COVID-19 pandemic restrictions. By 2023, the distribution closely returned to pre-2020 patterns.

Non-local trips followed a similar trend to local trips, with a significant increase in infrequent trips in 2020 and decreases in moderate and frequent trips. By 2023, the distribution largely reverted to 2019 levels, although frequent trips remained slightly lower.

Table 10 How often people travelled for weekly local trips

Local trips weekly	Fall 2019	Fall 2020	Fall 2023
Infrequent ( $\leq 2$ times)	40.0 %	48.6 %	39.5 %
Moderate (3-6 times)	40.5 %	35.6 %	40.7 %
Frequent ( $\geq 7$ times)	19.5 %	15.8 %	19.9 %

Table 11 How often people travelled for non-local trips

Non-local trips weekly	Fall 2019	Fall 2020	Fall 2023
Infrequent ( $\leq 2$ times)	53.5 %	64.6 %	54.7 %
Moderate (3-6 times)	30.7 %	24.4 %	30.5 %
Frequent ( $\geq 7$ times)	15.8 %	11.0 %	14.8 %

#### 4.10 Synthesis

Taken together, this chapter shows that everyday travel in Québec was strongly disrupted in 2020 and then only partially returned to pre-pandemic patterns by 2023. On the vehicle side, there was a clear shift in ownership toward SUVs and crossover SUVs, driven mainly by mid-career, higher-income, full-time workers, while older and lower-middle-income households were less likely to switch. Given evidence that larger vehicles can increase injury severity for pedestrians in the event of a collision, this fleet shift provides an additional safety context for later chapters focusing on risky driving behaviours, near-misses, and crashes (IIHS-HLDI crash testing, 2023).

In terms of travel behaviour, driving frequency and car-use duration both dropped in 2020 and then largely recovered by 2023, although with signs of more weekly and fewer strictly daily drivers. Walking became slightly more common overall, with a marked reduction in the share of non-walkers. By contrast, cycling, bus, and rail use showed sharper and more persistent declines in medium and long trips, with only partial rebounds in short-duration travel by 2023. Local and non-

local trip frequencies followed a similar pattern: clear reductions in 2020 and a general return toward 2019 levels thereafter.

Overall, the descriptive results point to a post-pandemic travel landscape characterized by a more SUV-dominated vehicle fleet, somewhat more walking, and a partial but incomplete recovery of public transport and cycling for longer trips. These shifts are important for the later chapters, which link changes in exposure and mode use to risky driving behaviours, near-misses, and crash outcomes.

## CHAPTER 5 RESULTS

The following sections illustrate how many drivers engaged in each risky behavior each year.

### 5.1 Risky driving behaviors

In Figure 12 to Figure 16, we can see the proportions of drivers who engaged in each risky behavior for each year. The data are categorized according to the frequency of these behaviors as follows:

- Never
- Less than once per month
- 1-3 times per month
- Less than weekly
- 1-4 times per week
- 5+ times per week

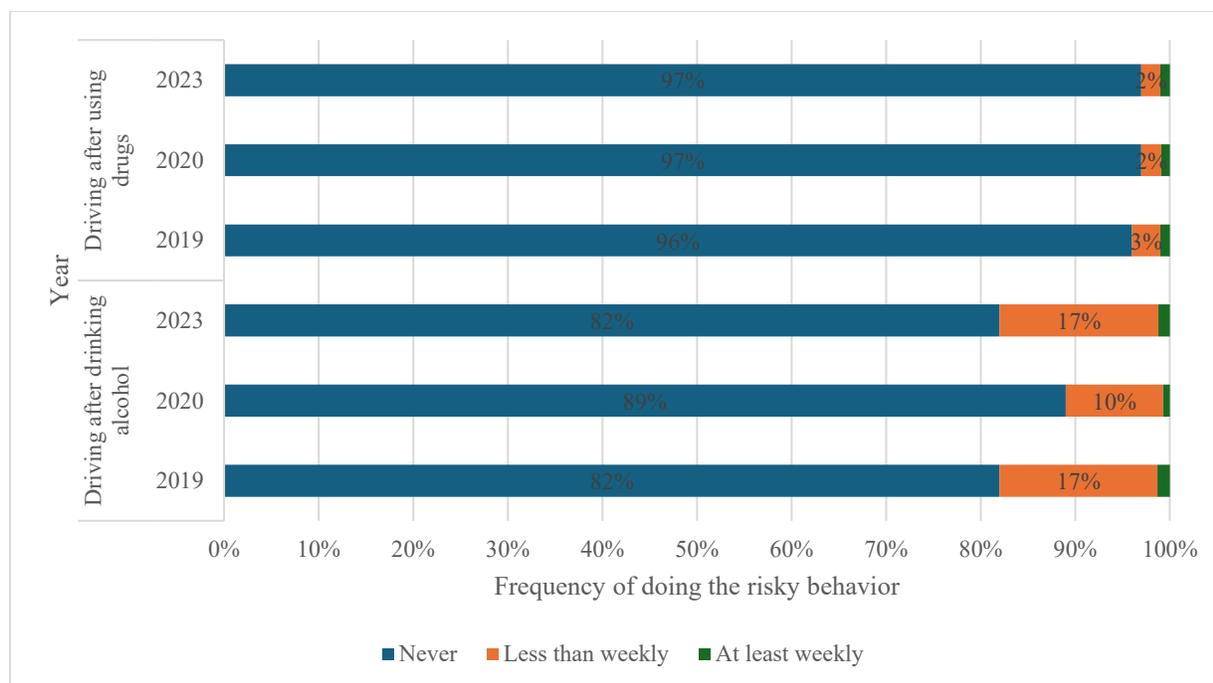


Figure 12 How often did drivers drink or use drugs and drive

Based on Figure 12 , we observe:

- Driving after drinking decreased notably in 2020 likely reflecting reduced driving during the COVID-19 pandemic but returned to nearly 2019 levels by 2023.

- Driving after using drugs remained consistently low from 2019 to 2023, with only a minimal change (approximately one percentage point), suggesting negligible variation over time.

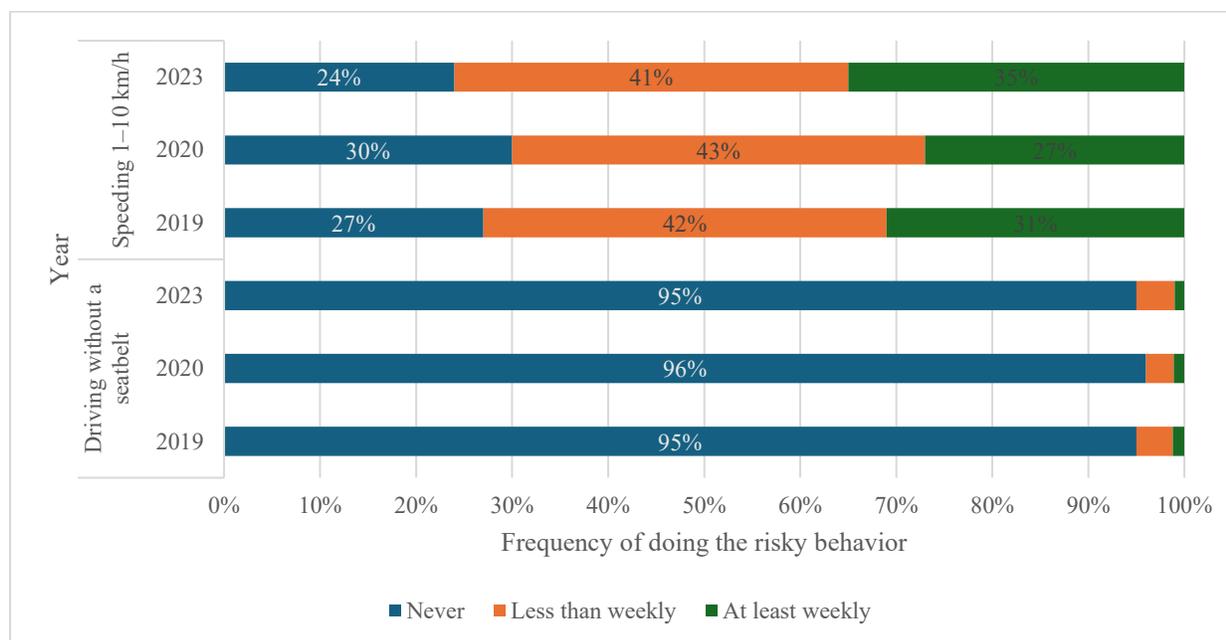


Figure 13 How often did drivers speed or drive without a seatbelt

Based on Figure 13, speeding (1-10 km/h) is one of the most common behaviours, with roughly only a quarter of people reporting not doing it. The proportion of respondents who reported speeding (1-10 km/h) decreased from 73% (42+31%) in 2019 to 70% in 2020, then increased to 77% in 2023. And for the seatbelt use we can see 1% percent raise in using it less than weekly.

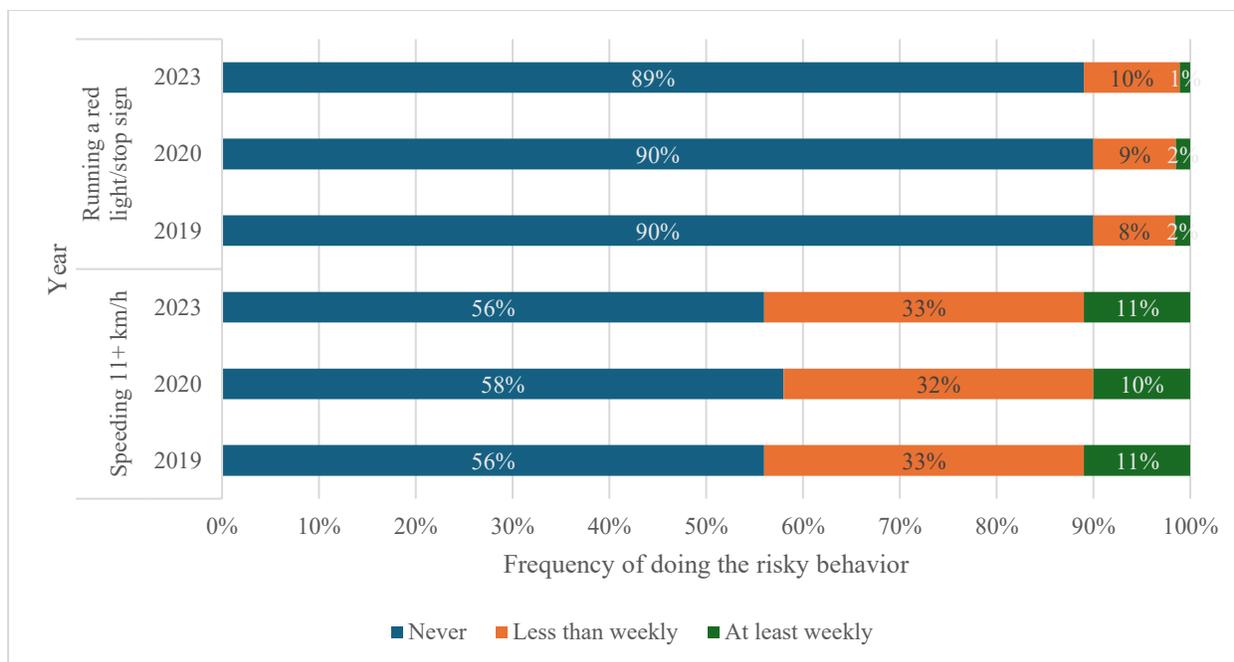


Figure 14 How often did drivers speed or run redlight or stop sign

Based on Figure 14, speeding at speeds higher than 11 km/h remained relatively constant, with a minor decrease in 2020; and running a red light or stop sign was stable, with a slight decrease in weekly occurrences over the years.

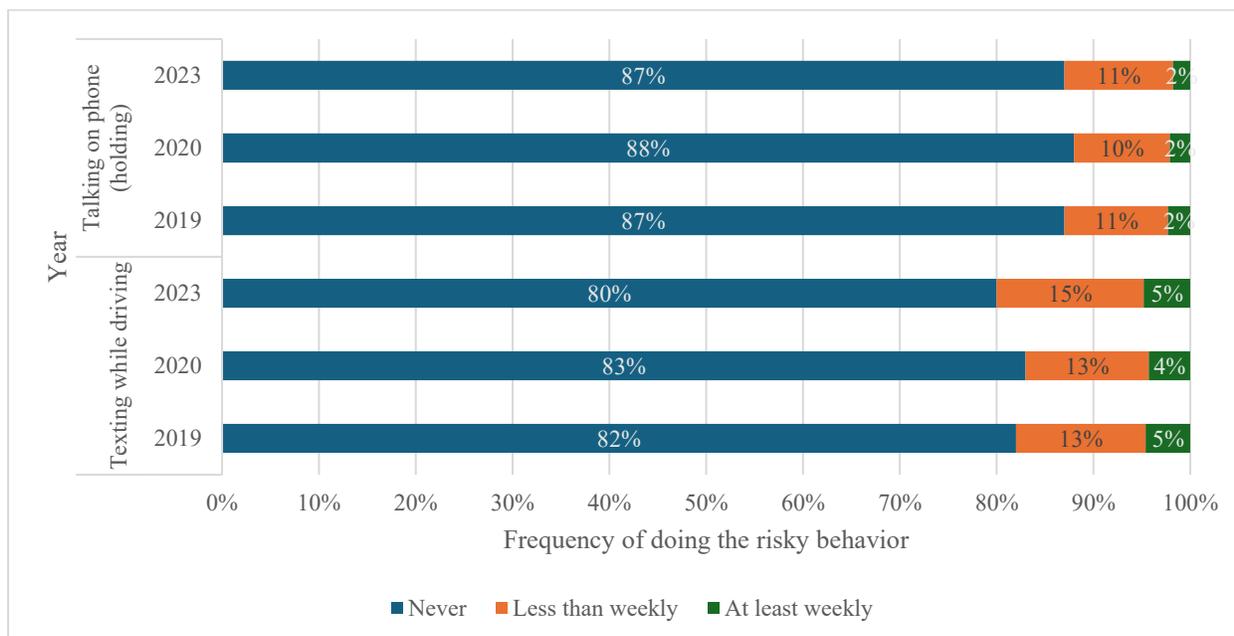


Figure 15 How often did drivers talk on the phone or text

Based on Figure 15, texting shows a higher prevalence in 2023 compared with 2019/2020, reflected by a lower “Never” share in 2023 (80%) than in 2019 (82%) and 2020 (83%). Talking on the phone showed a steady trend, decreasing in 2019 and then back to the same level in 2023 .

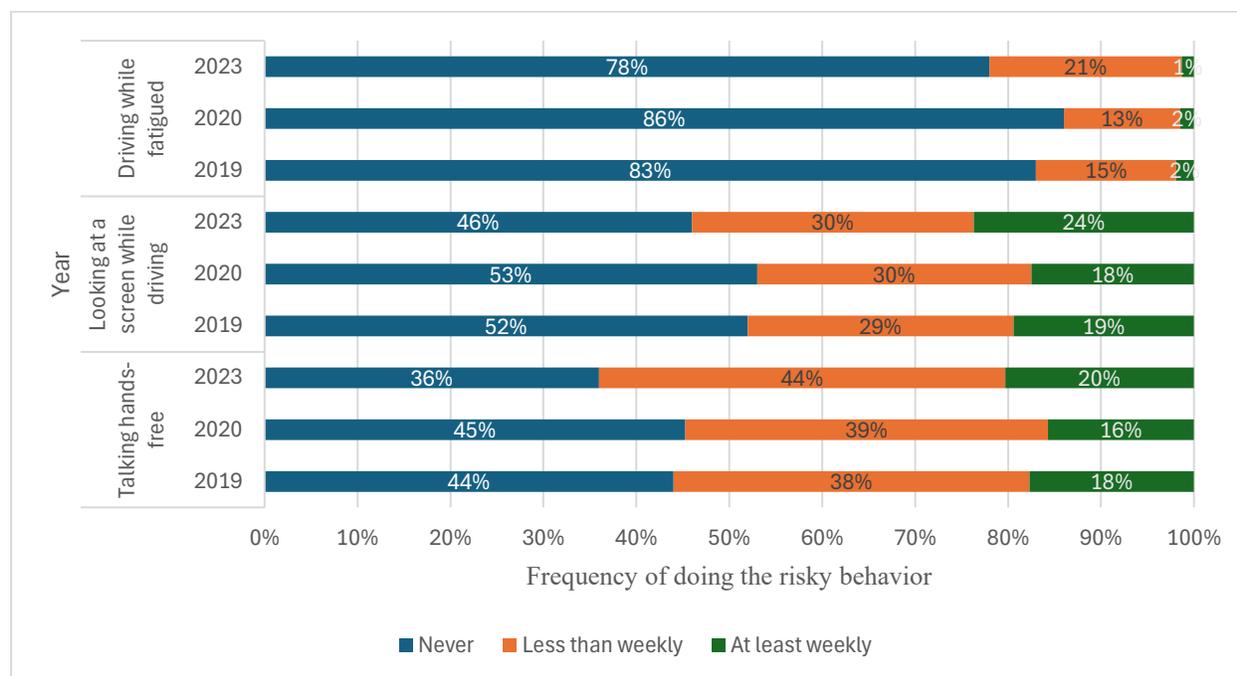


Figure 16 How often did drivers talk hands-free, look at a screen or drive while fatigued

If we look at the Figure 16, a steep change occurred in 2023 compared to the two previous years:

*Talking Hands-Free:* A considerable decrease was observed for people reporting “Never” between 2019 and 2023. In 2019 it was 44%, 45% in 2020, then decreased to 36% in 2023. Hands-free talking saw a significant increase in weekly occurrences by 2023.

*Looking at a Screen While Driving:* This behaviour also saw an increase as fewer people reported never doing it between 2019 and 2023. 52% of respondents reported never doing this in 2019, which increased to 53% in 2020, then decreased to 46% in 2023. Screen use while driving increased significantly by 2023 with a notable rise in weekly occurrences.

*Driving While Fatigued:* More people report driving while fatigued with just over 1 in 5 stating that they did it in 2023. The response “never” increased from 83% in 2019 to 86% in 2020, then decreased to 78% in 2023. Fatigue-related driving saw a decline in weekly occurrences over time.

Table 12 Association between survey year (2019/2020/2023) and frequency of risky driving behaviors (Pearson  $\chi^2$ ).

Risky behavior (frequency categories)	$\chi^2$ (df=8)	p-value	Cramér's V
Driving after drinking alcohol	58.66	< .001	0.074
Driving without wearing a seatbelt	6.79	.560	0.025
Driving after using drugs	1.21	.997	0.011
Speeding (1–10 km/h above limit)	36.23	< .001	0.058
Speeding (>10 km/h above limit)	6.80	.558	0.025
Running a red light / stop sign	8.23	.411	0.028
Texting while driving	7.56	.478	0.027
Talking on the phone (handheld)	4.32	.828	0.020
Talking on the phone (hands-free)	40.34	< .001	0.062
Looking at a screen while driving	32.93	< .001	0.056
Driving while fatigued	45.71	< .001	0.066

(N = 5,298 observations; n = 1,766 per year; df = 8 for all tests; effect size reported as Cramér's V.)

To assess whether the distribution of risky driving behavior frequencies changed across the three survey periods, Pearson chi-square tests of independence were conducted (Appendix D4) for each behavior (Year  $\times$  Frequency category). Table 12 shows statistically significant differences by year were observed for driving after drinking alcohol ( $\chi^2(8, N = 5,298) = 58.66, p < .001, V = 0.074$ ), speeding 1–10 km/h ( $\chi^2(8, N = 5,298) = 36.23, p < .001, V = 0.058$ ), hands-free talking ( $\chi^2(8, N = 5,298) = 40.34, p < .001, V = 0.062$ ), looking at a screen while driving ( $\chi^2(8, N = 5,298) = 32.93, p < .001, V = 0.056$ ), and driving while fatigued ( $\chi^2(8, N = 5,298) = 45.71, p < .001, V = 0.066$ ). By contrast, no statistically significant year differences were found for other risky driving behaviors (all  $p > .05$ ; Table 12). Across all behaviors, effect sizes were small (Cramér's  $V < 0.10$ ), indicating that although several behaviors show statistically detectable shifts over time, the magnitude of the association between year and reported frequency remains limited.

## 5.2 Substance use

### 5.2.1 Alcohol consumption

Table 13 Alcohol consumption (share of respondents %)

Category	2019	2020	2023	Change 2019 to 2023 %
0 units	33.5	31.9	33.2	- 0.3 ↓
< 5 units	43.0	39.4	44.6	+ 1.5 ↑
5 - 9 units	16.7	17.4	15.5	- 1.2 ↓
10 > units	6.8	11.3	6.8	0.0

According to Table 13, respondents' alcohol consumption is distributed as follows: most respondents either do not drink alcohol (roughly 1/3rd) or consume less than 5 units per week (39.4 % to 44.6 %). The trend is a small increase of people drinking less than 5 units per week (+1.5%), and a corresponding reduction in the 5 to 9 units per week category (-1.2%).

After a temporary 2020 surge in heavy drinking patterns, respondents reported that by 2023 they had largely reset to their 2019 baseline with a slight shift toward very light consumption.

A chi-squared test of independence was performed (Appendix D3) to assess changes in self-reported alcohol consumption frequency across the three survey years (2019, 2020, 2023). The analysis revealed a statistically significant but weak association,  $\chi^2(6, N = 5298) = 37.27, p < .001$ , Cramér's  $V = 0.059$ . As shown in the contingency table (see Appendix D3), the proportion of respondents reporting high-frequency consumption (10 or more times in the past year) increased notably during the pandemic year 2020 (11.27%) compared to 2019 (6.80%) and returned to pre-pandemic levels in 2023 (6.80%). Conversely, moderate consumption (1-4 times) was lower in 2020 (39.35%) than in 2019 (43.04%) and 2023 (44.56%). These patterns suggest a temporary increase in frequent alcohol use during the height of the COVID-19 pandemic, followed by a return to baseline in the post-pandemic period.

## 5.2.2 Cannabis use

Table 14 cannabis share of respondents %

Category	2019	2020	2023	Change 2019 to 2023 (%)
None	89.8	86.9	89.0	-0.9 ↓

Table 14 cannabis share of respondents % (continued)

Category (continued)	2019	2020	2023	Change 2019 to 2023 (%)
1–2 per week	4.1	5.7	4.4	+ 0.3 ↑
3–4 per week	1.5	2.4	2.6	+ 1.1 ↑
5 + per week	4.6	5.0	4.1	- 0.5 ↓

We also asked our respondents about how often they used cannabis from 2019 to 2023, which can be seen in Table 14: cannabis use remained low, with over 87% reporting “no use” showing a slight decrease from 89.8% in 2019 to 88.9% in 2023. Usage is stable; any movement is within a percentage. The only clear growth is a small change in moderate (3-4 weekly) users.

A chi-squared test of independence was conducted (Appendix D3) to examine differences in self-reported cannabis consumption frequency across the three survey years (2019, 2020, 2023). The results revealed a statistically significant but very weak association,  $\chi^2(6, N = 5298) = 13.56$ ,  $p = .035$ , Cramér's  $V = 0.036$ . Inspection of the contingency table (see Appendix D3) shows that the proportion of respondents reporting never using cannabis was highest in 2019 (89.81%) and lowest in 2020 (86.86%), with a slight rebound in 2023 (88.96%). Frequent use (>10 times in the past year) was marginally higher in 2020 (5.04%) compared to 2019 (4.59%) and 2023 (4.08%). Overall, cannabis consumption patterns remained relatively stable across the pandemic and post-pandemic periods.

### 5.3 Attitudes, perceptions and personality

The following subsections summarize attitudes, perceptions, and personality measured in the survey sample.

#### 5.3.1 Liberty

The responses to the Liberty statements by respondents are shown in Table 15. Most respondents lean toward individual autonomy and economic freedom with the strongest consensus around the right to enjoy wealth (77%) and the freedom to choose one’s own norms and traditions (59%). Views are more mixed on the role of government: they do not support limiting personal freedom for the “common good” (41% disagree vs. 37% agree) and opinions are split on whether government interferes too much (42% agree, 29% disagree, 29% neutral). Property rights in land use are the most contested, with disagreement slightly exceeding agreement (45% vs. 39%), and a

non-trivial neutral share, indicating divided views on how far such rights should extend. Notably, neutral responses are sizable on several items (14% to 29%), suggesting a substantial group of respondents who are neither clearly supportive nor clearly opposed to the statements.

Table 15 Liberty Opinion among drivers (n= 1,766)

Question	Agree (Somewhat or Totally)	Neutral	Disagree (Somewhat or Totally)
People who are successful in business have a right to enjoy their wealth as they see fit.	77.10%	7.40%	15.50%
Society works best when it lets individuals take responsibility for their own lives without telling them what to do.	54.70%	19.40%	26.00%
The government interferes far too much in our everyday lives.	42.20%	28.50%	29.30%
The government should do more to advance the common good, even if that means limiting the freedom and choices of individuals.	37.00%	22.40%	40.60%
Property owners should be allowed to develop their land or build homes in any way they choose, if they don't endanger their neighbors.	39.40%	15.70%	44.90%
I think everyone should be free to do as they choose, so long as they don't infringe upon the equal freedom of others.	54.30%	13.60%	32.10%
People should be free to decide what group norms or traditions they themselves want to follow.	59.00%	16.80%	24.20%

### 5.3.2 Pedestrian safety perception

Respondents' perceptions of safety as a pedestrian in 2019, 2020 and 2023 are shown in Table 16.

Table 16 Share of pedestrians feeling safe/unsafe in different scenarios

Scenario (n=1,941)	Year	Feeling safe (%)	Feeling in danger (%)
At a Pedestrian Crossing	2023	73 %	27 %
	2020	79 %	21 %
	2019	77 %	23 %
If Cars Have a Stop Sign	2023	83 %	17 %
	2020	86 %	14 %
	2019	86 %	14 %
With Respect to Amount of Traffic	2023	71 %	29 %
	2020	85 %	15 %
	2019	80 %	20 %
Residential Street with Traffic Light	2023	90 %	10 %
	2020	93 %	7 %
	2019	92 %	8 %
Busy Street with Traffic Light	2023	76 %	24 %
	2020	83 %	17 %
	2019	81 %	19 %

Regarding COVID-19, the data repeatedly notes 2020 as the year where people reported feeling the safest across scenarios, likely related to pandemic traffic reductions. This type of pattern has also been reported in Canadian COVID-era road safety literature and national safety reporting (Vanlaar et al., 2021).

By Fall 2023, that improvement had not only vanished but reversed: all five evaluations saw lower safety ratings than in 2019 and 2020 (especially with respect to Amount of Traffic from 2020 to 2023).

*Context matters:* The environments where people felt the safest throughout are signalised residential streets (90% feeling safe in 2023) and intersections where cars have a stop sign (>80% feeling safe). Perceived risk in 2023 is highest for “With respect to amount of traffic” (29% feeling in danger) and for “busy street with traffic light” (24% feeling in danger).

*“In danger” is growing:* In all scenarios, pedestrians feel more in danger compared to the pre-pandemic era (Table 17).

Table 17 How pedestrians feel compared to before COVID-19

Scenario	2019 to 2023 Feeling Safe*	2019 to 2023 Feeling in Danger**
At a pedestrian crossing	-3.4 pp ↓	+3.9 pp ↑
If cars have a stop sign	-2.7 pp ↓	+3.1 pp ↑
With respect to amount of traffic	-8.7 pp ↓	+9.2 pp ↑
Residential street with traffic light	-1.9 pp ↓	+2.5 pp ↑
Busy street with traffic light	-4.7 pp ↓	+5.2 pp ↑

\* “Safe” = Safe + Somewhat safe

\*\* “In Danger” = Somewhat in danger + In danger

\*\*\* pp = percentage points

Because these changes are calculated only on the “Safe” and “In danger” groups (excluding neutral responses), the shifts in feeling safe and feeling in danger do not have to be exact opposites. Overall, Table 17 shows that respondents felt safer in 2020 than before COVID-19, but by 2023 they felt less safe and more in danger than in 2019 across all scenarios.

This subsection is presented descriptively to document perceived pedestrian safety across years. No inferential statistical tests are reported here because pedestrian safety perception is not a primary outcome tied to the thesis objectives; interpretation is therefore limited to observed percentages.

### 5.3.3 Risk-taking personality

The participants’ responses to six risk-taking personality statements are shown in

Table 18.

Most respondents present a clearly risk-averse profile. Across five risk-taking personality statements, large majorities disagreed, indicating limited attraction to risky activities, low tolerance for behaviors disapproved of by those who are close to them, and general respect for legal boundaries.

The last question, whether one feels unsafe when riding with a careless driver, shows the expected pattern: about three-quarters agreed they feel unsafe with a careless driver, confirming strong safety concerns.

Table 18 Respondents agreement or disagreement with six risk-taking personality statements

Survey Statement	Disagree	Neutral	Agree
“I consider myself a risk-taker.”	67.7 %	18.3 %	14.0 %
“I often do risky behavior that I know those close to me would disapprove of.”	83.8 %	9.0 %	7.3 %
“The greater the risk, the more fun the activity.”	81.9 %	11.6 %	6.6 %
“I often think about doing risky behaviors that I know society would disapprove of.”	79.6 %	12.3 %	8.2 %
“I do not let the fact that something is illegal stop me from doing it.”	78.0 %	12.2 %	9.9 %
“I feel unsafe when riding with a careless driver.”	19.3 %	4.7 %	76.1 %

### 5.3.4 Acceptability of safe/unsafe behaviors

The participants’ responses to eight risk-taking personality statements are shown in Table 19, respondents show a very strong normative commitment to safe driving. Almost all agree that traffic rules must be respected, and large majorities reject clearly dangerous behaviours such as driving after drinking alcohol or using drugs, driving without a seatbelt, or making videos for social media while driving, with only small neutral or agreeing shares on these items.

Table 19 Agreement with the acceptability of safe or unsafe behaviors.

Statement	Agree	Neutral	Disagree
When driving, traffic rules must be respected	96.3 %	2 %	1.7 %
It is acceptable to drive after drinking alcohol or doing drugs	4.4 %	4.6 %	91 %
It is acceptable to drive through when traffic lights change from yellow to red	13.9 %	17.7 %	68.3 %
When road conditions are good, and nobody is around, driving at higher speed is ok	26.1 %	15.5 %	58.4 %

If you are a good driver, it is acceptable to drive a little faster	17.1 %	16.5 %	66.4 %
It is acceptable to drive without wearing seatbelt for short distances	3.6 %	3.3 %	93 %
It is acceptable when you need to make an urgent phone call or message someone while driving	6.5 %	7.8 %	85.7 %
It is acceptable to drive and make videos for posting/going live on social media	1.7 %	2.3 %	96 %

By contrast, attitudes are more divided for “borderline” violations, such as driving through a yellow light turning red, speeding when road conditions are good and nobody is around, or driving a little faster if one considers oneself a good driver. For these statements, a majority still disagree, but sizeable minorities agree and a noticeable proportion remain neutral, indicating that some respondents see these behaviours as conditionally acceptable rather than clearly unacceptable.

Overall, the pattern in Table 19 suggests that while the most extreme unsafe behaviours are overwhelmingly rejected, there is greater tolerance and ambiguity around moderate speeding and yellow-to-red light running, which may translate into situational rule-breaking in practice.

## 5.4 Crashes and near misses

### 5.4.1 Involvement in road crashes

The involvement in road crashes by participants is shown in Table 20. From 2019 to 2020 the percentage of respondents reporting having never been involved in crashes in that year increased to 93.9%. By 2023, it decreased to 91.7% indicating a rise in crash involvement.

Table 20 Respondents (n=1941) stated involvement in road crashes.

Year	Never (%)	1 Time (%)	2-3 Times (%)	3-4 Times (%)
Fall 2019	92.19	5.83	1.59	0.40
Fall 2020	93.94	4.81	0.96	0.28
Fall 2023	91.79	6.40	1.30	0.51

Table 21 The changes over the three years for involvement in crashes.

Crashes Counts	2019	2020	2023	Change 2020–2023 (%)
Never	1797	1833	1790	-0.39 % ↓
>1 time	144	108	151	+4.86 % ↑

A Pearson chi-square test of independence (Appendix D2) indicated that the distribution of crash involvement categories did not differ significantly by year,  $\chi^2(6, N = 5,298) = 8.33, p = .215$ , Cramér's  $V = .028$  (small effect). This suggests that the observed year-to-year differences in Table 21 are modest and may reflect sampling variability rather than a systematic shift in reported crash involvement across 2019, 2020, and 2023.

## 5.4.2 Involvement in near misses

Table 22 The percentage of respondents who were involved in near misses by frequency.

Year	Never (%)	1 Time (%)	2-3 Times (%)	3-4 Times (%)
Fall 2019	82.62	9.91	5.78	1.70
Fall 2020	86.86	8.21	3.79	1.13
Fall 2023	76.84	12.97	7.64	2.55

Near misses followed a similar pattern to crashes, with "Never" increasing from 82.62% in 2019 to 86.86% in 2020, then dropping to 76.84% in 2023, with corresponding increases in other categories, Table 23 reflecting increased near-miss involvement post-pandemic.

Table 23 The changes over the three years for involvement in near misses

Near misses	2019	2020	2023	Change 2020-2023 (%)
Never	1617	1696	1502	-7.11 ↓
>1 time	324	245	439	+35.49 ↑

Near-misses can be used as an early warning metric when evaluating post-pandemic safety. The data shows a decline in near misses from 2019 to 2020, possibly due to reduced travel activities because of restrictions, then a significant increase in reported near misses from 2020 to 2023. The overall trend from 2019 to 2023 indicates a rise in the proportion of respondents reporting near misses (from 16.69% to 22.62%).

A Pearson chi-square test of independence (Appendix D2) showed that the distribution of near-miss involvement categories differed significantly by year,  $\chi^2(6, N = 5,298) = 63.51, p < .001$ , Cramér's  $V = .077$  (small effect). This indicates a statistically reliable shift in near-miss reporting

across 2019, 2020, and 2023, consistent with the decline in 2020 followed by an increase in 2023 Table 23.

#### 5.4.2.1 Clean driving record

Clean driving record is used as a safety-outcome indicator. I examined its association with age group because age (and driving experience) is a central covariate in road-safety research and because preliminary cluster profiling suggested systematic age differences that could confound record cleanliness (e.g., fewer years licensed among younger respondents). This bivariate test is therefore presented to motivate the inclusion of age/experience-related covariates in subsequent models and to highlight potential dependence among predictors. To avoid an unfocused set of multiple bivariate tests, other inter-variable relationships are assessed in the multivariable modeling stage (Section 6.2), where covariates are evaluated jointly and diagnostics (including correlation structure/collinearity checks) are reported.

We cross-tabulated age group by clean driving record (Clean vs. Not clean; Table 24), reporting overall association with Pearson's chi-square and summarized effect size with Cramer's V. There was an association between age group and having a clean driving record,  $\chi^2(5)=56.12$ ,  $p<.001$ ; Cramer's V=0.178; N=1,766, indicating a small-to-moderate association (Appendix C1).

Table 24 Association between age group and clean driving record ( $\chi^2$  and effect size)

Statistic	Value
Pearson $\chi^2$	56.12
df	5
p-value	< .001
N	1,766
Cramer's V	0.178

In our sample, age is significantly associated with having a clean driving record. Younger drivers tend to show higher shares of clean records, likely reflecting shorter licensing durations and therefore fewer opportunities to accumulate violations, rather than inherently safer behavior. Conversely, older drivers who are overrepresented in the Safe Driver cluster also exhibit strong record quality consistent with greater driving experience, but they have had more time on the road to incur minor infractions. Taken together, the pattern suggests that both age and experience (years licensed) shape observed record cleanliness.

## **5.5 Summary of key points**

By 2023, distracted driving behaviors had worsened markedly compared to 2019; hands-free phone use, screen-looking, and driving while fatigued all increased substantially, texting also edged higher. Pedestrians reported feeling considerably less safe across all scenarios in 2023 than in 2019. Near-miss incidents surged after 2020, reaching levels well above pre-pandemic reports, while actual crash involvement showed no statistically significant change over the period.

## CHAPTER 6 ANALYSIS OF ATTITUDES & BEHAVIOR

### 6.1 Classification according to risky driving behaviors

In addition to interpretability, I examined cluster separation using the average silhouette coefficient. The silhouette values are highest for small K (particularly K = 2), which typically reflects a broad separation between generally safer and generally riskier respondents. However, the study's objective is not only to separate "safe vs unsafe," but to identify distinct behavioral profiles that are meaningful for interpretation, transitions over time, and later modeling. Therefore, K = 6 had a better presentation between (i) interpretable and policy-relevant profiles, (ii) sufficient granularity to distinguish technology-related behaviors from other risky behaviors, and (iii) stable cluster definitions that allow respondent-period transitions to be tracked across 2019, 2020, and 2023.

#### 6.1.1 Naming the six risky driving behavior clusters

After clustering I interpreted and named the clusters based on the dominant behaviors (Figure 17). Note that the connecting lines are used only for readability and do not imply a progression or ordering between behaviors; interpretation is based on differences in mean levels across behaviors and clusters. Table 25 shows the cluster names, the number of period-respondents in each cluster (the total being  $n = 1766 \times 3$  periods), and the key behaviors.

Table 25 Risky driving behavior clusters

Cluster	Name	The number of period-respondents	Behavior Profile
0	Safe Drivers	1862	Low across all risky behaviors
1	High Risk Drivers	91	High across almost all behaviors
2	Tech-Distracted Speeders	541	High speeding + high tech use (looking at screen, hands-free talking)
3	Screen Distracted Drivers	910	High on screen related distraction
4	Chatty Speeders	1471	High on phone talking, some speeding

Table 25 Risky driving behavior clusters (continued)

<b>Cluster (continued)</b>	Name	The number of period-respondents	Behavior Profile
<b>5</b>	Texting Drivers	423	High on texting, moderate on other distractions and speeding

Overall, the profiles indicate that High Risk Drivers, Tech-Distracted Speeders, and Texting Drivers are the most dangerous clusters, given their combination of frequent speeding, distraction, and other unsafe behaviours. The “High Risk Drivers” are more likely to do nearly all the risky behaviors. “Tech-Distracted Speeders” are also dangerous as they are the most likely to speed and are also prone to hands-free talking and looking at screens while driving. “Texting Drivers” are also dangerous as they are just as likely to speed as the “High Risk Drivers” and the most likely to text, do hands-free talking, and have some of the highest looking at screen frequencies. It is difficult to say whether the Tech-Distracted Speeders are more dangerous than the Texting Drivers as the first are more likely to speed, which is critical to the severity of crashes, but the later are much more likely to be distracted. “Screen-Distracted Drivers” appear slightly more dangerous than “Chatty Speeders” because, for most risky behaviours, their average frequencies are similar or higher, and they are particularly likely to talk hands-free and look at screens while driving.

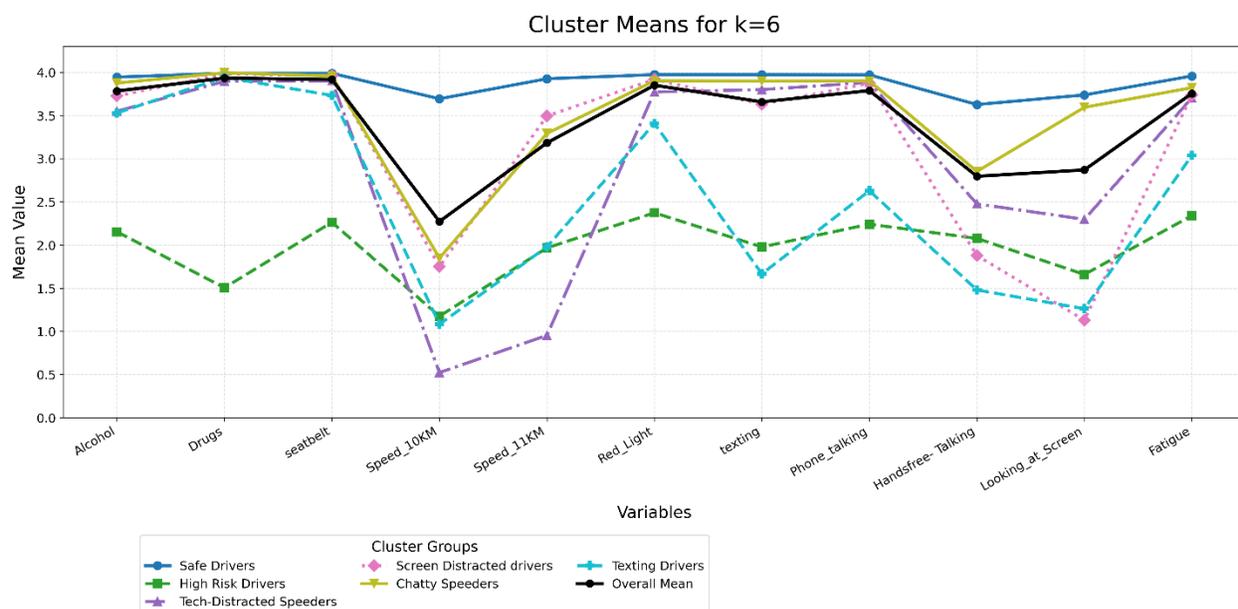


Figure 17 Mean scores for the eleven risky driving behaviors across the clusters. Higher values indicate lower frequency of risky behavior (safer behavior).

## 6.1.2 Risky driving behavior profiles

To better understand the clusters, their socio-demographics were examined for differences. We wanted to describe these clusters demographically and examine how the clusters relate to an outcome measure of traffic danger (“clean driving record”, “near misses / crashes”).

I examined how the clusters differ in characteristics like age, gender, income, education, region, driving experience and professional status. This analysis helped me to know clusters properly, see the differences in the cluster profiles across years if possible (2019 to 2023) and use these insights in further modeling, e.g., Multinomial logit (MNL)/prevention policy.

Figure 18 shows gender differences by risky driving behavior clusters. In the clusters, men dominate the most dangerous profiles of High-Risk Drivers, Tech-Distracted Speeders and Texting Drivers. Gender is a key differentiator of risky driving behavior. For the analysis, gender was measured as one of our questions. Responses were recoded into three groups: Woman, Man, and Other/gender-diverse (including gender-neutral, non-binary, and other). The figure displays only respondents who identified as Woman or Man and shows their distribution across the clusters. Respondents in the Other/gender-diverse group ( $n = 14$ ) are not shown in the figure due to small cell sizes.

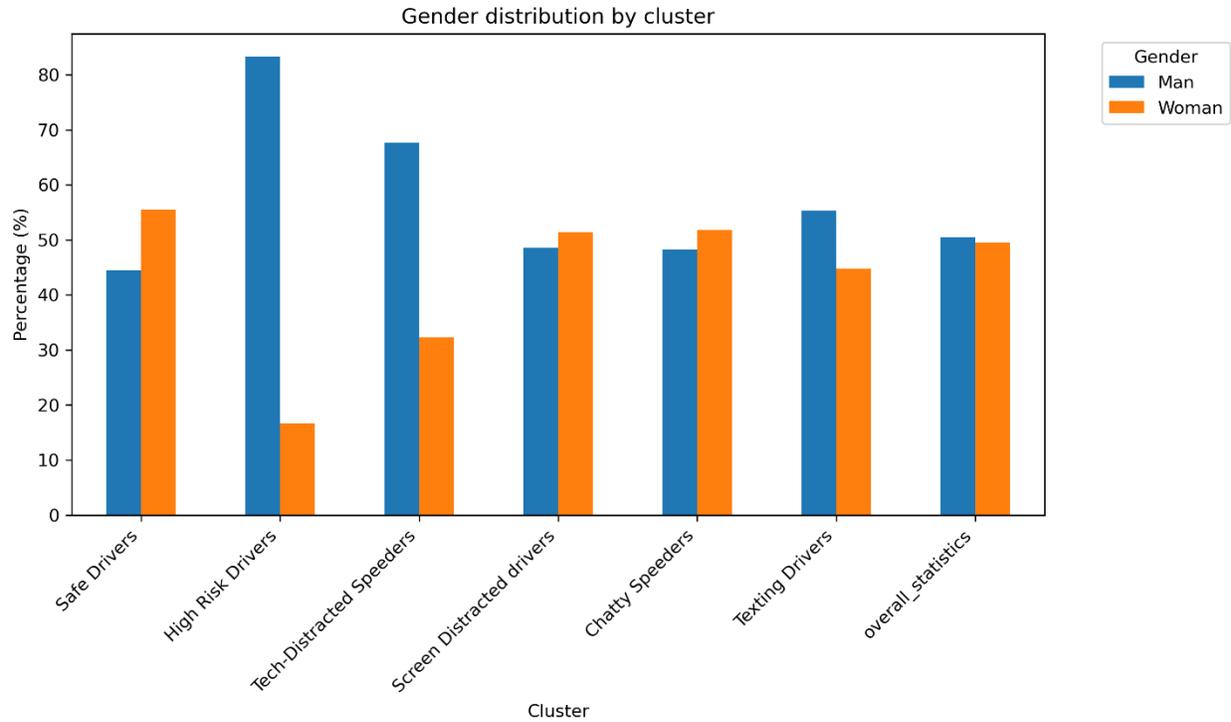


Figure 18 Gender distribution

Figure 19 shows household income differences by risky driving behavior clusters. Clusters with phone/screen behavior tend to have higher incomes while High Risk Drivers, Safe Drivers and Chatty Speeders show a shift toward lower average income.

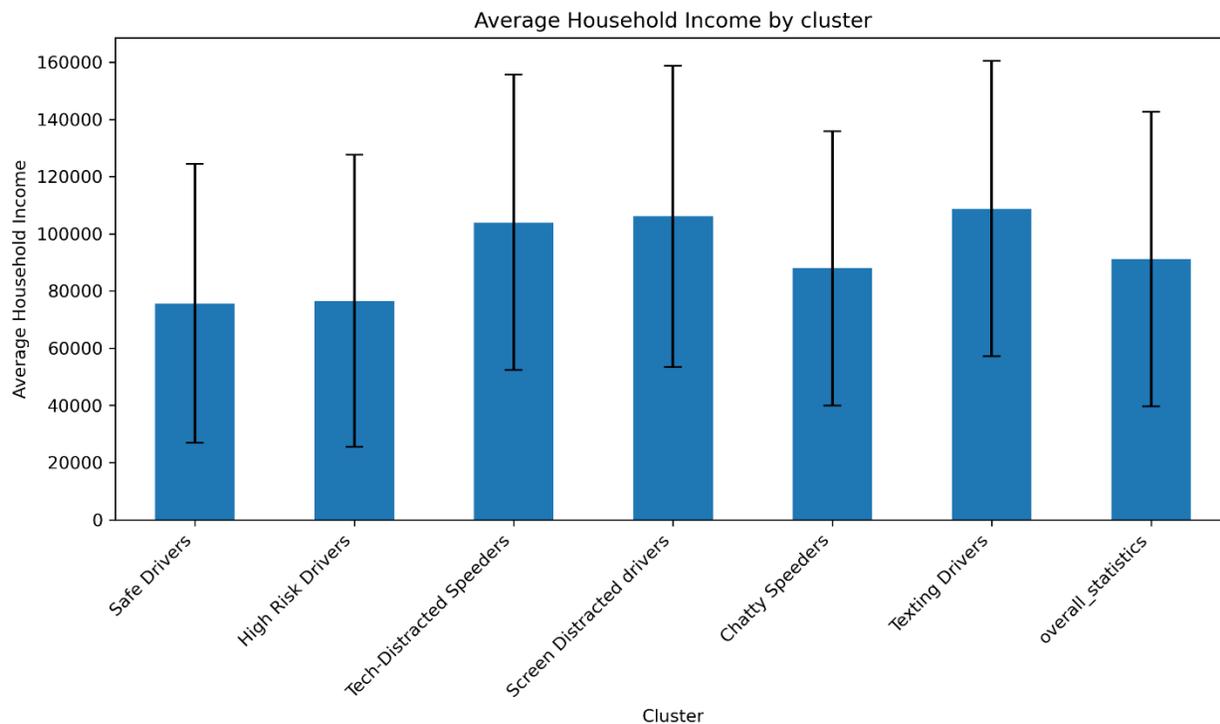


Figure 19 Household income

Table 22 Figure 20 shows education differences by risky driving behavior clusters, by converting education levels to years of education: if someone does not have any education, they receive 0 years of education, high school is 12 years of education, CÉGEP is 14 years and having a bachelor is assumed 18 years. Figure 20 reports average years of education (with confidence intervals), and the intervals overlap across clusters, firm differences cannot be concluded from the figure alone. Apart from High-Risk Drivers, which appears lower on average, the cluster averages are similar to each other and to the overall average.

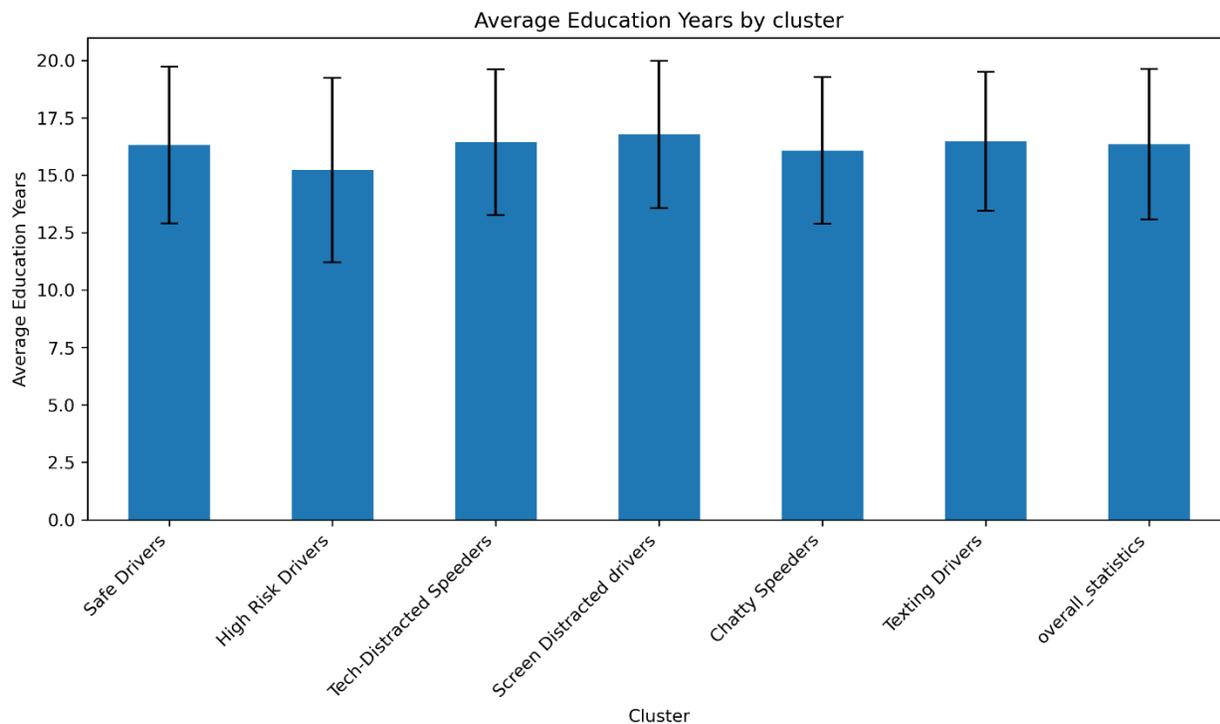


Figure 20 Education differences by risky driving behavior clusters.

One of the most dangerous groups, Texting Drivers is the most likely to be working full-time and which is consistent with their higher average income compared with the other clusters (Figure 21). Safe Drivers include a high share of retired (and the highest of all groups) and fewer occupationally active individuals.

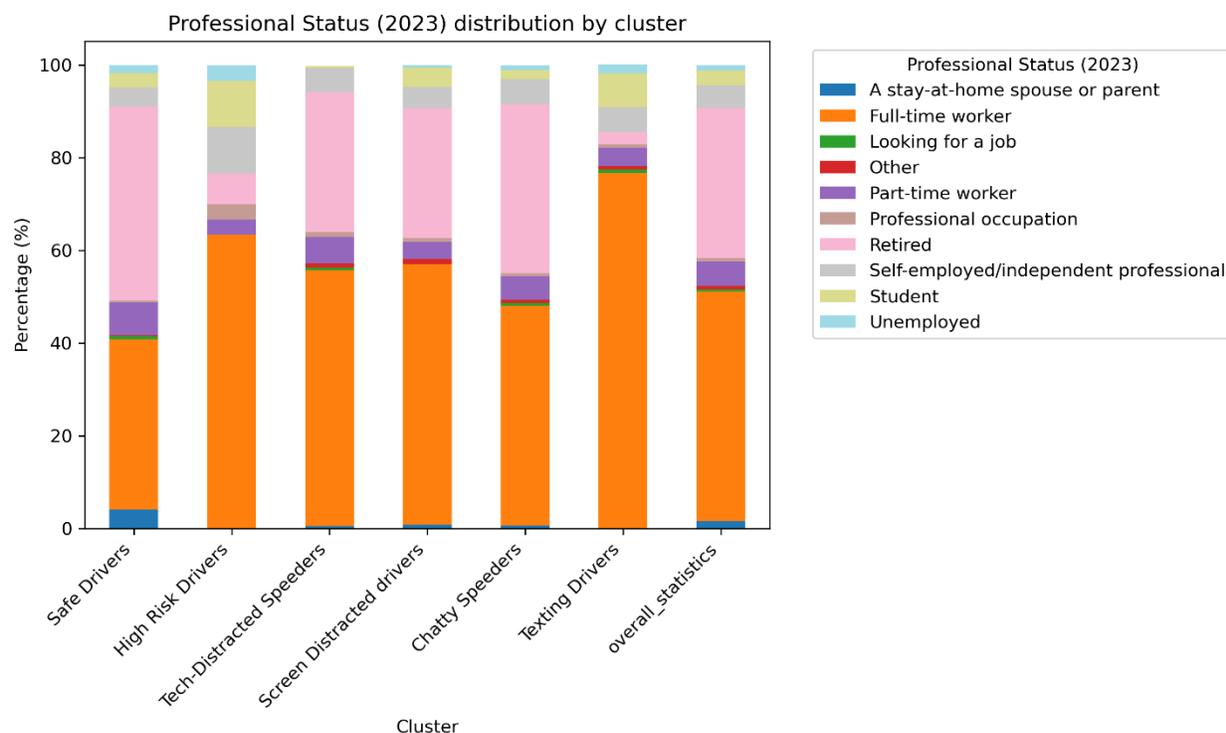


Figure 21 Professional status differences by risky driving behavior clusters.

Community size is a contextual characteristic (Figure 22). This variable is measured as an ordered categorical indicator (e.g., rural/small town, mid-sized city, large city) and converted roughly in the Figure 22 to approximate population values (number of inhabitants) to display an average community size by cluster. Some clusters show slightly lower average community-size values; however, differences appear small relative to the variability (error bars) and are interpreted cautiously, and are further assessed alongside other covariates in the multivariable models (Section 6.2). The mean score is reported only as a descriptive index of ordered.

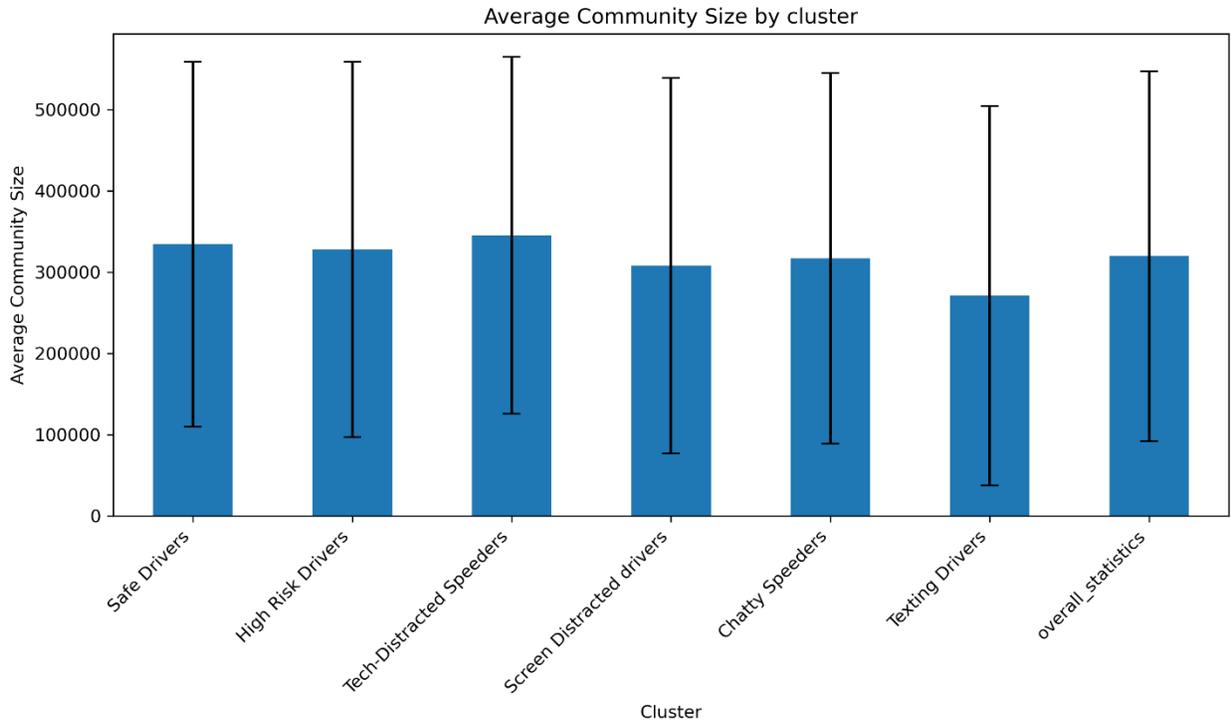


Figure 22 Community size (approximate population) by risky driving behaviour cluster.

Younger drivers are more likely to be in High-Risk driver and Texting driver clusters while older drivers tend to fall in the Safe Driver and Chatty Speeder clusters (Figure 23).

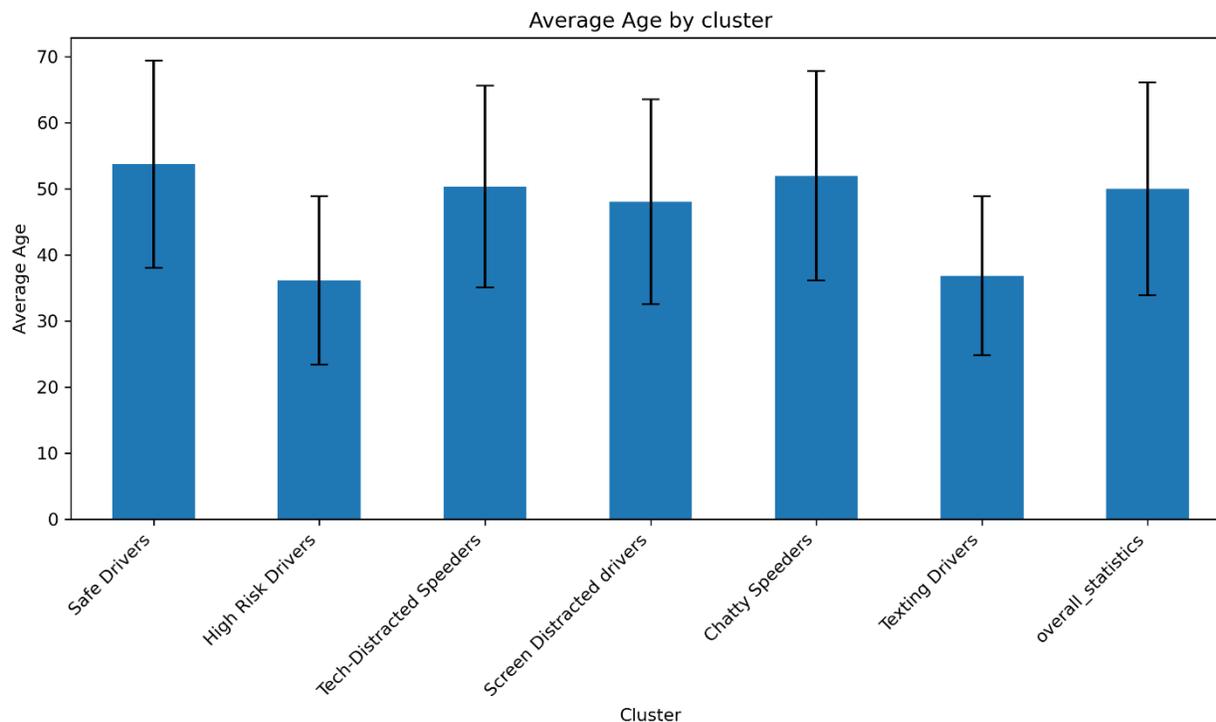


Figure 23 Age group differences by risky driving behavior clusters.

Using “Clean driving record” as a measure of traffic danger outcomes (Figure 24), drivers in the Texting Drivers and Tech-Distracted Speeders have the worst driving records. The Screen-Distracted Drivers, High Risk Drivers, and Chatty Speeders all have similar levels with Safe Drivers having the lowest which supports the naming of that later group.

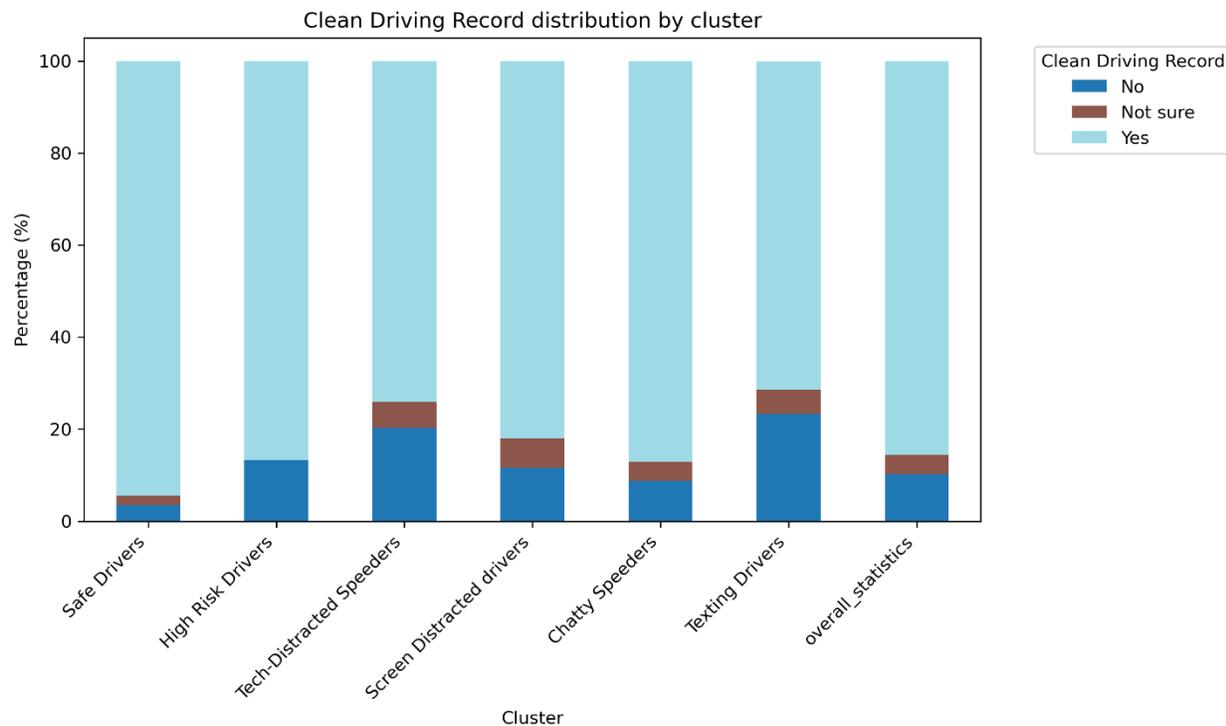


Figure 24 Clean driver for each cluster.

## 6.2 Crashes and near misses over time

### 6.2.1 Near misses

The frequency distribution of near-miss incidents for the six clusters across 2019, 2020, and 2023 are shown in Figure 25. Using the rate of respondents without no near miss as an indicator of safer outcomes, Safe Drivers are the safest group, with 90% (2019), 93% (2020), and 87% (2023) reporting no near misses. Next are Chatty Speeders (83%, 86%, 76%), followed by Screen-Distracted Drivers (81%, 85%, 71%). Tech-Distracted Speeders and Texting Drivers show intermediate safety profiles (Tech-Distracted Speeders: 74%, 81%, 71%; Texting Drivers: 70%, 75%, 69%). High-Risk Drivers are the least safe, with the lowest rate of respondents without any near miss (56%, 56%, 53%) across the three years. The overall statistics bars for each year lie between these extremes, with 81% (2019), 85% (2020), and 77% (2023) of respondents reporting no near misses.

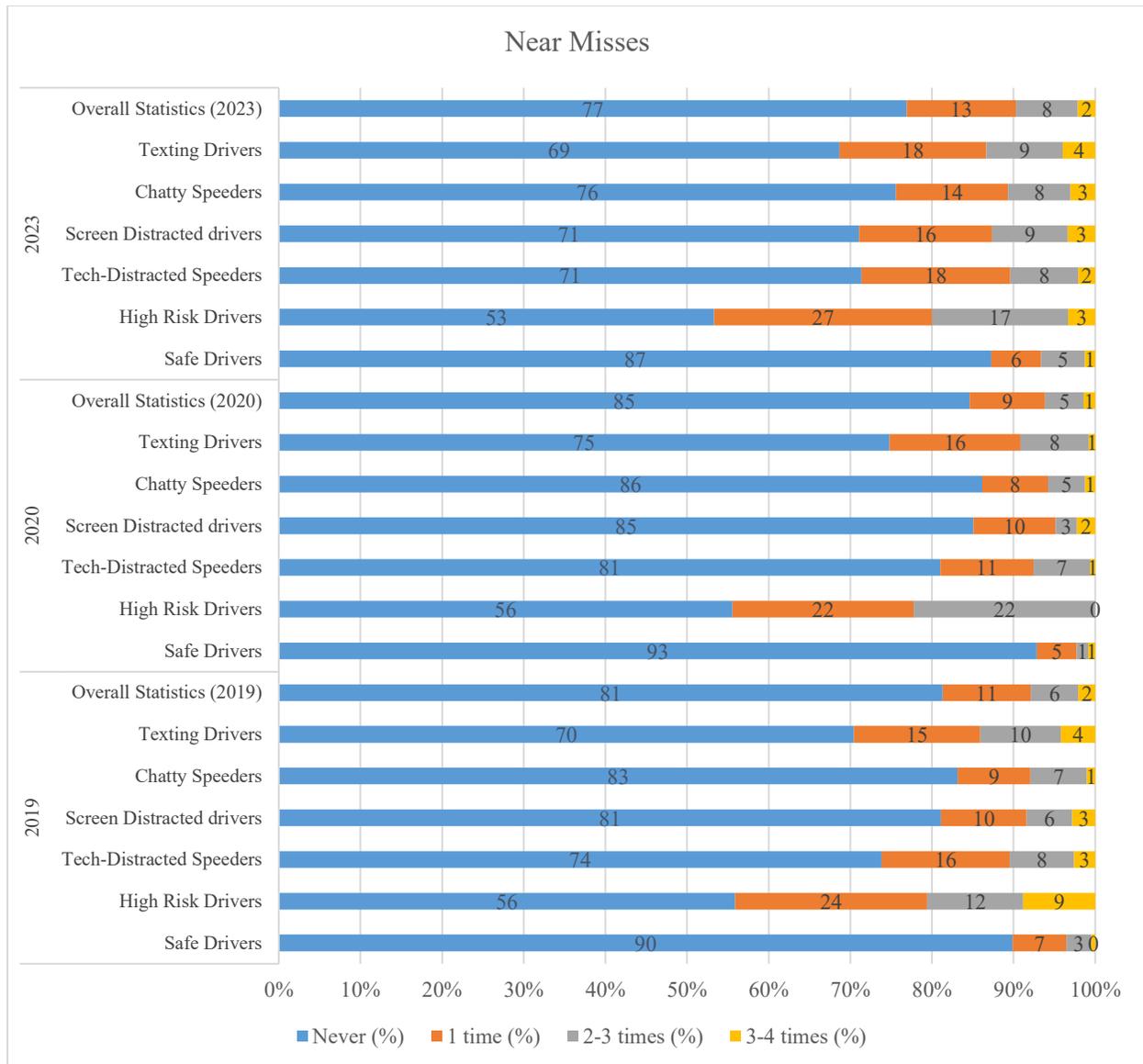


Figure 25 Near-miss frequencies for each cluster.

## 6.2.2 Crashes

The Figure 26 summarizes the frequency distribution of crash incidents for the six clusters across 2019, 2020, and 2023. Safe Drivers consistently reported the highest no-crash rates (95% in 2019, 96% in 2020, 95% in 2023), with minimal rates of higher crash frequency. High Risk Drivers exhibited the highest crash rates, with no-crash percentages of 61% (2019), 51% (2020), and 56% (2023), and elevated one-crash (up to 33% in 2020) and 2-3 crash rates (up to 20% in 2019). Texting Drivers showed moderate crash rates, improving from 85% no crashes in 2019 to 90% in

2023. Tech-Distracted Speeders, Screen-Distracted Drivers, and Chatty Speeders maintained high no-crash rates (88% - 95% across years), with low frequencies of multiple crashes.

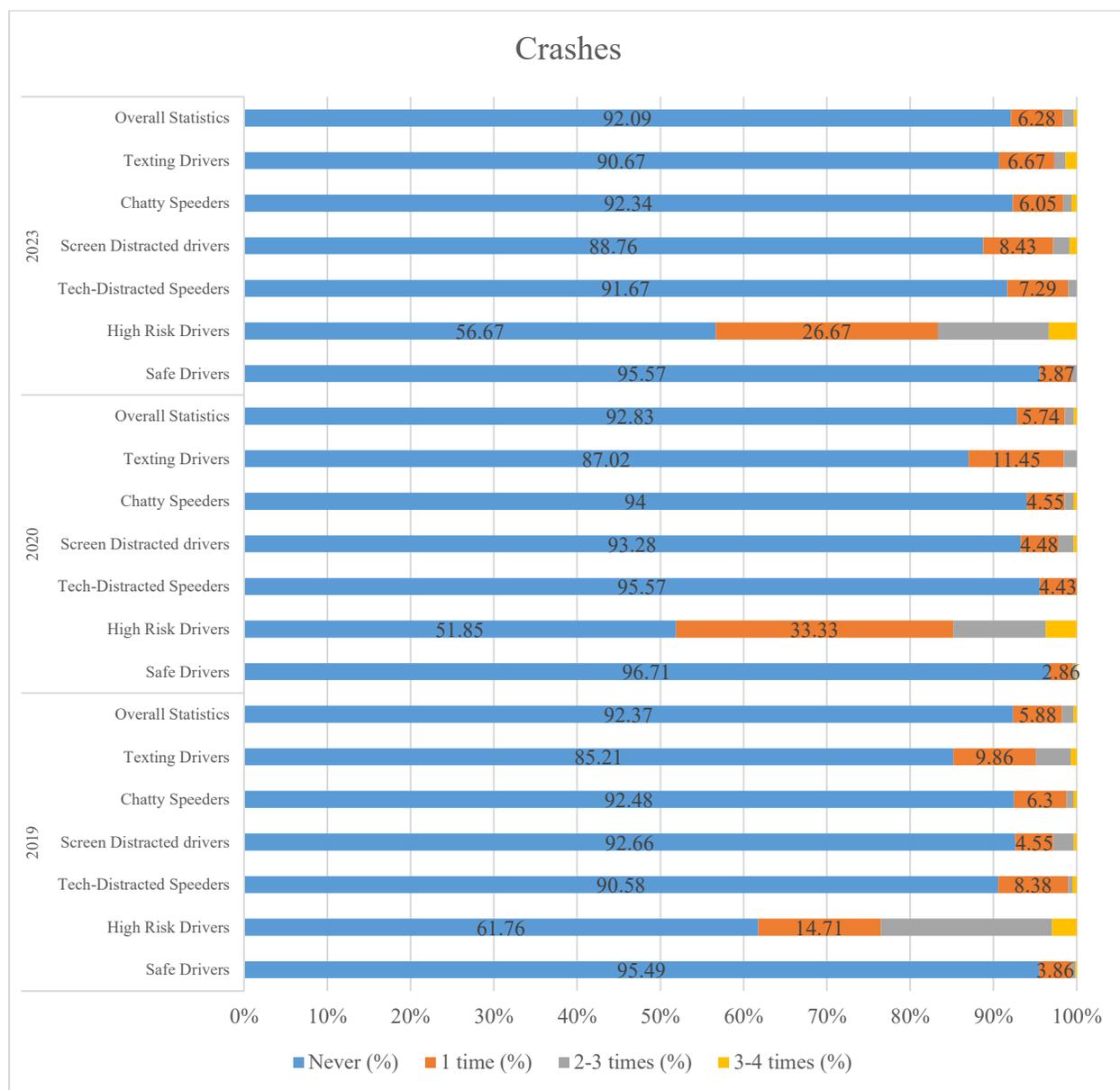


Figure 26 Crash frequencies for each cluster.

Overall, the cluster analysis indicates meaningful differences in demographic and behavioral risk profiles. Safe Drivers are more likely to include older or retired individuals (with slightly toward female), and they consistently show clean records and the lowest near-miss and crash rates. However, retirees and people aged 65+ do not constitute the majority of this segment. At the other

end of the spectrum, High-Risk Drivers are disproportionately younger males and more often have lower education and income, with a notable share of students; they report the poorest safety outcomes, including the highest involvement in near-misses and crashes. Texting Drivers and Tech-Distracted Speeders skew younger, show higher rates of full-time employment, and tend to come from higher-income households; they also exhibit elevated crash and near-miss rates and a higher prevalence of non-clean driving records, underscoring distraction as a key risk factor. By contrast, Screen-Distracted Drivers and Chatty Speeders occupy an intermediate position, with outcomes worse than Safe Drivers but not as severe as the High-Risk or tech-distracted groups. Taken together, the results suggest that age, gender, education, and occupational status together with distraction behaviors jointly shape crash and near-miss risk.

### **6.3 Classification according to attitudes**

In this sub-section, I categorize respondents based on their attitudes across the three sets of questions about attitudes toward Liberty, Risk-Taking Personality, and Acceptability of Risky Behaviors using clustering and cluster analysis. These three constructs are conceptually distinct and were measured using different sets of question: (i) the risky driving behavior clustering groups respondent-period records based on reported frequencies of 11 driving behaviors across the three periods; (ii) the Liberty clustering captures orientation toward individual freedom and the role of government; (iii) the Risk-Taking Personality clustering captures a stable personality tendency toward sensation-seeking or risk aversion; and (iv) the Acceptability clustering captures normative judgment about whether violating traffic rules is acceptable under different conditions. Because these questions measure different underlying constructs, combining them into a single clustering would mix behaviors with attitudes and personality. Therefore, four separate clustering analyses were conducted, one behavioral and three attitudinal, so that relationships between constructs could be tested transparently using cross-tabulations and regression models. Unless otherwise stated, differences across clusters are descriptive; where uncertainty bars overlap or cell sizes are small, interpretations are made cautiously and are confirmed in later multivariable models.

#### **6.3.1 Liberty opinions: conservative, libertarian, and liberal clusters**

Attitudes toward liberty shows opinions on personal responsibility which can influence behaviors in social contexts such as compliance with traffic rules or societal norms. The mean scores for each of the Liberty statements are shown for each cluster in Figure 27 along with the overall mean.

Analyzing the clustering results presented in Figure 27, we can describe the three Liberty clusters in the following way:

- *Cluster 1 (Conservative)*: This group shows moderate support for individual responsibility and property rights with some caution about personal freedom. In other words, this group may be labeled as “Conservatives”, since the members of this group believe in freedom up to a point but also accept certain norms or regulations for the sake of order. For example, previous research found that a conservative might not completely reject safety laws especially if they maintain social norms, reflecting a law-and-order orientation with limited government interference but emphasizing social norms over individualism (Iyer et al., 2012).
- *Cluster 2 (Libertarians)*: This group, labelled “Libertarians”, strongly value individual rights and personal freedom in both economic and personal spheres coupled with a limited role for government. They support free markets and believe people should be free to pursue their own lives with minimal state interference. This aligns with studies defining libertarians as those who prioritize individual liberty above other moral concerns showing weaker support for interventions like advancing the common good (Iyer et al., 2012).
- *Cluster 3 (Liberal)*: This group was labelled “Liberal” as they were the most likely to value the common good over the various freedoms. They are more willing to accept government action to promote the common good even at the cost of some individual freedom. This cluster reflects a “progressive” mindset – pro-collective/common-good in economics, but pro-personal freedom in the social realm (28% somewhat agree on common good), with balanced views on freedoms (e.g., 20% somewhat disagree on personal freedom) (Iyer et al., 2012).

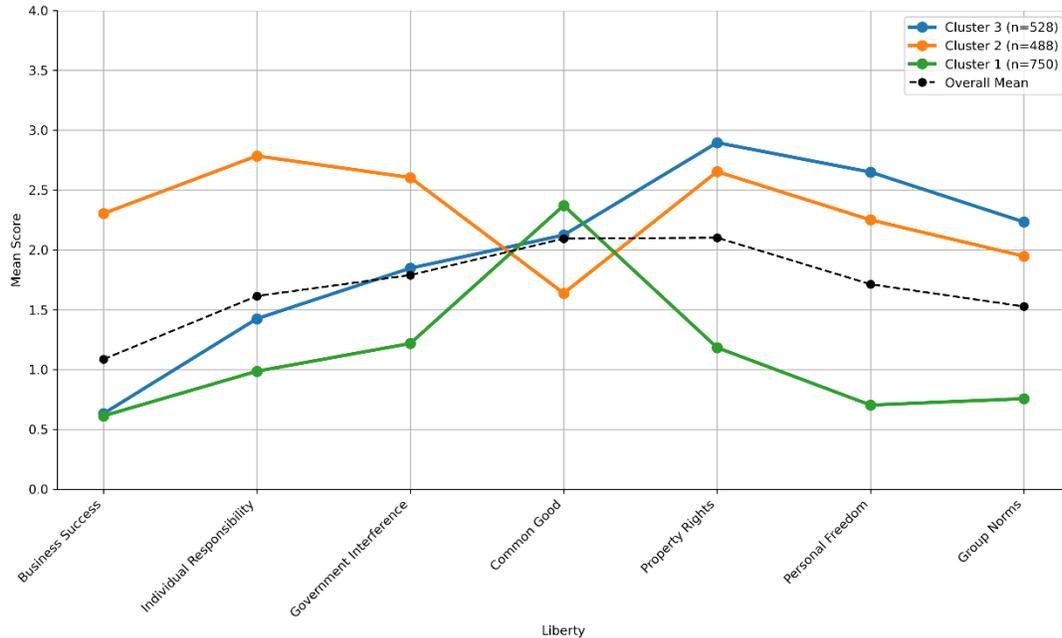


Figure 27 The means of respondents per cluster to different Liberty statements (4 = totally agree to 0 = totally disagree).

### 6.3.2 Risk taking personality: risk avoiders, situational risk takers, sensation seekers

The means of the clusters show different levels of disagreement with risk taking statements, enabling clustering into profiles based on sensation-seeking (Figure 28). These results show very clear distinctions between the groups except that no one feels comfortable with an unsafe driver.

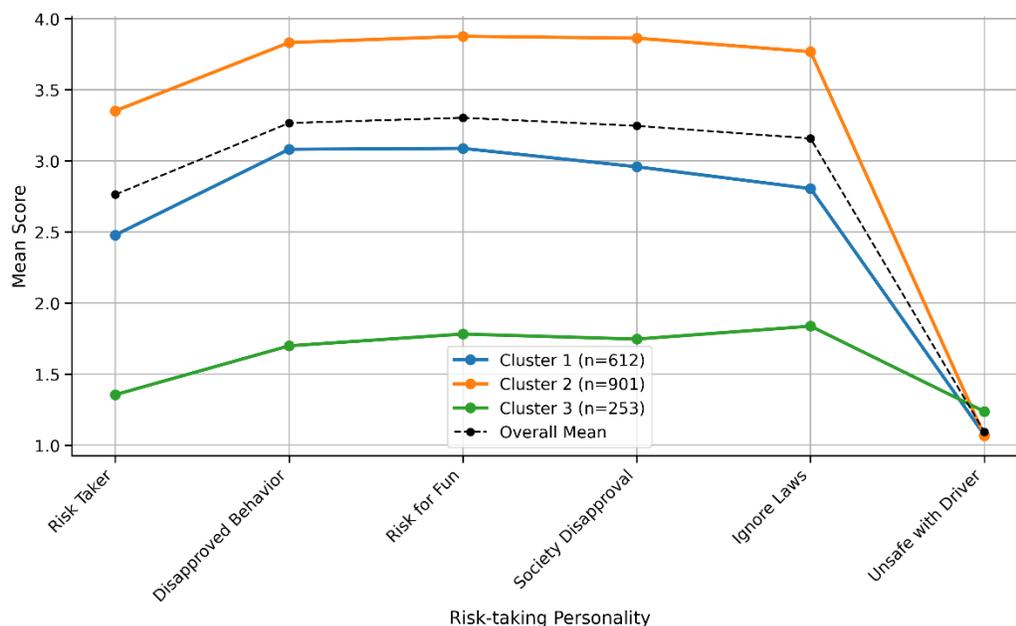


Figure 28 The profile means of respondents per cluster to different risk-taking personality questions (0 for totally agree to 4 for totally disagree).

The three cluster can be described in the following way:

- Cluster 1 (Situational Risk Takers):* For the statement “I tend to take risks”, 18% of respondents in this cluster chose the neutral category, and for the statement “It does not bother me to break the law if I can get away with it”, 12% chose the neutral category. Together with the mid-range cluster means in Figure 28, these neutral or moderate responses suggest context-dependent risk takers. As shown in Figure 28, Cluster 1 has mean scores between those of the other two clusters on most items, indicating a mid-level disagreement with statements about being a risk taker and ignoring laws. These results indicate situational rather than frequent risk-taking, consistent with research separating situational risk-takers from those who take risks frequently (Weber, 2001; Zhang et al., 2019)).
- Cluster 2 (Risk Avoiders):* Not agreeing with the risk-taking statements across some questions (e.g., 43% somewhat disagree on being a risk-taker; 49% totally disagree with the statement that it does not bother them to break the law if they can get away with it) indicates risk avoidance. The profile of risk avoiders shows low scoring on sensation-seeking scales and high on harm avoidance (Weber, 2001).

- *Cluster 3 (Sensation Seekers)*: This group corresponds to high risk-tolerance, thrill-seeking personalities. They tend to see themselves as risk-takers and might even enjoy the adrenaline (For the statement “the greater the risk, the more fun the activity”, 39% of respondents expressed agreement and 43% were neutral). Such individuals are well-documented in psychology as sensation seekers, defined by a desire for novel, intense experiences even if they involve significant danger (Zhang, Qu, Tao, & Xue, 2019). According to ESRA3 research on attitudes (Meesmann & Wardenier, 2024), these characteristics increase crash risks by increasing participation in risky driving behaviors.

### 6.3.3 Acceptability of risky driving behaviors: rule-followers, speeders, situational, and high-risk takers

This group of questions involves how acceptable various unsafe driving behaviors are for respondents such as speeding, drunk driving, running red lights, not wearing seatbelts, or using a phone while driving (Figure 29). These questions directly measure the willingness to violate traffic rules.

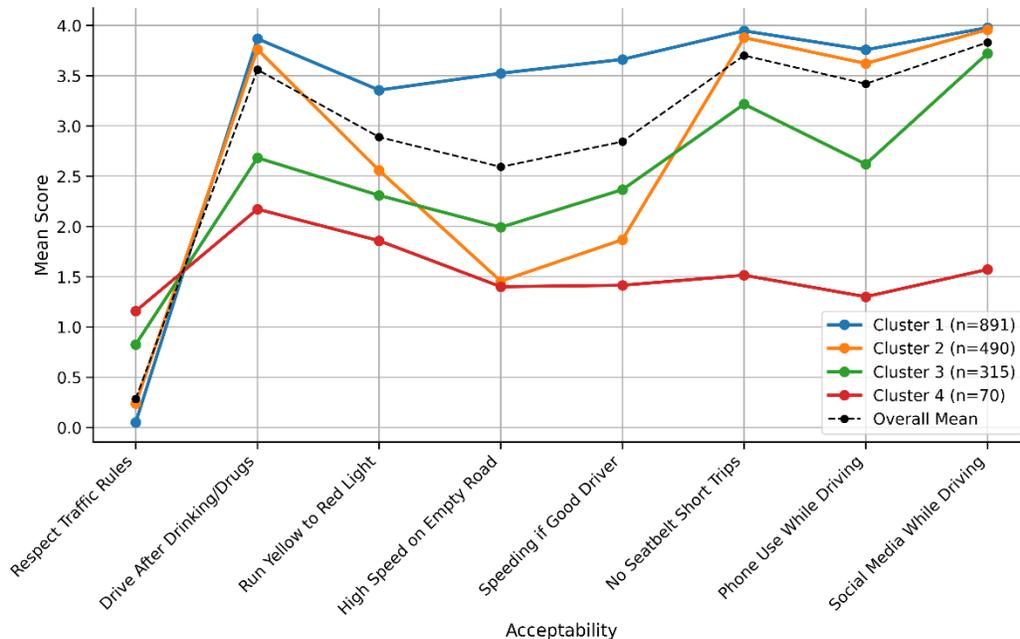


Figure 29. The profile means of respondents per cluster to different Acceptability of risky driving behavior questions (0 for totally agree to 4 is totally disagree).

Analyzing the clustering results in Figure 29, we can describe the four clusters in the following way:

- *Cluster 1 (Rule Followers)*: In general, this group strongly disagrees with any idea that risky behaviours are acceptable, e.g., they firmly believe traffic rules must be respected and state that it is not acceptable to speed, drink and drive, or drive without a seatbelt under any circumstances. These individuals demonstrate a strong commitment to following the law and taking personal responsibility for road safety, consistent with previous research that has identified a similar "rule-abiding" cluster in studies of driving attitudes (Coogan et al., 2014).
- *Cluster 2 (Speeders)*: Members of this cluster stand out primarily for their acceptance of speeding. They tend to consider driving above the speed limit as tolerable ("acceptable to drive faster if you are a good driver" and "on empty roads driving at a higher speed is okay"). However, they still disapprove of other high-risk behaviors like drunk/drugged driving and distracted driving.
- *Cluster 3 (Situational Risk Takers)*: This cluster's philosophy is "situational acceptance" of rule breaking. These respondents generally know and respect traffic safety rules, but they find certain violations acceptable under specific conditions and not just speeding. For example, they agree that "when roads are empty, driving at a higher speed is ok," or that occasionally running a yellow to red light is acceptable. They could also be somewhat okay about short trips driving without a seatbelt or using a phone only if it is an urgent call. The important thing to remember about this cluster is that they accept reckless behaviour when they believe it has lower risk.
- *Cluster 4 (High Risk Takers)*: This cluster is the smallest but most extreme group. The members of group find many risky behaviors acceptable or have a high tolerance for breaking driving rules. High Risk Takers might be the ones who somewhat or totally agree with statements that most people reject (e.g., they do not strongly oppose drunk driving, speeding, phone use and other dangerous behaviors). These High-Risk Takers likely fall within those who not only commit risky behaviors but also accept them as normal.

## 6.4 Relationships between attitudinal clusters and risky driving behavior clusters

Because attitudes were measured for the 2023 survey, all three cross-tabulations use the 2023 risky driving behavior clusters. The relationship between the Liberty clusters and the Risky Driving Behavior clusters is shown in Figure 30, followed by Risk-taking attitudinal clusters in Figure 31, and finally Acceptability of risky driving behaviors in Figure 32. I present the overall numbers and percentages of each Liberty cluster and 2023 risky driving cluster in Table 26.

Table 26 Distribution of respondents in liberty and 2023 risky behaviour clusters

Risky Driving Cluster	Conservative	Libertarian	Liberal	Total
Safe Drivers	157	223	162	542
High-Risk Drivers	2	15	13	30
Tech-Distracted Speeders	61	94	37	192
Screen-Distracted Drivers	121	135	100	356
Chatty Speeders	151	204	141	496
Texting Drivers	36	79	35	150
<b>Total respondents</b>	<b>528</b>	<b>750</b>	<b>488</b>	<b>1,766</b>
<b>Overall percentage (%)</b>	<b>29.9</b>	<b>42.5</b>	<b>27.6</b>	<b>100.0</b>

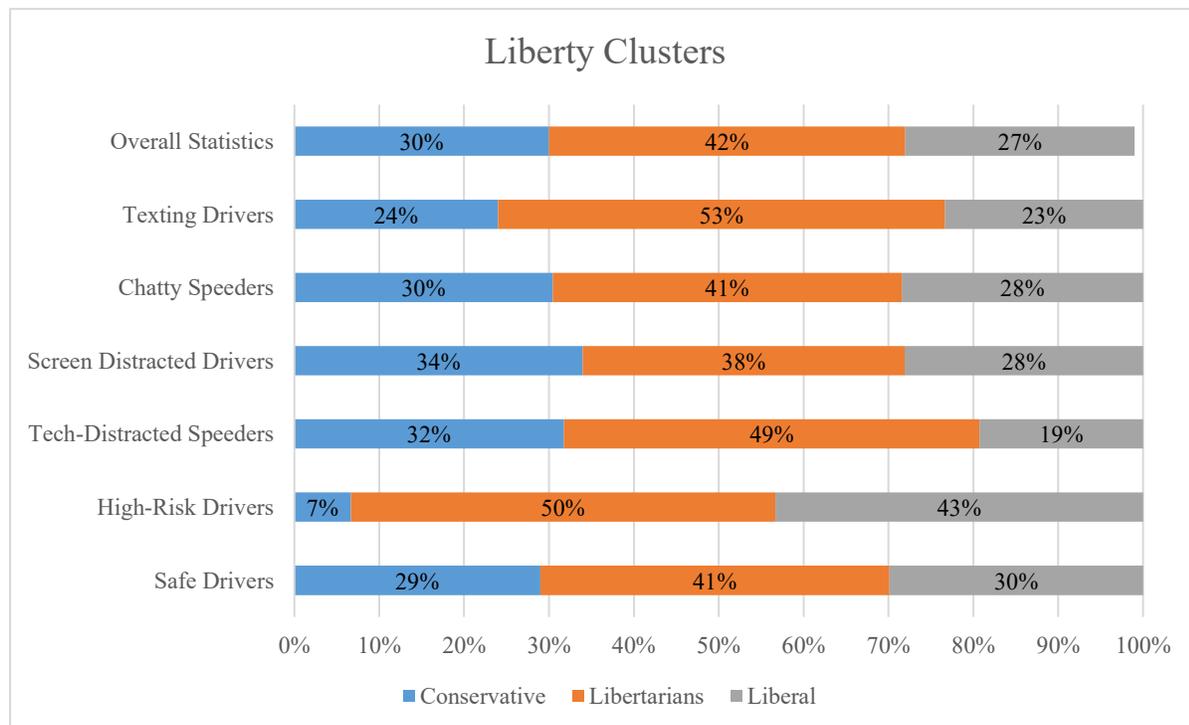


Figure 30. Liberty cluster's distribution among the six risky driving behaviors in 2023.

The overall numbers and percentages of each 2023 risk-taking personality cluster and risky driving behavior cluster are shown in Table 27 and Figure 31.

Table 27 Distribution of respondents in 2023 Risk-Taking Personality and risky behaviour clusters.

Risk-taking Cluster 2023	Situational Risk Takers	Risk Avoiders	Sensation Seekers	Total
Safe Drivers	166	326	50	542
High-Risk Drivers	5	4	21	30
Tech-Distracted Speeders	69	83	40	192
Screen-Distracted Drivers	135	183	38	356
Chatty Speeders	178	271	47	496
Texting Drivers	59	34	57	150
Total respondents	612	901	253	1,766
Overall percentage (%)	34.7	51.0	14.3	100.0

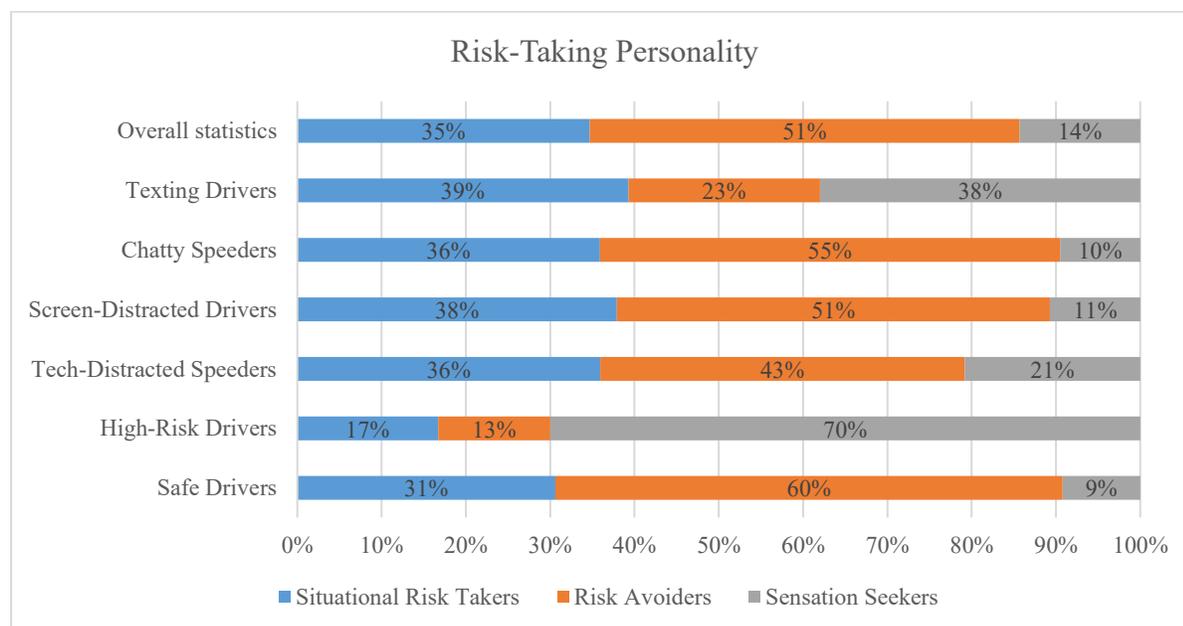


Figure 31 Risk-taking personality cluster's distribution among the six risky driving behaviors in 2023 based on Table 28.

I present the overall numbers and percentages of each acceptability cluster in Table 28 and the distribution of acceptability clusters across the six risky driving behavior profiles in 2023 in Figure 32 (based on Table 29).

Table 28 Distribution of respondents in Acceptability and 2023 risky behaviour clusters

Risky Driving Cluster	Rule-Followers	Speeders	Situational	High-Risk Takers	Total
Safe Drivers	394	84	51	13	542
High-Risk Drivers	3	1	5	21	30
Tech-Distracted Speeders	48	90	50	4	192
Screen-Distracted Drivers	154	124	68	10	356
Chatty Speeders	260	155	73	8	496
Texting Drivers	32	36	68	14	150
Total respondents	891	490	315	70	1,766
Overall percentage (%)	50.5	27.7	17.8	4.0	100.0

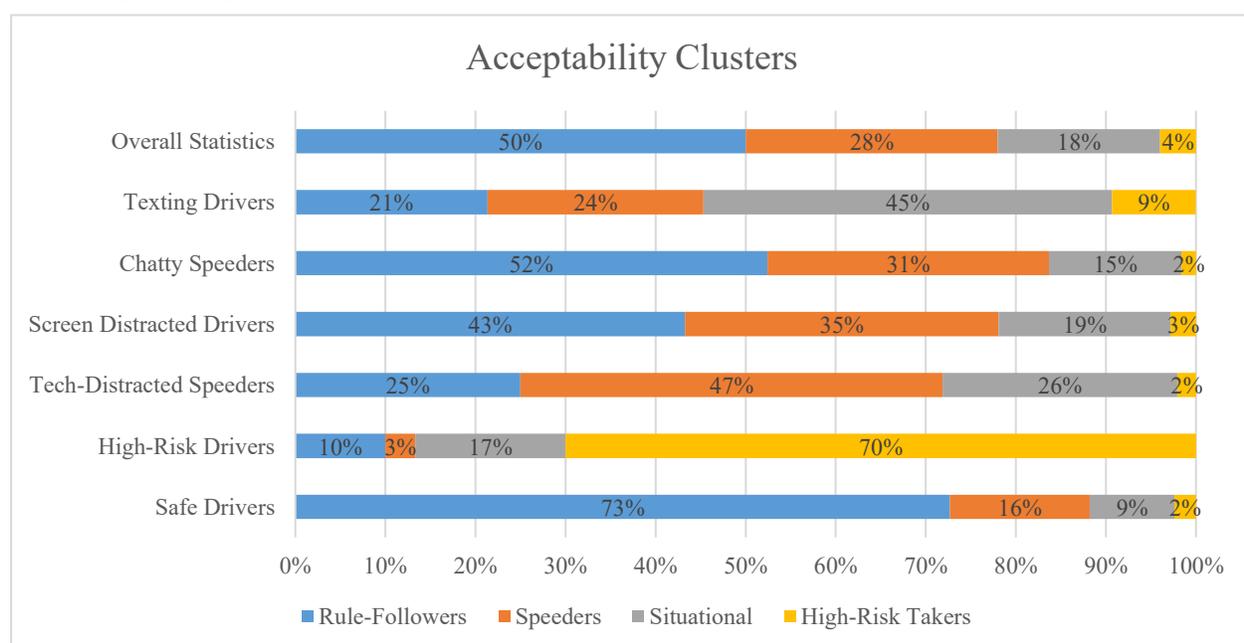


Figure 32. Acceptability cluster's distribution among the six risky driving behaviors in 2023 based on Table 28.

A summary of the attitudinal cluster relationships to the risky driving behavior clusters is given in Table 29. Percentages in this table refer to the share of each attitudinal cluster within a given risky

driving behavior cluster. For example, among Safe Drivers in 2023, 41% are Libertarians, 30% are Liberals, and 29% are Conservatives.

Table 29. The attitudinal mapping of six risky driving clusters (most common attitude cluster and the percentage of that cluster); if two clusters are similarly common for that group, both are mentioned.

<b>Driver Cluster</b>	<b>Liberty Orientation</b>	<b>Risk-Taking Personality</b>	<b>Acceptability of Violations</b>	<b>Behavioural Profile</b>
Safe Drivers	Mainly Libertarians (41%); also, Liberals (30%)	Predominantly Risk Avoiders (60%)	Strongly Rule-Followers (73%)	Cautious and lawful drivers; supportive of safety regulations; risks are taken only in specific situations.
High-Risk Drivers	Mostly Libertarians (50%) and Liberals (43%)	Largely Sensation Seekers (70%)	Strongly High-Risk Takers (70%)	Thrill-seeking drivers who engage in extreme speeding and dangerous behaviours; rules are often disregarded for personal excitement.
Tech-Distracted Speeders	Primarily Libertarians (49%) and Conservatives (32%)	Risk avoiders (43%) and Situational Risk Takers (36%)	Mostly Speeders (47%) and Situational Acceptors (26%)	Drivers who value personal freedom; justify speeding and selective rule-breaking; often distracted by technology.
Screen-Distracted Drivers	Conservatives (34%) and Libertarians (38%)	Mainly Risk Avoiders (51%), Situational Risk Takers (38%)	Rule-Followers (43%), Speeders (35%)	Generally cautious and supportive of safety rules, though prone to distraction; they often speeding.
Chatty Speeders	Libertarians (41%), Conservatives (30%)	Predominantly Risk Avoiders (55%), Situational Risk Takers (36%)	Mostly Rule-Followers (52%) and Speeders (31%)	Often rule-abiding but willing to accept situational risks; speeding seen as acceptable in certain contexts.
Texting Drivers	Predominantly Libertarians (53%)	Mixed: Situational Risk Takers (39%) and Sensation Seekers (38%)	Mainly Situational (45%)	Drivers who rationalize texting as acceptable in some situations; sensation-seeking and strongly emphasize personal freedom.

These behavioral patterns are consistent with pandemic-era road-safety evidence reported in North America and Canada, where reductions in traffic volumes were accompanied by increases in speeding and persistent risky behaviors even as mobility recovered. Canadian evidence based on

survey/self-reported behaviors similarly documents COVID-19-related changes in speeding, distraction, and impairment, supporting the relevance of these risk dimensions for profiling drivers in the present study (Traffic Injury Research Foundation, 2025; Vanlaar et al., 2021). In Québec, official road-safety reporting provides complementary context on crash and casualty trends over time, which can be used to situate these self-reported safety outcomes alongside administrative indicators (SAAQ, 2024).

### **6.5 Trends in the six risky driver behavior profiles across the three periods**

Overall, the survey data reveal shifts toward riskier habits between 2019, 2020, and 2023, particularly within clusters involving speeding and technology-related distraction, although some clusters demonstrate stability or minor improvements. As shown in Figure 33, there are noticeable shifts from Safe Drivers and other risky-driving clusters to the Chatty Speeders and technology-related clusters, especially between 2020 and 2023 after the strict COVID-19 restrictions ended.

Cluster Transitions Across Years (2019→2020→2023)



Figure 33 Transitions of the Risky Driving Behaviour Clusters across 2019, 2020, and 2023.

Figure 34 presents the proportions of the shifts of drivers into safer clusters or riskier clusters from 2019 to 2020 and from 2020 to 2023, using 2019 as the reference year. A chi-square test of independence on Cluster  $\times$  Year showed that the distribution of cluster memberships changed over time,  $\chi^2(10) = 40.54$ ,  $p < .001$ ; Cramér's  $V = 0.062$  (small effect;  $N = 5,298$ ). An examination of standardized residuals ( $|r| \geq 2$  as a practical salience threshold) indicates where the departures from independence occur. In 2020, Safe Drivers were over-represented relative to expectation ( $r = +4.78$ ), while Screen-Distracted Drivers ( $r = -2.73$ ) and Tech-Distracted Speeders ( $r = -2.15$ ) were under-represented. By 2023, the pattern reversed: Safe Drivers were under-represented ( $r = -4.80$ ), and Screen-Distracted Drivers were over-represented ( $r = +4.07$ ). Other clusters (e.g., Chatty

Speeders, Texting Drivers, High Risk Drivers) showed residuals near zero ( $|r| < 2$ ) according to this threshold, indicating empirically stable shares.

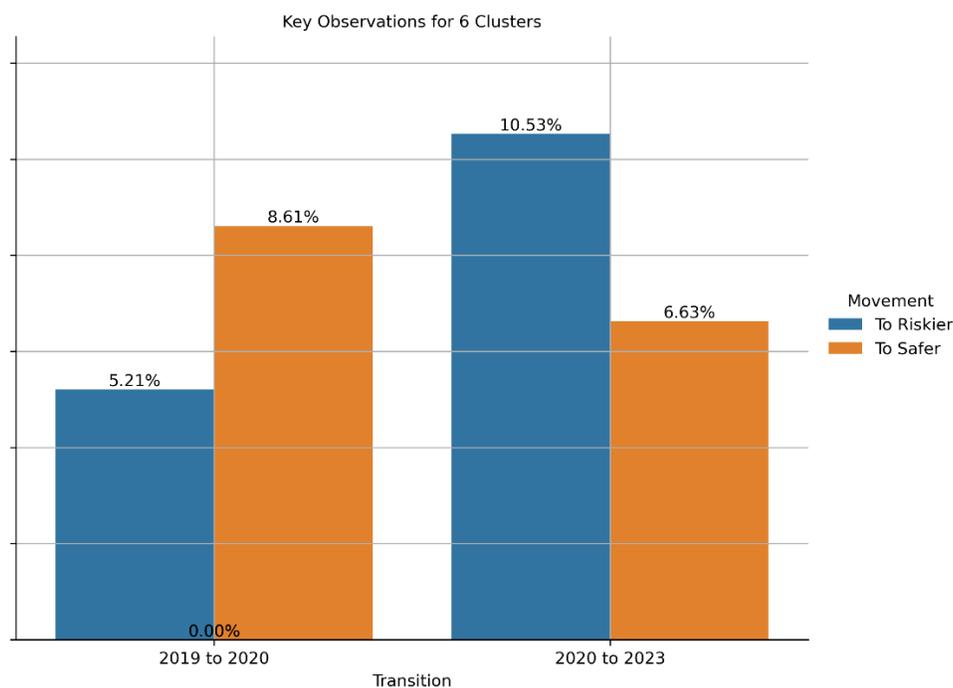


Figure 34 Percentage of all respondents in each risky driving behaviour cluster in 2019, 2020, and 2023.

Using the same information as the transition figure, we can also identify how many respondents remained in the same cluster across all three years versus those who changed clusters at least once. Figure 35 presents this cluster stability from 2019 to 2023.

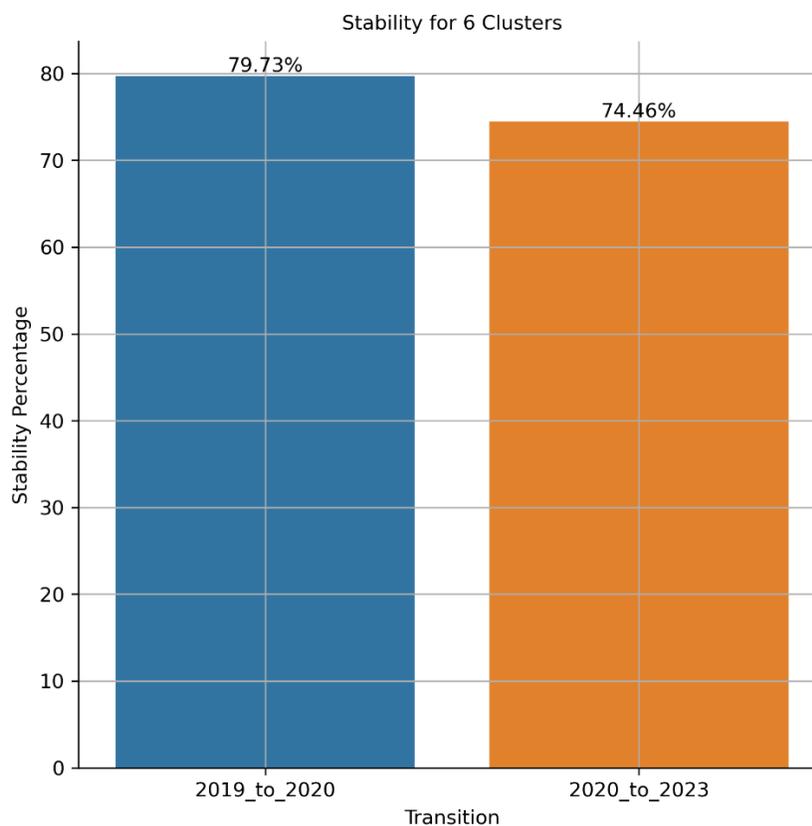


Figure 35 Clusters stability over time

Overall, it is quite stable with only a minority of the population (20 to 25%) changing. In other words, Figure 35 shows the overall stability of cluster membership across the two transition periods. Between 2019 and 2020, 79.3% of respondents remained in the same driving-behaviour cluster, while stability decreased slightly to 74.4% between 2020 and 2023. Other than that, in Table 30, we can examine how these changes occur within each cluster to better understand the main transition patterns and their characteristics. The “Reason” column is a descriptive label derived by comparing each transition-pattern group’s average values (or proportions) for crashes, near-misses, alcohol, and cannabis to the overall sample average for the same period; the terms “higher/lower” indicate directional deviation only and do not imply statistical significance. The “Trend in Dangerous Behaviour” column is coded from the direction of movement across risk profiles (e.g., moving from Safe Drivers toward distraction/speeding profiles is coded as “more dangerous,” and movement toward Safe Drivers as “safer”). Because these are descriptive

heuristics, they are used to narrate dominant transition patterns rather than to draw causal conclusions.

Table 30 Descriptive Statistics of cluster's transition from 2019 to 2023.

Pattern	Count	% Male	Dominant Age Group	Reason	Trend in Dangerous Behaviour
Chatty Speeders → Chatty Speeders → Chatty Speeders	305	0.51	65 years and older	lower crash avg; higher near-miss avg; lower alcohol avg; higher cannabis avg	More dangerous
Chatty Speeders → Chatty Speeders → Safe Drivers	11	0.55	55-64 years	same crash avg; same near-miss avg; higher alcohol avg; higher cannabis avg	Safer
Chatty Speeders → Chatty Speeders → Screen-Distracted Drivers	37	0.49	35-44 years	higher crash avg; higher near-miss avg; lower alcohol avg; higher cannabis avg	More dangerous
Chatty Speeders → Chatty Speeders → Tech-Distracted Speeders	21	0.52	65 years and older	same crash avg; lower near-miss avg; higher alcohol avg; lower cannabis avg	Safer
Chatty Speeders → Safe Drivers → Chatty Speeders	53	0.3	65 years and older	higher crash avg; higher near-miss avg; lower alcohol avg; lower cannabis avg	More dangerous
Chatty Speeders → Safe Drivers → Safe Drivers	17	0.29	65 years and older	lower crash avg; higher near-miss avg; lower alcohol avg; same cannabis avg	More dangerous
Chatty Speeders → Screen-Distracted Drivers → Screen-Distracted Drivers	13	0.46	25-34 years	same crash avg; higher near-miss avg; higher alcohol avg; higher cannabis avg	More dangerous
High Risk Drivers → High Risk Drivers → High Risk Drivers	17	0.82	25-34 years	lower crash avg; higher near-miss avg; higher alcohol avg; higher cannabis avg	More dangerous
Safe Drivers → Chatty Speeders → Chatty Speeders	24	0.5	55-64 years	higher crash avg; higher near-miss avg; lower alcohol avg; same cannabis avg	More dangerous

Table 30 Descriptive Statistics of cluster's transition from 2019 to 2023  
(continued)

Pattern (continued)	Count	% Male	Dominant Age Group	Reason	Trend in Dangerous Behaviour
Safe Drivers → Safe Drivers → Chatty Speeders	54	0.44	65 years and older	lower crash avg; higher near-miss avg; lower alcohol avg; higher cannabis avg	More dangerous
Safe Drivers → Safe Drivers → Safe Drivers	494	0.45	65 years and older	higher crash avg; higher near-miss avg; higher alcohol avg; higher cannabis avg	More dangerous
Safe Drivers → Safe Drivers → Screen-Distracted Drivers	16	0.56	25-34 years	higher crash avg; higher near-miss avg; higher alcohol avg; lower cannabis avg	More dangerous
Screen-Distracted Drivers → Chatty Speeders → Screen-Distracted Drivers	22	0.27	65 years and older	lower crash avg; higher near-miss avg; higher alcohol avg; same cannabis avg	More dangerous
Screen-Distracted Drivers → Safe Drivers → Screen- Distracted Drivers	22	0.23	45-54 years	same crash avg; higher near-miss avg; higher alcohol avg; higher cannabis avg	More dangerous
Screen-Distracted Drivers → Screen- Distracted Drivers → Chatty Speeders	13	0.46	35-44 years	same crash avg; same near- miss avg; lower alcohol avg; higher cannabis avg	Safer
Screen-Distracted Drivers → Screen- Distracted Drivers → Screen- Distracted Drivers	178	0.52	65 years and older	higher crash avg; higher near-miss avg; lower alcohol avg; higher cannabis avg	More dangerous
Tech-Distracted Speeders → Chatty Speeders → Tech-Distracted Speeders	13	0.62	55-64 years	lower crash avg; higher near-miss avg; same alcohol avg; same cannabis avg	More dangerous

Table 30 Descriptive Statistics of cluster's transition from 2019 to 2023  
(continued)

Pattern (continued)	Count	% Male	Dominant Age Group	Reason	Trend in Dangerous Behaviour
Tech-Distracted Speeders → Tech-Distracted Speeders → Tech-Distracted Speeders	112	0.71	65 years and older	higher crash avg; higher near-miss avg; lower alcohol avg; lower cannabis avg	More dangerous
Texting Drivers → Screen-Distracted Drivers → Screen-Distracted Drivers	11	0.45	35-44 years	same crash avg; higher near-miss avg; lower alcohol avg; higher cannabis avg	More dangerous
Texting Drivers → Screen-Distracted Drivers → Texting Drivers	9	0.33	25-34 years	same crash avg; same near-miss avg; lower alcohol avg; higher cannabis avg	Safer
Texting Drivers → Texting Drivers → Texting Drivers	84	0.62	25-34 years	lower crash avg; higher near-miss avg; higher alcohol avg; higher cannabis avg	More dangerous
Grand Total	1766	0.5	65 years and older	higher crash avg; higher near-miss avg; lower alcohol avg; higher cannabis avg	More dangerous

## 6.6 Other trends over the analysis period

I also present survey results on changes in alcohol use, cannabis use, car access, crashes, and near-misses for driver clusters, as illustrated in the figures from Figure 33 to Figure 40. For each of these variables, respondents answered frequency or quantity questions for 2019, 2020, and 2023 using ordered categories, which were recoded to representative numeric values (e.g., midpoints). The mean of these coded values was then computed by cluster and year. These variables were not used in the risky driving behaviour clustering itself, so their trends are independent of the cluster definitions.

### 6.6.1 Alcohol consumption trends

Alcohol consumption from 2019 to 2023 is reported in units, defined as one 333-ml bottle of beer per unit, can be seen in Figure 36. For weekly alcohol consumption, respondents indicated their

typical number of units of alcohol consumed per week in each period (2019, 2020, 2023). Answers were given in ordered categories (e.g., “0 units”, “Less than 5 units”, “5-9 units”, “10 or more units”). To approximate a continuous measure of weekly intake, each category was mapped to a representative numeric value: 0 units was coded as 0, “Less than 5 units” as 2, “5-9 units” as 7, and “10 or more units” as 10. The mean of these coded values was then computed by cluster and year, providing an estimate of average weekly alcohol consumption for each cluster over time.

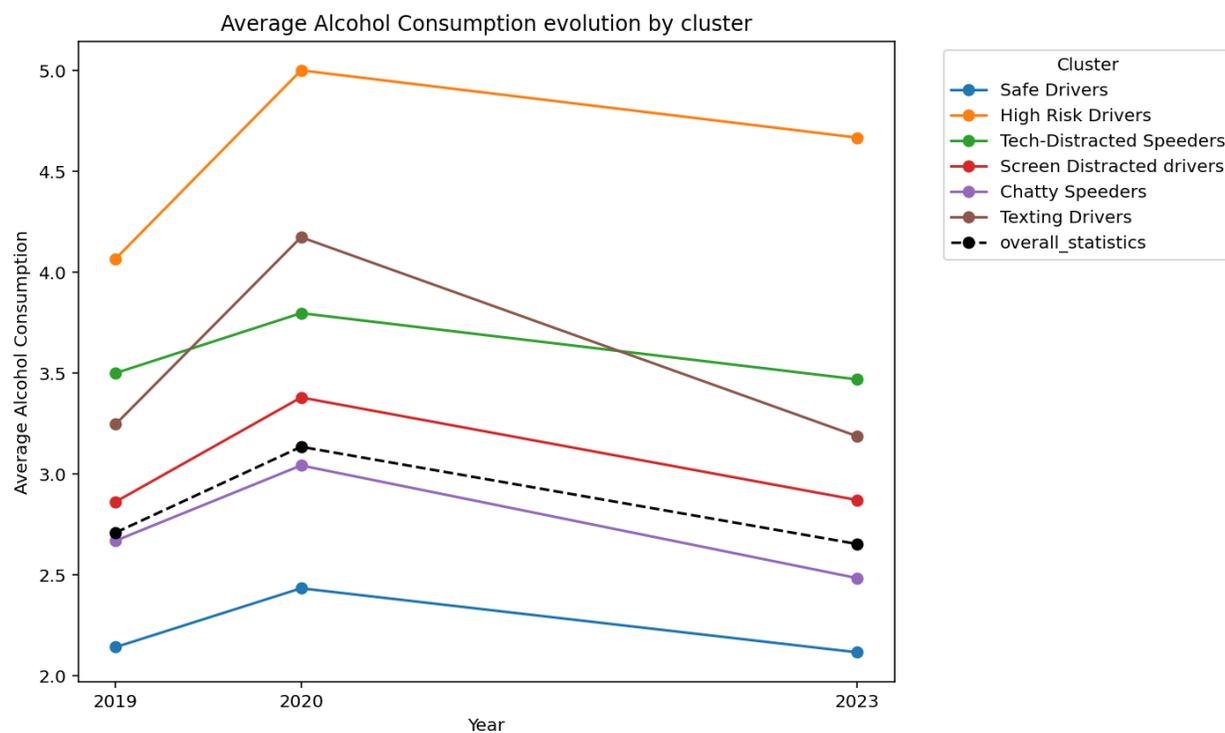


Figure 36 Average weekly alcohol consumption for each driving cluster (0 units = 0, Less than 5 units = 2, 5-9 units= 7, 10 or more units = 10).

### 6.6.2 Cannabis consumption trends

Cannabis consumption trends can also be seen in Figure 37. Using the same recoding approach, the cannabis frequency categories were converted to the numeric values indicated in the caption, and mean values were calculated by cluster and year to summarize average weekly cannabis use.

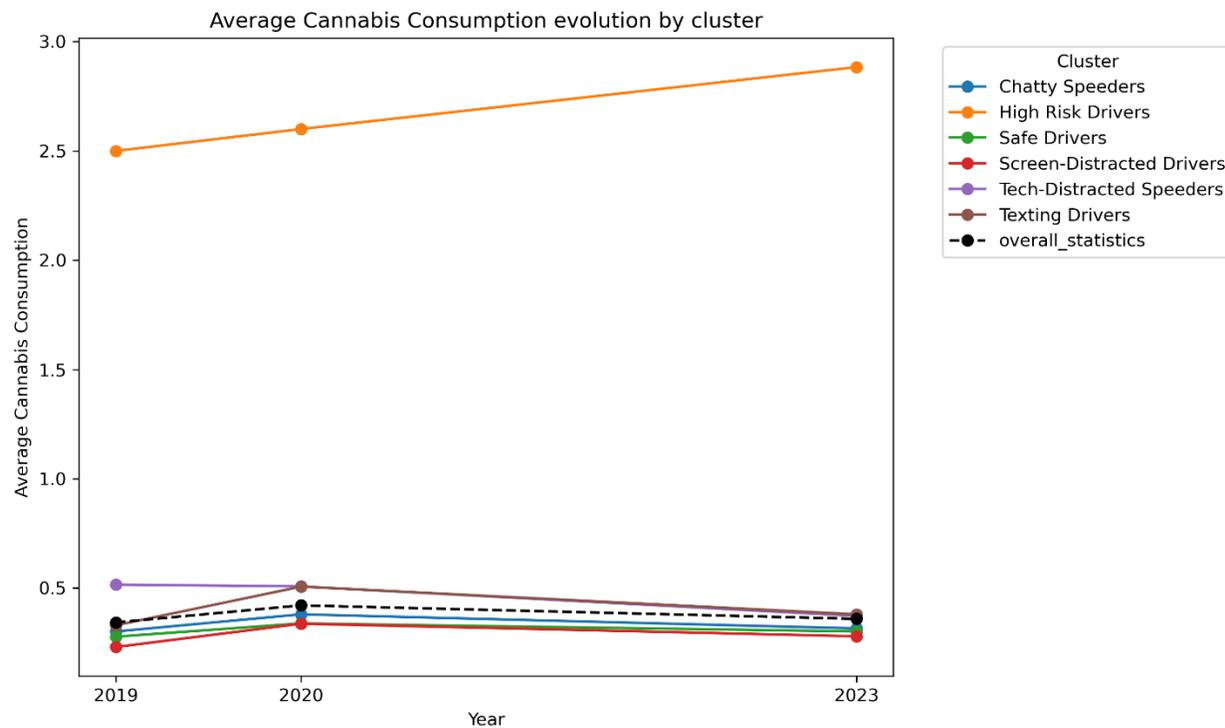


Figure 37 Average weekly cannabis consumption for each driving cluster (“None” = 0, “1 or 2 times a week” = 1.5, “3 to 4 times a week” = 3.5, “5 times or more per week” = 6).

### 6.6.3 Car access trends

For car access, respondents reported how reliably they owned or had access to a car in 2019, 2020, and 2023). The response categories reflected ordered levels of access (e.g., “Never”, “Hardly ever”, “Sometimes”, “Most of the time”, “Always have access”). These were transformed into an ordinal numeric scale (0, 1, 3, 5, and 7, respectively), where higher values indicate more consistent access to a vehicle. For each cluster and year, the average of this scale was calculated, yielding an approximate mean “car access score” that summarizes how regular access to a car differs between clusters and across years (Figure 35).

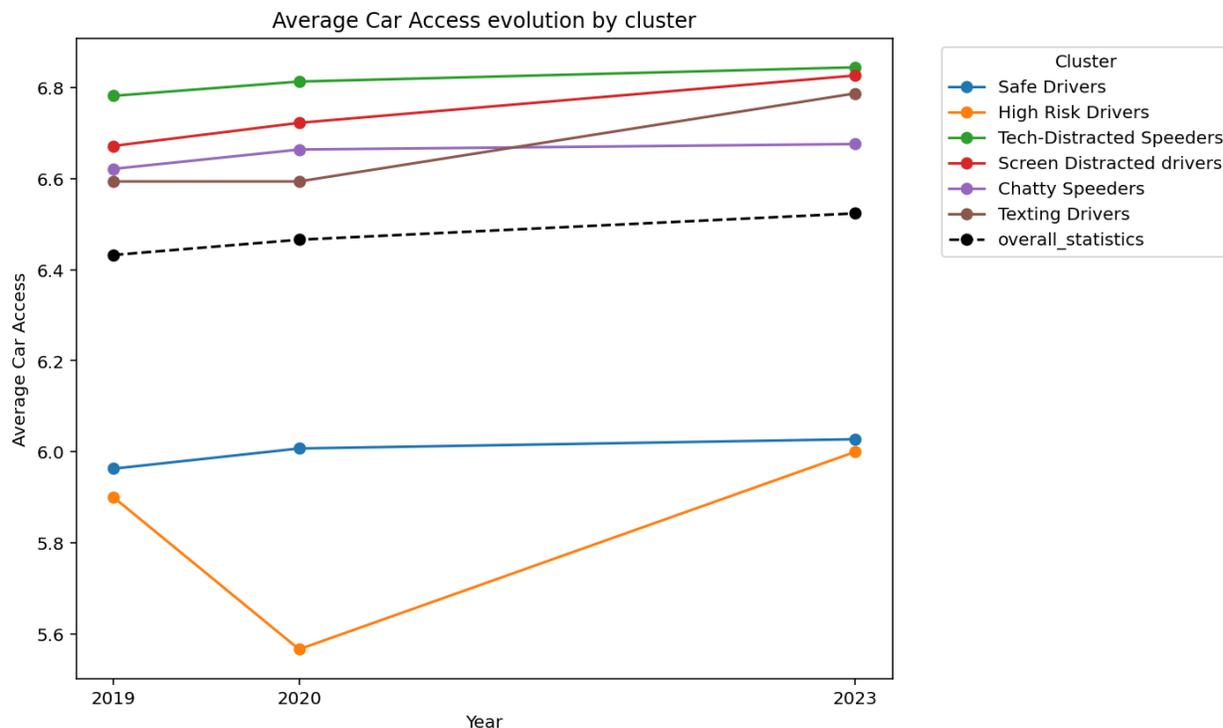


Figure 38 Average weekly car access for each driving cluster (None = 0, Always have access = 7).

#### 6.6.4 Trends in crashes

I next present involvement in crash and near misses in the following figures. For road crashes and near misses, in the survey, respondents were asked how many times they had been personally involved in crashes and near misses in each period (2019, 2020, 2023). The response options were ordinal frequency categories (e.g., “Never”, “1 time”, “2-3 times”, “3-4 times”). To obtain an approximate average number of crashes or near misses per respondent, these categories were recoded to numeric values representing either exact counts or midpoints of the ranges (0, 1, 2.5, 3.5, respectively). For each year and cluster, we then computed the mean of this recoded variable, producing cluster-specific average frequencies of crashes and near misses over time (Figure 39 and Figure 40). Figure 39 suggests a decrease in average crash involvement from 2019 to 2020, followed by an increase by 2023, with High-Risk Drivers remaining the highest across all years and Safe Drivers consistently the lowest.

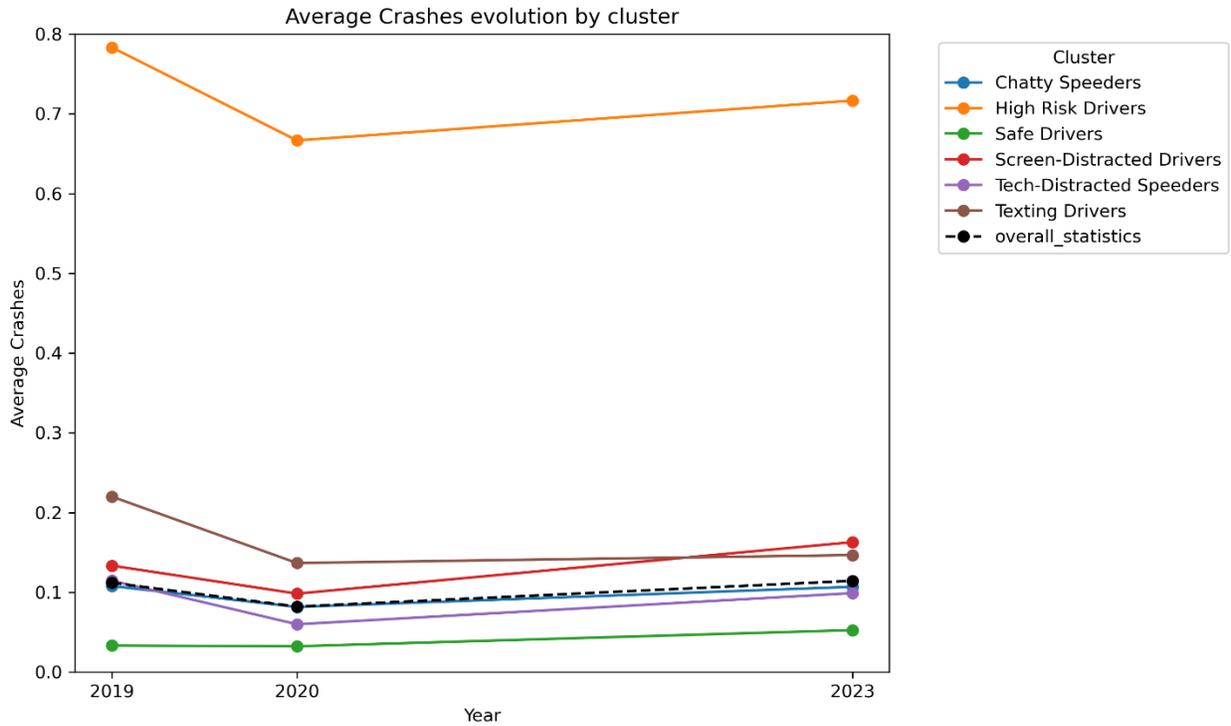


Figure 39 Average crash experience for each driving cluster (Never = 0, 3-4 times = 3.5).

### 6.6.5 Trends in near misses

The number of near misses in Figure 40 shows a drop in 2020 followed by an increase in 2023. In most clusters, near-miss averages in 2023 are higher than in 2019, especially for the more distracted and technology-oriented clusters.

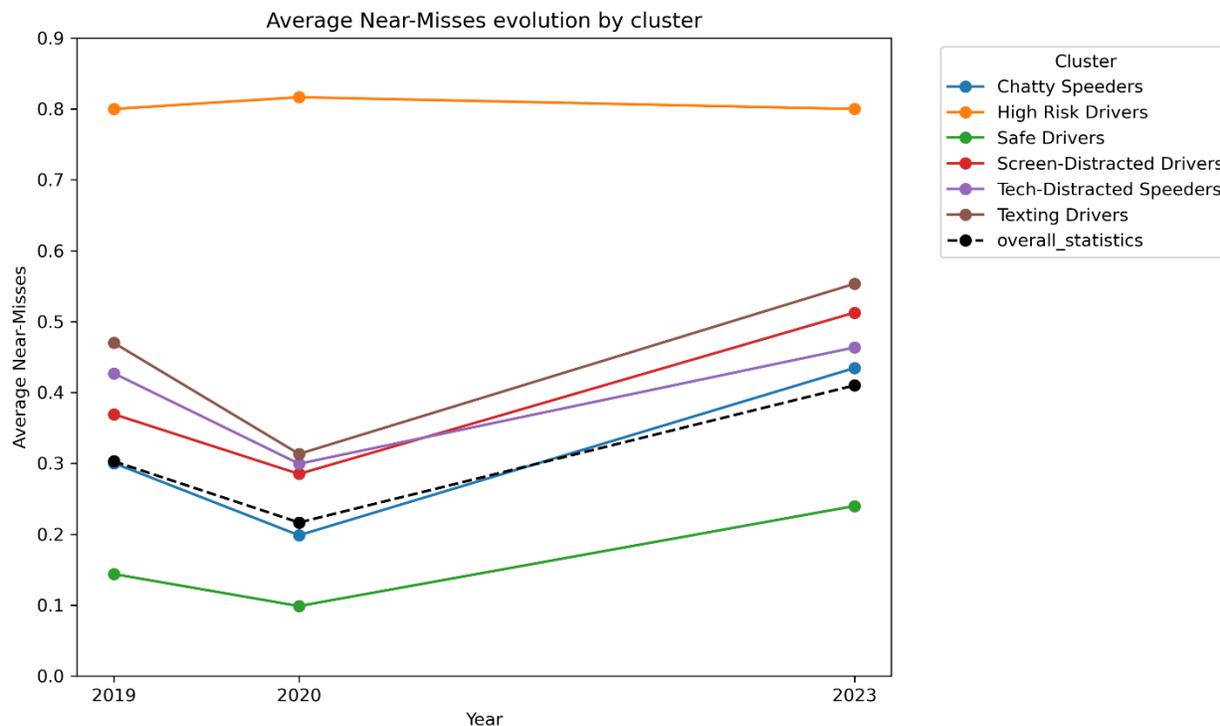


Figure 40 Average near-misses for each driving cluster (Never = 0, 3-4 times = 3.5).

Taken together, the statistical tables and trend figures show that driver groups behave differently over time. Alcohol consumption generally peaks in 2020 and then declines, cannabis use changes less but remains highest for High Risk Drivers, car access remains high with small increases, and both crashes and near-misses dip in 2020 before rising again by 2023, with larger increases for the more distracted and speeding-oriented clusters.

## 6.7 Multinomial logit analysis

A multinomial logit (MNL) model was fitted to predict membership in the six risky driving clusters from socio-demographic attributes and attitude variables across the three periods, and mobility patterns for each period (significance is defined by  $p < 0.05$ ). In all MNL models, the dependent variable is risky driving behaviour cluster membership (six categories), with the Safe Drivers cluster used as the reference outcome.

Because bivariate associations (e.g., the observed relationship between age and clean driving record) do not necessarily imply problematic multicollinearity in multivariable models, multicollinearity was assessed directly using variance inflation factors (VIFs). Pairwise

correlations alone can miss multivariate linear dependencies, which is why VIF-based diagnostics were used (Kim, 2019a).

The maximum VIF observed in the socio-demographic models was 2.62 (Age group 22-24), while the mobility models showed a maximum VIF of 3.68 (Vehicle type = No driving, 2019). The attitudinal models showed VIF values equal to 1.00, and the crash/substance-use models showed VIF values up to 1.15. These levels are below common screening thresholds (e.g., VIF in the 5-10 range), noting that such cutoffs are only rules of thumb and should be interpreted in context (Kim, 2019b; O'brien, 2007). For transparency and reproducibility, the full VIF tables for all model blocks and years are provided in Appendix B.

Given the number of coefficients across years and model blocks, detailed coefficient tables are provided in Appendix B, while the main text emphasizes synthesized results. Full coefficient tables (Appendix B) list estimated coefficients and p-values for all non-reference categories.

### **6.7.1 Multinomial logit for socio-demographic variables**

I present a summary of the significant variables in Appendix B1-1. Although age, driving experience, and clean driving record are conceptually related, all were retained to reflect distinct mechanisms (exposure/time licensed vs compliance/record outcomes).

With respect to the hypotheses presented, the results support the following interpretations for 2019:

- 1) H1 (Age). Younger groups (22-24 and 25-34 years) show higher odds of belonging to the High-Risk Drivers and Texting Drivers clusters than to the Safe Drivers cluster; therefore, H1 is supported for 2019.
- 2) H2 (Gender). Being male increases the odds of belonging to the High-Risk Drivers, Tech-Distracted Speeders, and Texting Drivers clusters compared with the Safe Drivers cluster; therefore, H2 is supported for 2019.
- 3) H3 (Driving experience). Lower driving experience (for example, drivers with 1 year of driving experience) shows some positive associations with cluster membership (for example, in the Tech-Distracted Speeders and Chatty Speeders clusters), but the pattern is not uniform across clusters; therefore, H3 is only partially supported for 2019.
- 4) H4 (Community size). The effects of community size are weak and mixed, with few significant terms; therefore, H4 receives only weak or partial support for 2019.

For the year 2020, the significant results are shown in Appendix B1-1

discussed below with respect to the hypotheses:

- 1) H1 (Age). Respondents in the younger age groups (22-24, 25-34, 35-44, 45-54 years) have higher odds of being in the Texting Drivers cluster than in the Safe Drivers cluster, with weaker effects for other clusters; overall, H1 is supported for 2020.
- 2) H2 (Gender). Male respondents have higher odds of belonging to all five risky driving behaviour clusters than to the Safe Drivers cluster; therefore, H2 is supported for 2020.
- 3) H3 (Driving experience). Compared with drivers who have more than 10 years of driving experience, shorter experience categories generally do not show higher odds of belonging to the risky clusters; therefore, H3 is not clearly supported for 2020.
- 4) H4 (Community size). Community Size = 2 is statistically significant only for the Texting Drivers cluster and effects are otherwise weak or mixed; therefore, H4 receives only partial support for 2020.

The significant results for the year 2023 are shown in Appendix B1-1 and discussed below with respect to the hypotheses:

- 1) H1 (Age) is supported for 2023 because younger groups (22-24 and 25-34) have higher odds of belonging to the High-Risk, Screen-Distracted, and Texting clusters.
- 2) H2 (Gender) is supported for 2023 because men have higher odds of belonging to the High-Risk, Tech-Distracted, and Texting clusters.
- 3) H3 (Experience) is not supported consistently for 2023 because several lower-experience categories are statistically significant in some clusters (e.g., 1-3 and 6-10 years), but the pattern is not uniform across clusters.
- 4) H4 (Community size) shows mixed directions with only a few significant terms, so support is weak/partial for 2023.

Across the three periods, age and gender effects are stable: younger respondents and men consistently have higher odds of belonging to several risky driving behaviour clusters than to the Safe Drivers cluster.

In contrast, driving-experience and community-size effects show no clear or consistent pattern across time, and do not support a simple interpretation that lower experience or a particular community size systematically leads to riskier driving.

A summary table with all the significant sociodemographic variables for three years is presented in Table 31.

Table 31 A summary table of significant socio-demographic variables from the 2019, 2020 and 2023 MNL analysis for each risky driving behaviour cluster (reference outcome: Safe Drivers).

Cluster	Variable	2019	2020	2023
High-Risk Drivers	Gender = Male	+	+	+
	Age Group = 22-24 years	+		
	Age Group = 25-34 years	+		+
	Household Income = \$75-99k	+	+	
	Clean Driving Record = No	+	+	
	Professional Driver = Yes	+	+	+
	Household Income = < \$25k		+	
	Education Level = ≤ High-School			+
	Education Level = CÉGEP / College			+
Tech-Distracted Speeders	Gender = Male	+	+	+
	Household Income = ≥ \$126k	+		+
	Education Level = Master+	-		
	Driving Experience = 1 year	-		-
	Clean Driving Record = No	+	+	+
	Employment Status (2023) = Not in labour force		-	
	Region = Laurentides		+	+
	Household Income = \$25-49k			-
	Region = Capitale-Nationale			+
	Region = Other			+
	Community Size = 1			-

Table 31 A summary table of significant socio-demographic variables from the 2019, 2020 and 2023 MNL analysis for each risky driving behaviour cluster (reference outcome: Safe Drivers) (continued)

Cluster	Variable	2019	2020	2023
Screen-Distracted Drivers	Age Group = 25-34 years	+		+
	Household Income = \$75-99k	+	+	
	Household Income = \$100-125k	+	+	+
	Household Income = ≥ \$126k	+	+	+
	Region = Laurentides	+	+	+
	Gender = Male		+	
	Clean Driving Record = No		+	+
	Age Group = 22-24 years			+
	Household Income = \$25-49k			-
	Driving Experience = 1 year			-
	Driving Experience = 2 years			-
	Driving Experience = 3 years			-
	Driving Experience = 6-10 years			-
	Chatty Speeders	Household Income = < \$25k	-	-
Education Level = Master+		-	-	
Employment Status (2023) = Not in labour force		-	-	-
Region = Laurentides		+		
Region = Other		+	+	+
Community Size = 1		-		-
Driving Experience = 1 year		-	-	-
Clean Driving Record = No		+	+	+
Household Income = \$25-49k			-	
Gender = Male			+	
Driving Experience = 3 years				-
Driving Experience = 5 years				-
Texting Drivers	Gender = Male	+	+	+
	Age Group = 22-24 years	+	+	+
	Age Group = 25-34 years	+	+	+
	Age Group = 35-44 years	+	+	+
	Age Group = 45-54 years	+	+	
	Employment Status (2023) = Not in labour force	-	-	-
	Clean Driving Record = No	+	+	+
	Age Group = 55-64 years		+	
	Community Size = 2		+	
	Driving Experience = 5 years		-	
	Household Income = \$100-125k			+
	Household Income = ≥ \$126k			+
	Driving Experience = 2 years			-

### 6.7.2 Multinomial logit for mobility variables

For mobility specifications, VIF values remained moderate (maximum VIF = 3.68 in 2019; 3.19 in 2020; 2.63 in 2023; Appendix B2), indicating that related indicators (e.g., vehicle type, driving frequency, car access) do not produce problematic redundancy in the models.

The significant results for the year 2019 are presented in Appendix B2-1 show that:

- 1) Occasional and rare/never driving frequency are generally associated with lower odds of belonging to the riskier clusters than to the Safe Drivers cluster.
- 2) Longer rail travel times and some categories of other-mode travel and non-local trip frequency are associated with higher odds of belonging to certain risky clusters (e.g., Screen-Distracted Drivers, Texting Drivers).

The MNL model with mobility variables for 2020 is presented in Appendix B2-1 shows that:

1. Occasional driving frequency and low car access are typically associated with lower likelihoods of being in several risky clusters compared with Safe Drivers.
2. Higher non-local trip frequency (medium or high) is associated with higher likelihoods of belonging to several risky clusters.
3. For some clusters, longer car travel time or longer biking time also shows positive associations with risky-cluster membership.

The MNL model with mobility variables for 2023 is presented in Appendix B2-1 and shows that:

- 1) Occasional or rare/never driving is generally associated with lower odds of belonging to the risky clusters than to the Safe Drivers cluster.
- 2) Longer use of other modes and higher non-local trip frequency tend to increase the odds of belonging to several risky clusters.
- 3) Some public-transport and walking-time contrasts indicate lower odds of risky-cluster membership relative to Safe Drivers.

### **6.7.3 Multinomial logit for attitude variables**

For the attitudinal models (2023 only), VIF values were  $\leq 1.00$  (Appendix B3), consistent with low overlap among the liberty, risk-taking personality, and acceptability cluster indicators. Attitudinal questions were not asked retrospectively for past years, so the MNL analysis with attitude variables is carried out only for the 2023 risky driving behaviour clusters.

### 6.7.3.1 Liberty

No significant associations were found at the  $p < 0.05$  level between the liberty clusters and the risky driving behavior clusters when comparing *libertarians* (reference group) to *conservatives* and *liberals*. At the  $p < 0.10$  level, being in the *conservative* liberty cluster is associated with a lower likelihood of being a High-Risk Driver rather than a Safe Driver, and with a higher likelihood of being a Screen-Distracted Driver than a Safe Driver, compared with *libertarians*. In addition, being in the liberal liberty cluster is (marginally) associated with a lower likelihood of being a Tech-Distracted Speeder than a Safe Driver, compared with *libertarians*.

### 6.7.3.2 Risk-taking personality

With *situational risk takers* as the reference risk-taking personality cluster, individuals in the *sensation seekers* cluster have higher odds of being Tech-Distracted Speeders and Texting Drivers rather than Safe Drivers, and individuals in the *risk avoiders* cluster have higher odds of being Texting Drivers rather than Safe Drivers, compared with *situational risk takers*.

### 6.7.3.3 Acceptability of risky driving behaviors

With *rule followers* as the reference acceptability cluster, individuals in the *situational risk taker* cluster have higher odds of belonging to every risky driving behavior cluster rather than the Safe Driver group. Those in the *speeder* cluster have higher odds of being Tech-Distracted, Screen-Distracted, Chatty, and Texting Drivers, while those in the *high-risk-taker* cluster show much higher odds only for High-Risk Drivers and Texting Drivers.

## 6.7.4 Multinomial logit for crashes and substance use variables

For crashes, near-misses, and substance-use models, VIF values were also low (maximum VIF  $\leq 1.15$  across years; Appendix B4), indicating negligible multicollinearity among these predictors. Crashes, near misses, and substance use are examined across the three periods in this section (see Appendix B2-4).

### 6.7.4.1 Before period (2019)

#### *Alcohol and drug use*

Reporting higher levels of alcohol and/or cannabis use is associated with increased odds of belonging to each of the risky driving behaviour clusters rather than to the Safe Drivers cluster, except for the Chatty Speeders cluster, which is not statistically different from Safe Drivers for

cannabis. The largest positive alcohol coefficients are observed for the High-Risk Drivers and Tech-Distracted Speeders clusters, while cannabis use is most evident for the High-Risk Drivers cluster, followed by the Texting Drivers cluster.

#### *Crashes and near-misses*

Higher counts of near-misses are associated with higher odds of belonging to each risky driving behaviour cluster rather than to the Safe Drivers cluster. Crashes are also associated with higher likelihoods to belong to the High-Risk Drivers, Texting Drivers, and Screen-Distracted compared with the Safe Drivers cluster.

### **6.7.4.2 During restrictions (2020)**

#### *Alcohol and drug use*

Respondents who report more frequent cannabis use have higher odds of belonging to the High-Risk Drivers cluster than to the Safe Drivers cluster for each non-zero cannabis-use category. This cluster does not have significant alcohol terms, suggesting that cannabis rather than alcohol distinguishes High-Risk Drivers from Safe Drivers. In contrast, Tech-Distracted Speeders and Texting Drivers stand out for alcohol: reporting 10 or more units of alcohol per week is associated with higher odds of belonging to these clusters than to the Safe Drivers cluster.

#### *Crashes and Near-misses*

Reporting at least one near-miss in 2020 is associated with higher odds of belonging to each risky driving behaviour cluster than to the Safe Drivers cluster. Reporting 2-3 near-misses is associated with especially high odds of belonging to the High-Risk Drivers, Tech-Distracted Speeders, Chatty Speeders, and Texting Drivers clusters. Reporting at least one crash in 2020 is associated with higher odds of belonging to the High-Risk Drivers and Texting Drivers clusters compared with the Safe Drivers cluster.

### **6.7.4.3 After the restrictions (2023)**

#### *Alcohol and drug use*

Reporting cannabis consumption three or more times per week is associated with higher odds of belonging to the High-Risk Drivers cluster, while the Chatty Speeders cluster is less likely than the Safe Drivers cluster to be associated with cannabis use. For alcohol, reporting zero units is less common among Tech-Distracted Speeders, Texting Drivers, and Screen-Distracted Drivers than

among Safe Drivers, and reporting 10 or more units per week is associated with higher odds of belonging to the Tech-Distracted Speeders cluster than to the Safe Drivers cluster.

### *Crashes and near-misses*

Across all three years, higher counts of near-misses are associated with higher odds of being classified in each risky driving behaviour cluster rather than in the Safe Drivers cluster. Crashes show a similar pattern: drivers who report one or more crashes are more likely to be in the High-Risk Drivers, Texting Drivers, and Screen-Distracted Drivers clusters than in the Safe Drivers cluster. In other words, having more crashes or near-misses is associated with a higher probability of belonging to the non-safe clusters rather than to the Safe Drivers group.

## **6.8 Safety outcome models (near-misses & crashes)**

I estimate two logistic regressions with binary outcomes: Near-miss (0/1) and Crash (0/1). Predictors include indicators for behavioral cluster membership (Safe Drivers as reference), exposure (weekly driving frequency), age, gender, driving experience, and community size, plus attitudinal covariates (risk-taking, acceptability of risky driving, liberty orientation) and year fixed effects.

### **6.8.1 Near-miss results**

I present the detailed model results from 2019 to 2023 in Appendix C1 to C3. In 2019, all non-safe clusters show significantly higher near-miss odds than the Safe Drivers cluster, with the largest odds ratios for the High-Risk Drivers and Texting Drivers clusters and positive associations also for the Tech-Distracted, Screen-Distracted, and Chatty Speeders clusters (all  $p < 0.01$ ).

In 2020, elevated odds persist and are generally larger than in 2019, again with High-Risk Drivers and Texting Drivers showing the highest near-miss odds, followed by the Tech-Distracted, Screen-Distracted, and Chatty Speeders clusters (all  $p < 0.001$ ).

In 2023, the same pattern remains: all non-safe clusters retain significantly higher near-miss odds than Safe Drivers, with especially strong associations for the High-Risk Drivers, Texting Drivers, and Screen-Distracted Drivers clusters (all  $p < 0.001$ ).

In the models with the full set of covariates, the behavioural cluster effects remain positive and generally statistically significant, indicating that cluster membership is associated with near-miss involvement even after accounting for exposure, socio-demographic, mobility, substance-use, and

attitudinal factors. Higher alcohol use (2020-2023), younger age (for example, 22-24 years in 2019 and 2023), low car access (2019), rail time  $\leq 40$  minutes and higher non-local trip frequency (2019), and liberty-liberal and risk-seeking profiles (2023) are positively associated with near-misses, whereas no driving and no/low car travel are protective (2019–2020). Driving experience is tested but does not show a clear or consistent association with near-miss outcomes once these other covariates are included. Details are provided in the model tables in the appendix.

With respect to hypothesis H8 (Near-miss), the results show that membership in any non-safe risky-driving cluster is associated with higher near-miss odds than Safe Drivers in the models with all predictors.

### **6.8.2 Crash results**

I present the detailed results from 2019 to 2023 in Appendix C4 to C6. In 2019, all non-safe clusters show significantly higher crash odds than the Safe Drivers cluster, with the largest odds ratios for the High-Risk Drivers and Texting Drivers clusters and positive associations also for the Tech-Distracted, Screen-Distracted, and Chatty Speeders clusters (all  $p < 0.01$ ).

In 2020, elevated odds persist and are generally larger than in 2019, again with High-Risk Drivers and Texting Drivers showing the highest crash odds, followed by the Tech-Distracted, Screen-Distracted, and Chatty Speeders clusters (all  $p < 0.001$ ).

In 2023, the same pattern remains: all non-safe clusters retain significantly higher crash odds than Safe Drivers, with especially strong associations for the High-Risk Drivers, Texting Drivers, and Screen-Distracted Drivers clusters (all  $p < 0.001$ ).

In the models with the full set of covariates, the behavioural cluster effects remain positive and generally statistically significant, indicating that cluster membership is associated with crash involvement even after accounting for exposure, socio-demographic, mobility, substance-use, and attitudinal factors. Higher alcohol use (2020-2023), younger age (for example, 22-24 years in 2019 and 2023), low car access (2019), rail time  $\leq 40$  minutes and higher non-local trip frequency (2019), and liberty-liberal and risk-seeking profiles (2023) are positively associated with near-misses, whereas no driving and no/low car travel are protective (2019-2020). Driving experience is tested but does not show a clear or consistent association with near-miss outcomes once these other covariates are included. Details are provided in the model tables in the appendix.

With respect to hypothesis H9 (Crash), the results show that non-safe clusters (especially High-Risk and Texting) have higher crash odds than Safe Drivers.

### **6.8.3 Synthesis**

Across 2019-2023, behavioral cluster membership is a consistent predictor of safety outcomes. Relative to Safe Drivers, non-safe clusters show elevated odds for both near-misses and crashes, with the largest effects for High-Risk and Texting, and positive associations for Screen-/Tech-Distracted and Chatty Speeders. In the companion models that include exposure, socio-demographic, mobility time-use, substance-use, and attitudinal covariates, the behavioural cluster effects remain positive and generally statistically significant, indicating that the associations between clusters and safety outcomes are not explained by these other factors alone.

These findings support hypotheses H8 and H9 by linking the risky driving behaviour clusters to near-miss and crash involvement. The broader implications of these safety outcome models are discussed in Chapter 7.

## CHAPTER 7 CONCLUSION, DISCUSSION & LIMITATIONS

### 7.1 Summary of the thesis

This thesis examined how the COVID-19 pandemic affected mobility, risky driving behaviors and road safety outcomes in Québec across three key periods: 2019 (pre-pandemic), 2020 (during restrictions) and 2023 (post-restrictions). Using an online survey of 1,941 respondents (1,766 drivers), it combined:

- Descriptive analysis of mobility and behaviors (Chapter 4 and 5).
- Six risky driving behavior clusters and three sets of attitudinal clusters (Section 6.1).
- MNL models for the determinants of membership in the six risky driving behavior clusters (Section 6.2).
- Logistic models for near-miss and crash outcomes (Section 6.3).

#### 7.1.1 Trends over time

Together, these analyses show how mobility, driver profiles, attitudes, and safety outcomes evolved before, during and after COVID-19.

COVID-19's influence is visible in both behavior and outcomes: 2020 looks safer, while 2023 shows more tech-distraction, crash involvement and near-misses than before the pandemic. 2020 shows reduced driving, lower crash and near-miss counts, and somewhat lower levels of some risky behaviors. By 2023, overall driving frequency and many behaviors return close to 2019 levels, but tech-based distraction (texting, looking at screens, hands-free talking) and minor speeding are more common. At the same time, self-reported crashes and near-miss involvement is higher in 2023 than in 2019, and all non-safe clusters show strong associations with both near-miss and crash outcomes.

Mobility and travel patterns shifted in 2020 and only partly returned to pre-COVID levels by 2023. Descriptive results in Chapter 4 show that public transport (bus and rail) use dropped strongly in 2020 and stayed below 2019 levels in 2023, while walking for short trips increased compared with 2019 and bike use among respondents did not fully recover by 2023. These patterns confirm that the pandemic temporarily reduced exposure, especially in 2020, while 2023 reflects a partial return with some persistent changes.

Risky driving behaviors became more frequent again by 2023, particularly minor speeding and technology-related distraction. Speeding 1-10 km/h over the limit is the most common risky

behavior. Its prevalence dipped slightly in 2020 and then rose above 2019 levels in 2023 (77% report doing it). Speeding 11+ km/h and running red lights/stop signs remained relatively stable over the three years with only small changes. Texting while driving and looking at screens show clear increases in 2023 compared with 2019. Talking hands-free also became more common by 2023. Driving while fatigued increased. Overall, 2020 appears as a temporary reduction in risky driving behavior, while by 2023, tech-related distractions, lower speed speeding, and fatigue driving clearly increased.

Near-misses and crashes decreased in 2020 and then rose again by 2023, especially near-misses. Crash involvement was reduced approximately by 25% in 2020 compared to 2019 and then increased by 39% in 2023 compared to 2020. The situation is worse for near-misses. Data showed the share of respondents with at least one near-miss decreased by 24% from 2019 to 2020 but increased 79% by 2023 compared to 2020. The mean near-miss count rose from 0.294 (2019) to 0.406 (2023). In other words, 2020 was the safest year in terms of self-reported crashes and near-misses (consistent with reduced travel).

Chapter 6.1 identified six behavior-based clusters:

- Safe Drivers, lowest on all risky behaviors;
- High-Risk Drivers, high on almost all risky behaviors;
- Tech-Distracted Speeders, frequent speeding (highest among all) plus looking at screens;
- Screen-Distracted Drivers, high on screen-related distraction;
- Chatty Speeders, frequent talking on the phone (especially hands-free); and
- Texting Drivers, who show high levels of texting as well as speeding and other distractions.

Cluster stability over time shows that most respondents remain in the same cluster, but there is movement toward more tech-distraction and chatty speeding between 2019 and 2023. Safe Drivers are over-represented in 2020 and under-represented in 2023, while Screen-Distracted Drivers increase in 2023. Using clean driving records and crash and near-miss frequencies, Safe Drivers have the cleanest records and the lowest crash and near-miss frequencies in all three years. All five non-safe clusters show higher near-miss odds than Safe Drivers in 2019, 2020 and 2023. For crashes, High-Risk Drivers, Screen-Distracted Drivers and Texting Drivers are repeatedly among the clusters with higher crash odds in all three years. Thus, the clustering approach successfully

identifies segments that are both behaviorally risky and more likely to report crashes and near-misses. High-Risk Drivers are the most extreme across behaviors, while Screen-Distracted Drivers and Texting Drivers are particularly important once near-miss and crash outcomes are considered because they repeatedly show higher likelihood of these events.

Overall, the profile results reinforce that technology-based distraction and frequent minor speeding are central features of the post-2020 pattern observed in 2023. From a Vision Zero or Safe System perspective, this supports prioritizing system-level countermeasures, such as technology-based tools that reduce distraction and speed management/road design measures that lower operating speeds by design, rather than relying only on individual behaviour change.

### **7.1.2 Individual characteristics**

Gender is a consistent and strong differentiator; age patterns are more complex. From the cluster descriptions, socio-demographic MNL models and summary tables, men are over-represented in the most dangerous behavior clusters (High-Risk Drivers, Tech-Distracted Speeders, Texting Drivers) and are less likely to be Safe Drivers. Being male is a significant positive predictor of non-safe cluster membership across several MNL models. This pattern is consistent with males being over-represented in non-safe clusters. Young adults (especially 25-34 and 22-24) are more likely to belong to High-Risk Drivers and Texting Drivers particularly in socio-demographic MNL models. Older drivers (especially 65+) are more often found among Safe Drivers and Chatty Speeders. However, age effects vary by cluster and year, so age patterns are not uniform across clusters and periods.

Liberty orientation are grouped into three clusters:

- 1) Conservative,
- 2) Libertarian,
- 3) Liberal.

Risk-taking personalities are grouped into three clusters:

- 1) Risk Avoiders,
- 2) Situational Risk Takers,

### 3) Sensation Seekers.

Acceptability of risky driving are grouped into four clusters:

- 1) Rule-Followers,
- 2) Speeders,
- 3) Situational Risk Takers,
- 4) High-Risk Takers.

Descriptive cross-tabulations and the attitude MNL show that acceptability of risky driving is the strongest and most consistent risky behaviour predictor: High-Risk Drivers and Texting Drivers are strongly associated with the High-Risk Taker acceptability cluster. Speed-related clusters (Tech-Distracted Speeders, Screen-Distracted Drivers, Chatty Speeders) are more associated with Speeders or Situational Risk Takers acceptability profiles. Being in Speeders, Situational Risk Takers, or High-Risk Takers attitude clusters significantly increases the odds of belonging to non-safe behavior clusters compared to Rule-Followers. This pattern is consistent with the Theory of Planned Behavior: what drivers see as acceptable is closely reflected in what they report doing. This strong association is also expected because the acceptability questions refer directly to the specific risky driving behaviors analyzed in the clusters. General risk-taking personality shows some relationships but is less central: Sensation Seekers are more frequent among Tech-Distracted Speeders and some Texting Drivers, but High-Risk Drivers are not always more sensation-seeking than Safe Drivers in the models. Risk Avoiders and Situational Risk Takers are spread across several clusters. Overall, general risk-taking shows weaker and less consistent relationships than driving-specific acceptability. Liberty clusters based on Moral Foundations show weak associations with risky driving: Libertarian orientations are common in several clusters, including Safe Drivers. Conservative and Liberal liberty profiles show only minor differences in cluster membership, and most relationships are not significant at  $p < 0.05$ . Thus, liberty-related hypotheses are not supported in a strong way: broader liberty beliefs appear less important than driving-specific norms and acceptability, and the estimated effects are not strong enough to show a clear, robust link between liberty orientations and risky driving in our models.

### **7.1.3 Safety outcomes**

Non-safe clusters have systematically higher odds of near-miss and crash involvement than Safe Drivers, even after controlling for age, gender, exposure and attitudes. The safety outcome models in Chapter 6.3 examine near-miss and crash outcomes while controlling for socio-demographics, exposure (driving frequency, car access), substance use, and attitudes: For near-misses, all five non-safe clusters have significantly higher odds of reporting  $\geq 1$  near-miss than Safe Drivers in 2019, 2020 and 2023, confirming the near-miss hypothesis. For crashes, all non-safe clusters show higher odds than Safe Drivers; however, statistical significance varies by year and cluster. High-Risk Drivers are consistently among the clusters with the largest odds ratios for crashes. Screen-Distracted Drivers and Texting Drivers also exhibit elevated crash odds, particularly in 2019 and 2023. Tech-Distracted Speeders and Chatty Speeders show higher crash odds in 2023. Overall, the crash hypothesis is supported: membership in any non-safe cluster is associated with higher crash odds than Safe Drivers, although the strength of this relationship varies across clusters and periods.

### **7.1.4 Context influences**

Location and context showed more complicated effects (H0Loc). We hypothesized drivers in rural areas might take more risks (e.g. speeding on empty roads, not wearing seatbelts) due to cultural norms and lower levels of law enforcement. The MNL modelling results did not show a strong urban-rural divide in most behaviors; however, for Tech-Distracted Speeders and Chatty Speeders region and community size were significant for the risky behavior clusters. There were indications that Tech-Distracted Speeders and Chatty Speeders drivers in smaller communities have specific risky habits: the Texting Drivers and Chatty Speeders clusters had the highest share of respondents from small to mid-sized towns (<100K population) and fewer from the largest city. This may reflect that community size and context are related to how drivers combine phone use and speeding. Despite their complexity these patterns indicate that the environment may influence some risky behaviours.

## **7.2 Discussion of existing literature**

Overall, the observed “safer 2020” and “riskier 2023” pattern is consistent with Canadian evidence that changes in exposure during the pandemic coincided with shifts in risky driving (notably speeding and distraction), and that some risky behaviors increased among certain groups even when overall travel declined (Lyon et al., 2024; Vanlaar et al., 2021).

In particular, the prominence of technology-based distraction in 2023 aligns with Canadian monitoring results (e.g., Road Safety Monitor work) showing distracted driving as a persistent and evolving issue, which supports interpreting the growth of the Screen-Distracted and Texting profiles as a meaningful post-pandemic road-safety concern (*Road Safety Monitor - Traffic Injury Research Foundation, 2025*).

Finally, because Québec's official road safety record and annexes SAAQ reports and police-reported collision statistics for the province) provide administrative indicators of collision victims and trends, future triangulation between self-reported patterns (this thesis) and administrative records (SAAQ) would strengthen inference about whether the apparent rebound in near-misses/crashes corresponds to broader collision-victim trends (*Bilan-Routier-2021*).

### **7.3 Limitations**

Like all studies, this research has several limitations that must be acknowledged. First, our data are based on self-reported behaviors and attitudes collected through questionnaires. Self-reports can introduce social desirability bias or recall errors, and this concern is magnified here because participants in 2023 were asked to recall their behaviors from 2019 and 2020. For instance, the true incidence of certain risky behaviors such as texting while driving or running red lights may be under-reported. Because the study spans pre-, during-, and post-COVID-19 periods, changes in restrictions and pandemic conditions may also have influenced how respondents remember and report their behaviors. Second, our sample is region-specific (specifically drivers from the province of Québec), so the findings may not generalize to all of Canada or other countries. The driving culture, laws, and enforcement intensity can vary by region, meaning our results should be extrapolated with caution beyond similar contexts. In addition, Québec was treated as one pooled sample in the main analyses; territorial realities (e.g., regional enforcement, road context, and mobility alternatives) can differ substantially across administrative regions, which may mask meaningful within-Québec heterogeneity (SAAQ, 2023).

Additionally, we did not deeply explore some factors that could influence driving behavior. In particular, emotional and cognitive states such as anger, stress, or confidence levels were not explicitly measured in our survey, even though they are known to affect driver decision-making. These unexamined variables might account for further variation in risky driving tendencies and

could interact with the factors we did measure (for example, stress may exacerbate the likelihood of speeding or distraction).

#### **7.4 Novel findings**

This study offers several novel insights that broaden the understanding of driver behavior during and around the COVID-19 pandemic. One novel aspect is the integration of drivers' attitude orientations as liberty opinions into traffic safety analysis. To our knowledge, few studies have explicitly examined whether a person's attitudes on individual liberty are related to their risky driving behaviors. Although our results showed this relationship is more complex, our work provides a first look indicating that the observed effects are not strong enough to demonstrate a clear, robust link between liberty orientations and risky driving. This calls for deeper psychological investigation into how attitudes translate into risk-taking behaviors for driving, to better understand when and how broader liberty-related beliefs might matter for traffic safety.

Another novel contribution of this project is the detailed profiling of distracted driving behaviors in combination with traditional risky behaviors. Although phone use while driving has been studied extensively, our cluster approach uncovered that certain drivers engage in multiple forms of technology-based distraction; for example, the Texting Drivers not only text but they also look at screens and talk (hands-free) while driving. Meanwhile, Tech-Distracted Speeders pair those distractions with speeding. This combination can be deadly and law enforcement and education campaigns typically target these behaviors separately. Moreover, we found that groups that normally comply with the law may have engaged in texting while driving. Some cluster members in Texting Drivers are "Risk Avoider" personalities and reported no other crimes (even avoiding alcohol) and still texted while driving. This is a novel insight that texting has a unique social acceptability or addictive nature that can attract even generally cautious drivers. This suggests that technology-based distraction can cut across broader risk profiles, and that interventions may need to address normative/behavioral mechanisms specific to distraction rather than assuming it is limited to generally high-risk drivers (*Road Safety Monitor - Traffic Injury Research Foundation*, 2025).

#### **7.5 Future research**

Building on the findings and limitations of this work on the impact of COVID-19 on mobility, risky driving, and road safety outcomes, several avenues for future research are recommended:

1. **Broader Populations and Settings:** Replicate and extend this study in other regions and populations to test the generalizability of the findings. A wider geographic scope (across different provinces or countries) and diverse cultural settings would help determine whether the patterns observed in Québec hold elsewhere, or if unique local factors play a role.
2. **Psychological Factors:** Investigate how emotional and cognitive factors (such as drivers' transient moods, stress levels, or situational aggression) might influence risky driving behavior. Future studies could incorporate measurements of these states (e.g., via surveys or simulator experiments) and additional personality assessments to determine how such internal factors contribute to or exacerbate unsafe driving tendencies.
3. **Environmental and Cultural Context:** Examine more closely how community context, enforcement levels, and cultural norms affect risky driving. For instance, research could compare rural and urban drivers in terms of attitudes and behavior to understand why certain risk profiles (like Tech-Distracted Speeders or Chatty Speeders) were more prevalent in smaller towns. Such studies would clarify whether different countermeasures or policies are needed in different types of communities.
4. **Attitudes and Behavior Mechanisms:** Conduct in-depth studies on how personal values and attitudes translate into driving behavior. This could involve longitudinal research or qualitative interviews to see how strongly general beliefs (e.g., libertarian vs. collectivist views on rules) predict driving choices over time. Understanding whether the weak link we observed between liberty-oriented attitudes and risky driving is robust could clarify how far such general attitudes can be used to inform road safety interventions.
5. **Post-Pandemic Trends:** Continue to monitor driving behaviors and safety outcomes in the post-2023 period. It remains an open question whether the pandemic-related shifts in risky driving that we documented will diminish as conditions normalize or if they represent a lasting new normal in driver behavior. Ongoing data collection in the years after 2023 would help determine whether rates of speeding, distraction, near-misses, and crashes return to pre-pandemic baselines or persist at higher levels.
6. **Intervention Strategies:** Finally, future research could evaluate the effectiveness of tailored intervention strategies for the high-risk groups identified in this study. For example, researchers might design and test educational programs, targeted enforcement campaigns,

or in-vehicle technological aids aimed specifically at young male drivers, habitual speeders, or tech-distracted drivers to see which approaches can successfully reduce their risky behaviors and crash involvement.

## **7.6 Practical implications for road safety practice**

From a Safe System / Vision Zero perspective, the thesis results support prioritizing countermeasures that reduce both the likelihood and severity of error, especially for technology-based distraction and frequent minor speeding, which increased by 2023 and are concentrated in identifiable driver profiles (*Ministère des Transports, de la Mobilité durable et de l'Électrification des transports, 2019; Transportation Association of Canada, 2023*).

Consistent with this approach, the most impactful changes are primarily at the system level (rather than focusing on individuals), notably measures that keep operating speeds low, technology that prevents speeding, and regulations or technology that prevent distraction such as texting and calling while driving (*Road Safety Intervention Framework, 2019*). However, because such measures can be politically difficult, the driver profiles identified in this thesis provide a pragmatic way to target interventions to the groups most associated with these behaviors. This includes targeting the identified driver-profile groups that may otherwise hold relatively safety-oriented attitudes (e.g., through targeted messaging and enforcement focused on distraction for Screen-Distracted and Texting Drivers; integrated distraction and speed messaging for Tech-Distracted Speeders; and norm/acceptability-focused strategies given the strong role of acceptability clusters), while recognizing that stronger approaches are likely needed for individuals in the High-Risk Drivers profile (*Road Safety Intervention Framework, 2019*).

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## **APPENDIX A THE QUESTIONNAIRE**

The following pages present the questionnaire used in the survey, including all questions from the introductory information and consent section through to the final questions.

Figure 41 shows the questionnaire's questions.

A1. This survey is part of a research project conducted by researchers from Polytechnique Montréal University .

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**Conflicts of interest**

The research team does not have a conflict of interest in terms of the present research project.

Prior to consenting to completing this survey, please take the time to fully read all the information provided.

We invite you to ask all questions you consider relevant to the research project supervisor, or to any team member, and to request clarification for any word or concept that is unclear to you. We also invite you to request guidance from any individual from whom you judge appropriate, in regard to your participation.

Figure 41 A1 question

Figure 42 shows the questionnaire's questions (continued)

LimeSurvey 

A2. 0

B1. Leger Participant ID

B2. Do you have a valid driving license?

Yes

No

C1. In which region of Québec do you live?

Bas-Saint-Laurent

Saguenay-Lac-Saint-Jean

Capitale-Nationale

Mauricie

Estrie

Montréal

Outaouais

Abitibi-Témiscamingue

Côte-Nord

Nord-du-Québec Gaspésie-

Îles-de-la-Madeleine Chaudière-

Appalaches

Laval

Lanaudière

Laurentides

Montérégie

Centre-du-Québec

C2. Based on your original birth certificate, what sex were you given at birth?

Female

Male

Figure 42 A2 to C2 questions

Figure 43 shows the questionnaire's questions (continued)

**C3. What is your gender?**

Man

Woman

Transgender

Gender neutral

Non-binary

Other

**C4. What is your age?**

Under 22 years

22-24 years

25-34 years

35-44 years

45-54 years

55-64 years

65 years and older

**C5. Did you have a driving license in the fall of 2019?**

Yes

No

**C6. Which mode has only two wheels?**

Walking

Bus

Subway

Bicycle

Car

**C7.**

**C8. What type of urban setting do you live in?**

A city larger than 100,000 people

City or town fewer than 100,000 people but more than 10,000

A town or rural area with fewer than 10,000 people

Figure 43 C3 to C8 questions

Figure 44 shows the questionnaire’s questions (continued)

**D1. What type of vehicle were you using?**

	Small/comp act car	Sedan (normal sized car, 4-doors)	Crossover SUV	SUV	Minivan	Truck	I don't drive
Fall 2023	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fall 2020	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fall 2019	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**D2. Roughly how often did you drive?**

	Never	1-2 times per year	1-2 times per month	1-2 times per week	Most or all days of the week
Fall 2023	<input type="checkbox"/>				
Fall 2020	<input type="checkbox"/>				
Fall 2019	<input type="checkbox"/>				

**D3. Did you own/have access to a car ?**

	Always have access	Most of the time	Sometimes	Hardly ever	Never
Fall 2023	<input type="checkbox"/>				
Fall 2020	<input type="checkbox"/>				
Fall 2019	<input type="checkbox"/>				

**D4. How much (in minutes) did you walk on a regular WEEKDAY?  
(distances are given based on average walking speeds)**

	I didn't walk	Less than 15 minutes (about 1 km)	About 15 to 29 minutes (about 1 to 2 km)	About 30 to 59 minutes (about 2 to 4 km)	About 60 minutes or more (4 km or more)
On FOOT in the fall of 2023 (after the end of the pandemic restrictions)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
On foot in the fall of 2020 (during the COVID-19 pandemic)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
On foot in the fall of 2019 (before the COVID-19 pandemic)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**D5. How much (in minutes) did you travel by BICYCLE on a regular WEEKDAY?**

	No time	About 20 minutes	About 30-40 minutes	About 45-60 minutes	About 1 -1.25 hours	About 1.5 hours-2 hours	About 2-3 hours	More than 3 hours
By BICYCLE in the fall of 2023 (after the end of the pandemic restrictions)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
By bicycle in the fall of 2020 (during the COVID-19 pandemic)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
By bicycle in the fall of 2019 (before the COVID-19 pandemic)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 44 D1 to D5 questions

Figure 45 shows the questionnaire’s questions (continued)

**D6. How much (in minutes) did you travel by these modes on a regular WEEKDAY?**

	No time	About 20 minutes	About 30-40 minutes	About 45-60 minutes	About 1 -1.25 hours	About 1.5 hours-2 hours	About 2-3 hours	More than 3 hours
By BUS in the fall of 2023 (after the end of the pandemic restrictions)	<input type="checkbox"/>							
By bus in the fall of 2020 (during the COVID-19 pandemic)	<input type="checkbox"/>							
By bus in the fall of 2019 (before the COVID-19 pandemic)	<input type="checkbox"/>							
By RAIL (metro/subway/commuter train) In the fall of 2023 (after the end of the pandemic restrictions)	<input type="checkbox"/>							
By rail (metro/subway/commuter train) In the fall of 2020 (during the COVID-19 pandemic)	<input type="checkbox"/>							
By rail (metro/subway/commuter train) In the fall of 2019 (before the COVID-19 pandemic)	<input type="checkbox"/>							

**D7. How much (in minutes) did you travel by these modes on a regular WEEKDAY?**

	No time	About 20 minutes	About 30-40 minutes	About 45-60 minutes	About 1 -1.25 hours	About 1.5 hours-2 hours	About 2-3 hours	More than 3 hours
By CAR in the fall of 2023 (after the end of the pandemic restrictions)	<input type="checkbox"/>							
By car in the fall of 2020 (during the COVID-19 pandemic)	<input type="checkbox"/>							
By car in the fall of 2019 (before the COVID-19 pandemic)	<input type="checkbox"/>							
By OTHER MODES (scooter, skateboard, etc.) In the fall of 2023 (after the end of the pandemic restrictions)	<input type="checkbox"/>							
By other modes (scooter, skateboard, etc.) In the fall of 2020 (during the COVID-19 pandemic)	<input type="checkbox"/>							
By other modes (scooter, skateboard, etc.) In the fall of 2019 (before the COVID-19 pandemic)	<input type="checkbox"/>							

**D8. How confident are you about your responses for trips you had?**

	Not at all	Not very confident	Somewhat confident	Very confident
How confident are you about your responses for 2023?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How confident are you about your responses for 2020?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How confident are you about your responses for 2019?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 45 D6 to D9 questions

Figure 46 shows the questionnaire’s questions (continued)

**D9. For a typical week, how often did you make out-of-home trips? (Local trips are any trips less than about 2 km or a 20 to 30-minute walk. Non-local trips are any trips where the destination is more than 2 km or more than a 30-minute walk)**

	Less than 1 time	1-2 times	3-4 times	5-6 times	7-8 times	9-10 times	11-12 times	13-14 times	More than 14 times
Fall 2023: Weekly local trips	<input type="checkbox"/>								
Fall 2023: Weekly non-local trips	<input type="checkbox"/>								
Fall 2020: Weekly local trips	<input type="checkbox"/>								
Fall 2020: Weekly non-local trips	<input type="checkbox"/>								
Fall 2019: Weekly local trips	<input type="checkbox"/>								
Fall 2019: Weekly non-local trips	<input type="checkbox"/>								

**D10. How confident are you about your responses for out-of-home trips?**

	Not at all	Not very confident	Somewhat confident	Very confident
How confident are you about your responses for 2023?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How confident are you about your responses for 2020?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How confident are you about your responses for 2019?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 46 D9 to D10 questions

Figure 47 shows the questionnaire’s questions (continued)

**D11. After the end of the pandemic restrictions (fall of 2023), how frequently did you have these behaviors as a car driver? (The information is confidential, and your responses are anonymous)**

	Never	Less than 1 time per month	1-3 times a month	1- 4 times a week	5 or more times a week
Drive after drinking alcohol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive after using drugs (other than medication)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive without wearing your seatbelt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive 1-10 KM/h faster than the speed limit inside built-up areas (i.e., where there are buildings, homes, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive 11 or more KM/h faster than the speed limit inside built-up areas (i.e., where there are buildings, homes, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Running a red traffic light or not stopping at a stop sign	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Please choose "1-4 times a week" as a sign of your attention	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Texting on your mobile phone while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Talking (while holding) your mobile phone while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Talking handsfree on your mobile phone while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Looking at a screen (your phone, dashboard, etc.) while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Driving when you were so tired or sleepy that you had trouble keeping your eyes open	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**D12.**

**D13. How confident are you about your responses for your trips as a car driver for fall 2023?**

	Not at all	Not very confident	Somewhat confident	Vary Confident
How confident are you about your responses?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 47 D11 to D13 questions

Figure 48 shows the questionnaire’s questions (continued)

**D14. During the COVID-19 pandemic in Quebec (fall 2020) when restrictions were applied, how frequently did you have these behaviors as a car driver? (The information is confidential and your responses are anonymous)**

	Never	Less than 1 time per month	1-3 times a month	1-4 times a week	5 or more times a week
Drive after drinking alcohol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive after using drugs (other than medication)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive without wearing your seatbelt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive 1-10 KM/h faster than the speed limit inside built-up areas (i.e., where there are buildings, homes, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive 11 or more KM/h faster than the speed limit inside built-up areas (i.e., where there are buildings, homes, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Running a red traffic light or not stopping at a stop sign	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Texting on your mobile phone while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Talking (while holding) your mobile phone while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Talking handsfree on your mobile phone while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Looking at a screen (your phone, dashboard, etc.) while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Driving when you were so tired or sleepy that you had trouble keeping your eyes open	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**D15. How confident are you about your responses as a car driver for fall 2020?**

	Not at all	Not very confident	Somewhat confident	Very confident
How confident are you about your responses?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 48 D15 to D14 questions

Figure 49 shows the questionnaire’s questions (continued)

**D16. Before COVID-19 pandemic (fall of 2019), how frequently did you do these things as a car driver? (The information is confidential and your responses are anonymous)**

	Never	Less than 1 time per month	1-3 times a month	1-4 times a week	5 or more times a week
Drive after drinking alcohol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive after using drugs (other than medication)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive without wearing your seatbelt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive 1-10 KM/h faster than the speed limit inside built-up areas (i.e., where there are buildings, homes, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drive 11 or more KM/h faster than the speed limit inside built-up areas (i.e., where there are buildings, homes, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Running a red traffic light or not stopping at a stop sign	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Texting on your mobile phone while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Talking (while holding) your mobile phone while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Talking handsfree on your mobile phone while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Looking at a screen (your phone, dashboard, etc.) while driving (i.e., your vehicle is moving).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Driving when you were so tired or sleepy that you had trouble keeping your eyes open	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**D17. How confident are you about your responses as a car driver for fall 2019?**

	Not at all	Not very confident	Somewhat confident	Very confident
How confident are you about your responses?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**D18. Please indicate your weekly alcohol consumption by unit. One unit is a bottle (333 ml) of beer or a small glass of wine.**

	Fall 2019	During the pandemic (fall 2020)	Fall 2023
0 units	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Less than 5 units	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5-9 units	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10 or more units	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 49 D16 to D18 questions

Figure 50 shows the questionnaire’s questions (continued)

**D19. Please indicate your weekly cannabis consumption.**

	Fall 2019	During the pandemic (fall 2020)	Fall 2023
None	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1 or 2 times a week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 to 4 times a week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 times or more per week	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**E1. Please read the following sentences and indicate your AGREEMENT or DISAGREEMENT:**

	Totally disagree	Somewhat disagree	Neutral	Somewhat agree	Totally agree
People who are successful in business have a right to enjoy their wealth as they see fit.	<input type="checkbox"/>				
Society works best when it lets individuals take responsibility for their own lives without telling them what to do.	<input type="checkbox"/>				
The government interferes far too much in our everyday lives.	<input type="checkbox"/>				
The government should do more to advance the common good, even if that means limiting the freedom and choices of individuals.	<input type="checkbox"/>				
Property owners should be allowed to develop their land or build homes in any way they choose, if they don't endanger their neighbors	<input type="checkbox"/>				
I think everyone should be free to do as they choose, so long as they don't infringe upon the equal freedom of others.	<input type="checkbox"/>				
People should be free to decide what group norms or traditions they themselves want to follow.	<input type="checkbox"/>				

Figure 50 D19 to E1 questions

Figure 51 shows the questionnaire's questions (continued)




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**E2. In the following periods, how safe did you feel as a PEDESTRIAN when crossing the street?**

	Safe	Somewhat safe	Somewhat in danger	In danger	I did not live in Quebec at that time
At a pedestrian crossing in fall 2023	<input type="checkbox"/>				
At a pedestrian crossing in fall 2020	<input type="checkbox"/>				
At a pedestrian crossing in fall 2019	<input type="checkbox"/>				
If the cars have a stop sign in fall 2023	<input type="checkbox"/>				
If the cars have a stop sign in fall 2020	<input type="checkbox"/>				
If the cars have a stop sign in fall 2019	<input type="checkbox"/>				
Please choose "safe" as the answer 2019	<input type="checkbox"/>				
With respect to the amount of traffic in fall 2023	<input type="checkbox"/>				
With respect to the amount of traffic in fall 2020	<input type="checkbox"/>				
With respect to the amount of traffic in fall 2019	<input type="checkbox"/>				

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**E3. In the following periods, how safe did you feel as a PEDESTRIAN when crossing the street?**

	Safe	Somewhat safe	Somewhat in danger	In danger	I did not live in Quebec at that time
On a residential street with a traffic light in fall 2023	<input type="checkbox"/>				
On a residential street with a traffic light in fall 2020	<input type="checkbox"/>				
On a residential street with a traffic light in fall 2019	<input type="checkbox"/>				
On a busy street with a traffic light in fall 2023	<input type="checkbox"/>				
On a busy street with a traffic light in fall 2020	<input type="checkbox"/>				
On a busy street with a traffic light in fall 2019	<input type="checkbox"/>				

Figure 51 E2 to E3 questions

Figure 52 shows the questionnaire’s questions (continued)

**E4. In the following periods, how many times had you personally been involved in road crashes and near misses (A near miss requires an evasive action to avoid being hit or colliding with a vehicle)?**

Never    1 time    2-3 times    3-4 times

During fall 2023 (after the end of the COVID-19 restrictions), how many times have you personally been involved in road crashes?  —  —  —

During fall 2020 (during the COVID-19 pandemic), how many times have you personally been involved in road crashes?  —  —  —

During fall 2019, (before the COVID-19 pandemic), how many times have you personally been involved in road crashes?  —  —  —

During fall 2023 (after the end of the COVID-19 restrictions): How many times did you experience near misses?  —  —  —

During fall 2020 (during the COVID-19 pandemic): How many times did you experience near misses?  —  —  —

During fall 2019 (before the COVID-19 pandemic): How many times did you experience near misses?  —  —  —

**E5. How confident are you about your responses involving road crashes and near misses?**

Not at all    Not very confident    Somewhat confident    Very confident

How confident are you about your responses for 2023?  —  —  —

How confident are you about your responses for 2020?  —  —  —

How confident are you about your responses for 2019?  —  —  —

**E6. For the following statements, please indicate your AGREEMENT or DISAGREEMENT.**

Totally agree    Somewhat agree    Neutral    Somewhat disagree    Totally disagree

I consider myself a risk-taker  —  —  —  —

I often do risky behavior that I know those close to me (parents, family, friends, etc.) would disapprove of  —  —  —  —

The greater the risk the more fun the activity  —  —  —  —

I often think about doing risky behavior that I know society would disapprove of  —  —  —  —

I do not let the fact that something is illegal stop me from doing it  —  —  —  —

I feel unsafe when riding with a careless driver  —  —  —  —

Figure 52 E4 to E6 questions

Figure 53 shows the questionnaire’s questions (continued)

**E7. For the following statements, please indicate your AGREEMENT or DISAGREEMENT.**

	Totally agree	Somewhat agree	Neutral	Somewhat disagree	Totally disagree
When driving, traffic rules must be respected	<input type="checkbox"/>				
It is acceptable to drive after drinking alcohol or doing drugs	<input type="checkbox"/>				
It is acceptable to drive through when traffic lights change from yellow to red	<input type="checkbox"/>				
When road conditions are good, and nobody is around, driving at higher speed is ok	<input type="checkbox"/>				
If you are a good driver, it is acceptable to drive a little faster	<input type="checkbox"/>				
It is acceptable to drive without wearing seatbelt for short distances	<input type="checkbox"/>				
It is acceptable when you need to make an urgent phone call or message someone while driving	<input type="checkbox"/>				
It is acceptable to drive and make videos for posting/ going live on social media (Facebook, Instagram, YouTube, etc.)	<input type="checkbox"/>				

**E8.**

**F1. How much is your household (excluding roommates) income annually?**

0 to 5,000 \$	<input type="checkbox"/>
5,000 \$ to 9,000 \$	<input type="checkbox"/>
10,000 \$ to 24,000 \$	<input type="checkbox"/>
25,000 \$ to 49,000 \$	<input type="checkbox"/>
50,000 \$ to 75,000 \$	<input type="checkbox"/>
75,000 \$ to 99,000 \$	<input type="checkbox"/>
100,000 \$ to 125,000 \$	<input type="checkbox"/>
126,000 \$ to 150,000 \$	<input type="checkbox"/>
151,000 \$ to 200,000 \$	<input type="checkbox"/>
More than >200,000 \$	<input type="checkbox"/>

**F2. What was your postal code? First 3 characters.**

Fall 2023	<input type="text"/>
Fall 2020	<input type="text"/>
Fall 2019	<input type="text"/>

Figure 53 E7 to F1 questions

Figure 54 shows the questionnaire's questions (continued)

**F3. Which one of these options is a transport mode?**

Neighborhood

Book

Tree

University

Car

**F4.**

**F5. What is the highest qualification or educational certificate that you have obtained?**

None

Primary education

Secondary education (e.g., high school)

Professional training or similar

CÉGEP or college

Bachelor's degree or similar

Master's degree or higher

**F6. Which of the following terms best describes your current professional status?**

Full-time worker

Part-time worker

Self-employed/independent professional

Unemployed

Professional occupation

Looking for a job

Retired

A stay-at-home spouse or parent

Student

Other

Figure 54 F3 to F6 questions

Figure 55 shows the questionnaire's questions (continued)

**F7. What was your status in the fall of 2020? select the status.**

Full-time worker

Part-time worker

Self-employed/independent professional

Unemployed

Professional occupation

Looking for a job

Retired

A stay-at-home spouse or parent,

Student

Other

**F8. What was your status in the fall of 2019? select the status.**

Full-time worker

Part-time worker

Self-employed/independent professional

Unemployed

Professional occupation

Looking for a job

Retired

A stay-at-home spouse or parent

Student

Other

**G1. What was your household composition in the fall of 2023? please select the number of adults and children in your household.**

0 1 2 3 4 5 6 or more

Adults (people 18 years or older)

Children (under the age of 18 years old)

Figure 55 F7 to G1 questions

Figure 56 shows the questionnaire's questions (continued)

**G2. What was your household composition in the fall of 2020? please select the number of adults and children in your household.**

0 1 2 3 4 5 6 or more

Adults (people 18 years or older)  —  —  —  —  —  —

Children (under the age of 18 years old)  —  —  —  —  —  —

**G3. What was your household composition in the fall of 2019? please select the number of adults and children in your household.**

0 1 2 3 4 5 6 or more

Adults (people 18 years or older)  —  —  —  —  —  —

Children (under the age of 18 years old)  —  —  —  —  —  —

**G4. Do you have a clean driving record?**

Yes

No

Not sure

**G5. How many years do you have experience in driving?**

1

2

3

4

5

6-10

More than 10

**G6. Do you use a navigation app while driving in new locations that you are unfamiliar with?**

Always

Most of the time

2-3 times a week

2-3 times a month

1-2 times a year

Never

Figure 56 G2 to G6 questions

Figure 57 shows the questionnaire's questions (continued)

G7. Are you a professional driver?

Yes

No

Figure 57 G7 of question

## APPENDIX B MULTINOMIAL LOGIT MODELS

### Appendix B1 Socio-demographic

Following tables present the full multinomial logit (MNL) model results for 2019, 2020 and 2023, risky driving behaviour clusters as a function of socio-demographic variables (reference cluster: Safe Drivers).

Reference categories marked “(Ref)”. Coefficients with  $0.01 \leq p < 0.05$  are shown in italics and coefficients with  $p < 0.01$  are shown in bold. Unless explicitly stated otherwise, the reference category for each categorical predictor is given either in the table caption or directly in the variable label (e.g., “Gender = Female (Ref)”, “Household Income = \$50-75k (Ref)”), and the same conventions are applied consistently across all MNL models in this chapter, so they are not repeated for every table.

Table 32 presents the full multinomial logit (MNL) results for 2019 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers).

Table 32. Multinomial logit (MNL) results for 2019 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers).

Explanatory	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	$p >  z $	Coeff.	$p >  z $	Coeff.	$p >  z $	Coeff.	$p >  z $	Coeff.	$p >  z $
<b>Intercept</b>	-	0.0	-1.413	0.001	-1.4917	0.0	-0.0121	0.967	-	0.0
	6.5855								3.8194	
<b>Gender = Female (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Gender = Male</b>	<b>1.406</b>	0.002	<b>0.7926</b>	0.0	0.0821	0.591	0.1053	0.414	<b>0.7069</b>	0.001
<b>Age Group = 65 years and older (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Age Group = 22-24 years</b>	2.8709	0.036	0.3177	0.649	0.6664	0.271	-0.3897	0.431	<b>3.5243</b>	0.0
<b>Age Group = 25-34 years</b>	2.4644	0.033	0.0344	0.934	0.6779	0.05	-0.157	0.606	<b>3.1564</b>	0.0

Table 32. Multinomial logit (MNL) results for 2019 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Age Group = 35-44 years</b>	1.7612	0.124	-0.3243	0.397	0.2659	0.409	-0.3671	0.18	<b>2.2183</b>	0.003
<b>Age Group = 45-54 years</b>	0.711	0.556	-0.268	0.467	0.2889	0.345	-0.2731	0.291	<b>1.8803</b>	0.01
<b>Age Group = 55-64 years</b>	-	0.696	-0.0567	0.842	0.3643	0.13	-0.1724	0.388	1.1274	0.118
<b>Household Income = \$50-75k (Ref)</b>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Household Income = &lt; \$25k</b>	0.5295	0.564	-0.5145	0.228	-0.2097	0.549	<b>-0.7675</b>	0.01	-	0.17
<b>Household Income = \$25-49k</b>	0.6653	0.411	-0.4616	0.134	-0.437	0.126	-0.3634	0.068	-0.078	0.833
<b>Household Income = \$75-99k</b>	<i>1.5042</i>	0.041	0.3779	0.18	<i>0.6429</i>	0.014	0.2396	0.241	-0.032	0.93
<b>Household Income = \$100-125k</b>	0.8502	0.292	0.2775	0.366	<b>0.8959</b>	0.001	0.3915	0.069	0.5491	0.101
<b>Household Income = ≥ \$126k</b>	0.7887	0.304	<i>0.6687</i>	0.014	<b>1.0533</b>	0.0	0.1703	0.409	0.285	0.366
<b>Education Level = Bachelor (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Education Level = ≤ High-School / Voc.</b>	0.4478	0.426	0.0696	0.77	0.1911	0.384	0.0017	0.993	0.055	0.847
<b>Education Level = CÉGEP / College</b>	0.3288	0.536	-0.0808	0.724	0.2678	0.174	0.1396	0.398	-	0.171
<b>Education Level = Master+</b>									0.3864	
<b>Education Level = Master+</b>	0.0657	0.913	<i>-0.6561</i>	0.021	-0.0912	0.689	<i>-0.4245</i>	0.036	-	0.147
<b>Employment Status (2023) = Full-time worker (Ref)</b>	-	-	-	-	-	-	-	-	-	-
									0.4574	

Table 32. Multinomial logit (MNL) results for 2019 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Employment Status (2023) = Part-time / Self-emp.</b>	0.5192	0.391	-0.5155	0.125	-0.1713	0.534	-0.1052	0.644	-	0.933
<b>Employment Status (2023) = Student</b>	0.9375	0.247	-0.0884	0.895	0.9415	0.072	0.0555	0.909	0.1513	0.797
<b>Employment Status (2023) = Not in labour force</b>	-	0.583	-0.562	0.067	-0.1604	0.526	<i>-0.4988</i>	0.024	-	0.036
<b>Region = Montréal (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Region = Montérégie</b>	-	0.412	-0.3197	0.384	0.0217	0.941	0.3723	0.129	-0.19	0.624
<b>Region = Capitale-Nationale</b>	0.7265	0.54	0.4235	0.146	-0.1188	0.675	0.3266	0.156	-	0.782
<b>Region = Laval</b>	0.4017	0.762	0.4053	0.169	-0.117	0.681	0.1869	0.415	0.0312	0.937
<b>Region = Laurentides</b>	0.2548	1.2813	0.7845	0.061	<i>0.7486</i>	0.038	<b>0.8538</b>	0.01	-	0.255
<b>Region = Other</b>	0.383	0.504	0.1213	0.651	0.1796	0.429	<b>0.7299</b>	0.0	0.2315	0.448
<b>Region = Remote North</b>	-	0.742	1.103	0.159	0.3666	0.656	1.1445	0.097	0.6765	0.465
<b>Community Size = 0 (Ref)</b>	3.1551	-	-	-	-	-	-	-	-	-
<b>Community Size = 1</b>	-	-	-	-	-	-	-	-	-	-
<b>Community Size = 2</b>	0.4211	0.478	-0.35	0.27	0.0722	0.777	<b>-0.4616</b>	0.035	0.0897	0.804
<b>Driving Experience = More than 10 years (Ref)</b>	-	0.268	0.057	0.821	0.0148	0.946	-0.2271	0.212	0.3196	0.271
<b>Driving Experience = 1 year</b>	-	-	-	-	-	-	-	-	-	-
<b>Driving Experience = 2 years</b>	0.6902	-	-	-	-	-	-	-	-	-
	-	0.617	<i>-2.131</i>	0.047	-9.1436	0.685	<b>-3.0369</b>	0.004	-	0.661
	7.1047	-	-	-	-	-	-	-	8.3735	-
	-	0.777	-6.8885	0.637	-8.2415	0.654	-8.1876	0.647	-	0.642
	0.2554	-	-	-	-	-	-	-	7.7959	-

Table 32. Multinomial logit (MNL) results for 2019 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Driving Experience = 3 years</b>	-0.5924	0.641	-6.6804	0.637	-7.383	0.64	-1.274	0.114	-7.5054	0.64
<b>Driving Experience = 4 years</b>	0.3592	0.698	-0.6549	0.477	-1.0776	0.22	-1.7336	0.116	-1.9792	0.089
<b>Driving Experience = 5 years</b>	-1.4121	0.262	-0.6348	0.391	-1.0773	0.103	-0.0421	0.932	-1.2937	0.066
<b>Driving Experience = 6-10 years</b>	-0.5367	0.423	-0.5295	0.204	-0.5413	0.116	0.0043	0.988	-0.3704	0.279
<b>Clean Driving Record = Yes (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Clean Driving Record = No</b>	<b>1.3013</b>	0.018	<b>1.3999</b>	0.0	0.4773	0.109	<b>0.7601</b>	0.003	<b>1.679</b>	0.0
<b>Professional Driver = No (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Professional Driver = Yes</b>	<b>1.1796</b>	0.004	0.0117	0.962	-0.4064	0.084	-0.3684	0.058	0.2386	0.375

Table 33 presents the full multinomial logit (MNL) results for 2020 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers).

Table 33. Multinomial logit (MNL) results for 2020 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: cluster membership; reference outcome: Safe Drivers)

Explanatory Variable	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Intercept</b>	-8.0578	0.000	-2.0466	0.000	-1.8105	0.000	-0.1285	0.652	-3.8702	0.000

Table 33. Multinomial logit (MNL) results for 2020 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Gender = Female (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Gender = Male</b>	<b>1.3191</b>	0.014	<b>1.0426</b>	0.000	0.3287	0.032	<b>0.3392</b>	0.008	<b>1.0349</b>	0.000
<b>Age Group = 65 years and older (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Age Group = 22-24 years</b>	1.9729	0.264	0.7112	0.368	0.3081	0.610	0.2361	0.627	<b>3.6978</b>	0.000
<b>Age Group = 25-34 years</b>	1.8820	0.219	0.1962	0.653	0.4408	0.201	-0.3719	0.214	<b>2.5861</b>	0.000
<b>Age Group = 35-44 years</b>	1.9104	0.201	0.0264	0.948	0.2804	0.388	-0.2928	0.280	<b>1.5037</b>	0.019
<b>Age Group = 45-54 years</b>	0.2594	0.872	-0.0405	0.917	-0.1194	0.708	-0.3873	0.132	1.4289	0.023
<b>Age Group = 55-64 years</b>	-5.5777	0.727	0.1551	0.621	0.2223	0.374	0.0474	0.810	1.2437	0.032
<b>Household Income = \$50-75k (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Household Income = &lt; \$25k</b>	2.9800	0.023	-0.6961	0.157	0.0211	0.953	-0.6478	0.028	-0.8217	0.194
<b>Household Income = \$25-49k</b>	1.7491	0.163	-0.6541	0.053	-0.2646	0.357	-0.4179	0.037	-0.2164	0.582
<b>Household Income = \$75-99k</b>	2.5610	0.031	0.1015	0.737	<b>0.7012</b>	0.008	0.2286	0.254	0.1920	0.601
<b>Household Income = \$100-125k</b>	2.0449	0.100	0.1033	0.747	<b>1.0566</b>	0.000	0.3155	0.135	0.3847	0.281

Table 33. Multinomial logit (MNL) results for 2020 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Household Income = ≥ \$126k</b>	1.5892	0.20	0.4529	0.105	<b>0.9771</b>	0.000	0.0480	0.812	0.6074	0.05
<b>Education Level = Bachelor (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Education Level = ≤ High-School / Voc.</b>	1.1447	0.084	0.3483	0.177	0.3587	0.100	-0.021	0.904	-	0.86
<b>Education Level = CÉGEP / College</b>	0.5858	0.394	0.2161	0.383	0.3719	0.061	0.1306	0.419	-	0.76
<b>Education Level = Master+</b>	-0.0893	0.909	-0.267	0.355	-0.2354	0.311	<b>-0.641</b>	0.002	-	0.09
<b>Employment Status (2023) = Full-time worker (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Employment Status (2023) = Part-time</b>	-0.9953	0.301	-0.315	0.341	-0.2936	0.290	-0.242	0.278	-	0.43
<b>Employment Status (2023) = Student</b>	0.3335	0.707	-0.662	0.433	0.5138	0.321	-0.090	0.843	-	0.72
<b>Employment Status (2023) = Not in labour force</b>	-1.513	0.19	<i>-0.717</i>	0.030	-0.4473	0.089	<b>-0.702</b>	0.001	-	0.04
<b>Region = Montréal (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Region = Montérégie</b>	-0.4717	0.59	0.0586	0.878	0.0846	0.775	0.2970	0.223	-	0.31

Table 33. Multinomial logit (MNL) results for 2020 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Region = Capitale-Nationale</b>	-1.1422	0.31	0.4665	0.133	0.0219	0.936	0.1352	0.554	-	0.32
<b>Region = Laval</b>	-0.6158	0.59	0.2736	0.409	-0.0586	0.842	0.1738	0.438	0.2180	0.55
<b>Region = Laurentides</b>	0.5605	0.58	<i>0.8928</i>	0.041	<i>0.6679</i>	0.055	0.2786	0.402	-	0.64
<b>Region = Other</b>	-0.0376	0.956	0.3937	0.158	0.2149	0.343	<b>0.5925</b>	0.001	-	0.574
<b>Region = Remote North</b>	1.2708	0.369	0.9827	0.231	0.3322	0.676	0.8829	0.165	-	0.403
<b>Community Size = 0 (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Community Size = 1</b>	0.2202	0.779	-0.4396	0.178	0.1052	0.677	-0.3720	0.088	0.4553	0.215
<b>Community Size = 2</b>	-0.3233	0.617	-0.2823	0.302	0.0668	0.756	-0.1518	0.398	<i>0.6172</i>	0.037
<b>Driving Experience = More than 10 years (Ref)</b>	-	-	-	-	-	-	-	-	-	-
<b>Driving Experience = 1 year</b>	-5.0913	0.628	-7.4993	0.626	-8.4404	0.645	<b>-3.0342</b>	0.004	-	0.626
<b>Driving Experience = 2 years</b>	0.4562	0.643	-6.4671	0.616	-7.4109	0.620	-7.7811	0.623	-	0.612
<b>Driving Experience = 3 years</b>	0.7128	0.608	-6.0364	0.625	-1.3609	0.213	-1.1833	0.149	-	0.617
<b>Driving Experience = 4 years</b>	0.4203	0.700	-0.2381	0.796	-6.5495	0.616	-0.6188	0.408	-	0.231
<b>Driving Experience = 5 years</b>	-0.6100	0.635	-0.7180	0.390	-0.2371	0.686	-0.3031	0.548	-	0.026
<b>Driving Experience = 6-10 years</b>	-0.4995	0.541	-0.6166	0.173	0.0378	0.904	0.1195	0.672	-	0.370



Table 34. Multinomial logit (MNL) results for 2023 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
Age Group = 22-24 years	2.0549	0.147	1.3478	0.068	1.5195	0.009	1.1387	0.031	3.5057	0.000
Age Group = 25-34 years	2.0862	0.073	0.6232	0.144	1.0886	0.002	0.4511	0.161	2.9530	0.000
Age Group = 35-44 years	1.3738	0.226	-0.1642	0.673	0.4335	0.165	-0.1570	0.575	1.5303	0.024
Age Group = 45-54 years	-0.3262	0.797	-0.2731	0.462	0.0806	0.788	-0.2650	0.310	1.2191	0.071
Age Group = 55-64 years	-0.8083	0.546	0.0928	0.749	0.2902	0.220	0.0153	0.939	1.0634	0.098
Household Income = \$50-75k (REF)	-	-	-	-	-	-	-	-	-	-
Household Income = < \$25k	0.9386	0.264	-0.4523	0.315	-0.1947	0.550	-0.5672	0.052	-0.7967	0.185
Household Income = \$25-49k	0.0036	0.996	-0.7332	0.027	-0.6645	0.013	-0.2450	0.219	-0.3016	0.445
Household Income = \$75-99k	1.2613	0.078	0.4859	0.090	0.4112	0.100	0.4037	0.057	0.5802	0.104
Household Income = \$100-125k	0.4190	0.604	0.3262	0.290	0.8275	0.001	0.2374	0.299	0.6858	0.050
Household Income = ≥ \$126k	0.2661	0.743	0.6561	0.018	0.7999	0.001	0.1756	0.418	0.8025	0.013
Education Level = Bachelor (REF)	-	-	-	-	-	-	-	-	-	-
Education Level = ≤ High-School / Voc.	1.9545	0.007	-0.0553	0.824	0.0832	0.696	0.1511	0.407	-0.0094	0.974

Table 34. Multinomial logit (MNL) results for 2023 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Education Level = CÉGEP / College</b>	<b>1.6438</b>	<b>0.026</b>	<b>-0.0478</b>	<b>0.838</b>	<b>0.1863</b>	<b>0.333</b>	<b>0.1895</b>	<b>0.269</b>	<b>-0.1296</b>	<b>0.630</b>
Education Level = Master+	1.0843	0.187	-0.5342	0.059	0.0282	0.897	-0.3351	0.112	-0.5294	0.108
<b>Employment Status (2023) = Full-time worker (REF)</b>	-	-	-	-	-	-	-	-	-	-
Employment Status (2023) = Part-time / Self-emp.	0.3044	0.660	-0.0688	0.824	-0.2992	0.266	-0.1702	0.470	-0.4013	0.254
Employment Status (2023) = Student	0.0476	0.958	-1.8566	0.095	0.4669	0.339	-0.3908	0.442	0.1967	0.722
Employment Status (2023) = Not in labour force	-1.2832	0.209	-0.6121	0.051	-0.3937	0.117	-0.5087	0.023	-1.3062	0.007
<b>Region = Montréal (REF)</b>	-	-	-	-	-	-	-	-	-	-
Region = Montérégie	-1.3764	0.127	0.2298	0.534	0.2171	0.450	0.3694	0.144	0.1158	0.763
Region = Capitale-Nationale	-0.6105	0.478	0.6139	0.043	0.2988	0.242	0.1212	0.617	-0.3382	0.416
Region = Laval	-1.1532	0.315	0.5065	0.096	-0.1586	0.567	0.0499	0.829	0.0819	0.835
Region = Laurentides	0.6797	0.997	0.9324	0.043	0.8681	0.015	0.5176	0.139	0.5237	0.294
Region = Other	-0.1153	0.856	<b>0.8003</b>	0.003	0.4136	0.062	0.6627	0.001	0.3697	0.231
Region = Remote North	-20.9290	1.000	0.7768	0.416	1.1930	0.093	0.7425	0.286	-0.7533	0.546

Table 34. Multinomial logit (MNL) results for 2023 risky driving behaviour clusters as a function of socio-demographic variables (dependent variable: cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Community Size = 0 (REF)</b>	-	-	-	-	-	-	-	-	-	-
<b>Community Size = 1</b>	0.6981	0.333	<b>-0.8305</b>	0.011	-0.0924	0.708	-0.4803	0.035	0.2500	0.480
<b>Community Size = 2</b>	-0.0687	0.911	-0.2687	0.306	-0.0951	0.654	-0.1128	0.547	0.5208	0.071
<b>Driving Experience = More than 10 years (REF)</b>	-	-	-	-	-	-	-	-	-	-
<b>Driving Experience = 1 year</b>	-	1.000	-2.7463	0.013	-3.5787	0.001	-3.6806	0.001	-	1.000
<b>Driving Experience = 2 years</b>	26.1389								28.8351	
<b>Driving Experience = 3 years</b>	-0.3448	0.725	-	1.000	-2.9494	0.007	-	1.000	-2.3939	0.031
<b>Driving Experience = 4 years</b>			24.3124				25.6841			
<b>Driving Experience = 5 years</b>	0.2758	0.839	-	1.000	-2.5482	0.022	-1.9572	0.020	-1.9103	0.092
<b>Driving Experience = 6-10 years</b>			26.2759							
<b>Clean Driving Record = Yes (REF)</b>	1.0866	0.282	-1.2855	0.285	-47.3640	1.000	-0.6721	0.369	-0.6308	0.469
<b>Clean Driving Record = No</b>	0.6307	0.523	-1.6889	0.074	-1.0497	0.073	-1.1858	0.040	-0.7816	0.216
<b>Professional Driver = No (REF)</b>	-0.6364	0.417	-0.4479	0.277	-0.6613	0.045	-0.3563	0.248	-0.2410	0.500
<b>Professional Driver = Yes</b>	-	-	-	-	-	-	-	-	-	-
	1.1445	0.090	<b>1.7225</b>	0.000	0.9207	0.002	0.7267	0.013	1.7506	0.000
	-	-	-	-	-	-	-	-	-	-
	<b>1.4773</b>	0.001	-0.1209	0.647	-0.1234	0.572	-0.3767	0.062	0.4515	0.088

## Appendix B1-1 Significant socio-demographic variables

Summary tables of significant effects list only variables with  $p < 0.05$ , using “+” to indicate higher odds and “-” to indicate lower odds of belonging to a given risky cluster relative to Safe Drivers and the relevant reference category. To facilitate cross-year comparison, a single consolidated summary table (2019/2020/2023) is provided, reporting the direction of significant effects across years for each cluster.

This table summarizes only the socio-demographic variables that are statistically significant in the 2019 MNL model.

Table 35. Significant socio-demographic variables from the 2019 MNL analysis for each risky driving behaviour cluster (reference outcome: Safe Drivers)

Risky Behavior	Significant Variables	Direction
High-Risk Drivers	Gender = Male,	+
	Age Group = 22-24 years	+
	Age Group = 25-34 years	+
	Household Income = \$75-99k,	+
	Clean Driving Record = No,	+
Tech-Distracted Speeders	Professional Driver = Yes	+
	Gender = Male,	+
	Household Income = $\geq$ \$126k,	+
Screen-Distracted Drivers	Education Level = Master+,	-
	Driving Experience = 1 year	-
	Clean Driving Record = No	+
	Age Group = 25-34 years	+
Screen-Distracted Drivers	Household Income = \$75-99k,	+
	Household Income = \$100-125k,	+
	Household Income = $\geq$ \$126k,	+
	Region = Laurentides	+

Table 35. Significant socio-demographic variables from the 2019 MNL analysis for each risky driving behaviour cluster (reference outcome: Safe Drivers) (continued)

<b>Risky Behavior</b>	<b>Significant Variables</b>	<b>Direction</b>
Chatty Speeders	Household Income = < \$25k,	-
	Education Level = Master+,	-
Texting Drivers	Employment Status (2023) = Not in labour force,	-
	Region = Laurentides,	+
	Region = Other,	+
	Community Size = 1	-
	Driving Experience = 1 year	-
	Clean Driving Record = No	+
	Gender = Male,	+
	Age Group = 22-24 years,	+
	Age Group = 25-34 years,	+
	Age Group = 35-44 years,	+
Age Group = 45-54 years,	+	
Texting Drivers	Employment Status (2023) = Not in labour force,	-
	Clean Driving Record = No	+

Table 36 summarizes only the socio-demographic variables that are statistically significant in the 2020 MNL model, to support comparison across clusters.

Table 36. Significant socio-demographic variables from the 2020 MNL analysis for each risky driving behaviour cluster (reference outcome: Safe Drivers)

<b>Risky Behavior</b>	<b>Significant Variables</b>	<b>Direction</b>
High-Risk Drivers	Gender = Male,	+
	Household Income = < \$25k	+
	Household Income = \$75-99k	+
	Clean Driving Record = No	+
	Professional Driver = Yes	+
Tech-Distracted Speeders	Gender = Male,	+
	Employment Status (2023) = Not in labour force	-
	Region = Laurentides	+
Tech-Distracted Speeders	Clean Driving Record = No	+

Table 36. Significant socio-demographic variables from the 2020 MNL analysis for each risky driving behaviour cluster (reference outcome: Safe Drivers) (continued)

<b>Risky Behavior</b>	<b>Significant Variables</b>	<b>Direction</b>
Screen-Distracted Drivers	Gender = Male,	+
	Household Income = \$75-99k	+
	Household Income = \$100-125k	+
	Household Income = $\geq$ \$126k	+
	Region = Laurentides	+
	Clean Driving Record = No	+
Chatty Speeders	Gender = Male	+
	Household Income = < \$25k	-
	Household Income = \$25-49k	-
	Education Level = Master+	-
	Employment Status (2023) = Not in labour force	-
	Region = Other	+
	Driving Experience = 1 year	-
	Clean Driving Record = No	+
Texting Drivers	Gender = Male,	+
	Age Group = 22-24 years,	+
	Age Group = 25-34 years,	+
	Age Group = 35-44 years	+
	Age Group = 45-54 years	+
	Age Group = 55-64 years	+
	Employment Status (2023) = Not in labour force,	-
	Community Size = 2,	+
	Driving Experience = 5 years	-
	Clean Driving Record = No	+

Table 37 summarizes only the socio-demographic variables that are statistically significant in the 2023 MNL model, to support comparison across clusters.

Table 37. Significant socio-demographic variables from the 2023 MNL analysis for each risky driving behaviour cluster (reference outcome: Safe Drivers)

<b>Risky Behavior</b>	<b>Significant Variables</b>	<b>Direction</b>
High-Risk Drivers	Gender = Male,	+
	Age Group = 25-34 years	+
	Education Level = ≤ High-School	+
	Education Level = CÉGEP / College,	+
	Professional Driver = Yes	+
Tech-Distracted Speeders	Gender = Male,	+
	Household Income = \$25-49k,	-
	Household Income = ≥ \$126k,	+
	Region = Capitale-Nationale,	+
	Region = Laurentides,	+
	Region = Other,	+
	Community Size = 1,	-
	Driving Experience = 1 year	-
	Clean Driving Record = No	+
	Screen-Distracted Drivers	Age Group = 22-24 years
Age Group = 25-34 years		+
Household Income = \$25-49k,		-
Household Income = \$100-125k,		+
Household Income = ≥ \$126k,		+
Region = Laurentides,		+
Driving Experience = 1 year		-
Driving Experience = 2 years		-
Driving Experience = 3 years		-
Driving Experience = 6-10 years,		-
Clean Driving Record = No	+	
Chatty Speeders	Household Income = < \$25k	-
	Employment Status (2023) = Not in labour force,	-
	Region = Other,	+
	Community Size = 1	-
	Driving Experience = 1 year	-
	Driving Experience = 3 years	-
	Driving Experience = 5 years	-
	Clean Driving Record = No	+
Texting Drivers	Gender = Male,	+
	Age Group = 22-24 years,	+
	Age Group = 25-34 years,	+
	Age Group = 35-44 years,	+
	Household Income = \$100-125k,	+

Table 37. Significant socio-demographic variables from the 2023 MNL analysis for each risky driving behaviour cluster (reference outcome: Safe Drivers) (continued)

<b>Risky Behavior (continued)</b>	<b>Significant Variables</b>	<b>Direction</b>
Texting Drivers	Household Income = $\geq$ \$126k,	+
	Employment Status (2023) = Not in labour force,	-
	Driving Experience = 2 years	-
	Clean Driving Record = No	+

### Appendix B1-2 VIFs of socio-demographics

Table 38 reports variance inflation factors (VIFs) for the socio-demographic predictors included in the 2019 MNL model to assess potential multicollinearity.

Table 38 Variance inflation factors (VIFs) for the socio-demographic predictors

<b>Variable (Identical VIF values across the 2019, 2020, and 2023 versions)</b>	<b>VIF</b>
Age Group = 22-24 years	2.62
Driving Experience = 6-10 years	1.83
Community Size = 1	1.74
Region = Montérégie	1.67
Household Income = $<$ \$25k	1.52
Driving Experience = 5 years	1.48
Employment Status (2023) = Student	1.42
Region = Laurentides	1.38
Region = Capitale-Nationale	1.27
Professional Driver = Yes	1.26
Employment Status (2023) = Part-time / Self-emp.	1.26
Region = Laval	1.25
Clean Driving Record = No	1.18
Region = Remote North	1.12
Driving Experience = 1 year	1.11
Driving Experience = 4 years	1.10
Driving Experience = 2 years	1.09

Table 38 Variance inflation factors (VIFs) for the socio-demographic predictors (continued)

Variable (Identical VIF values across the 2019, 2020, and 2023 versions)	VIF
Driving Experience = 3 years	1.09
Region = Other	0.99
Education Level = CÉGEP / College	0.87
Community Size = 2	0.82
Household Income = $\geq$ \$126k	0.82
Education Level = $\leq$ High-School / Voc.	0.70
Employment Status (2023) = Not in labour force	0.54
Age Group = 25-34 years	0.53
Age Group = 55-64 years	0.31
Household Income = \$75-99k	0.28
Age Group = 35-44 years	0.28
Gender = Male	0.28
Household Income = \$25-49k	0.23
Household Income = \$100-125k	0.16
Education Level = Master+	0.04
Age Group = 45-54 years	0.03

## Appendix B2 Mobility

Table 39 presents the full multinomial logit (MNL) results for 2019 risky driving behaviour clusters as a function of mobility variables.

Table 39. MNL analysis results for mobility variables in 2019 (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers)

Explanatory Variable	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
Vehicle Type (2019) = SUV/Crossover	-0.2130	0.655	0.1331	0.495	0.3280	0.052	0.1020	0.480	-0.3417	0.140
Vehicle Type (2019) = Minivan/Truck	0.9043	0.163	0.7469	0.023	0.6597	0.032	0.0165	0.955	-0.0509	0.906
Vehicle Type (2019) = No Driving	-2.6821	0.055	-1.8471	0.149	-0.9412	0.359	-1.4700	0.006	-2.5921	0.044

Table 39. MNL analysis results for mobility variables in 2019 (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
Driving Frequency (2019) = Occasional	-1.1324	0.037	<b>-1.3947</b>	0.000	<b>-0.9538</b>	0.000	-0.7038	0.000	-1.6670	0.000
Driving Frequency (2019) = Rare/Never	0.8681	0.344	<b>-3.5347</b>	0.003	<b>-3.8593</b>	0.001	<b>2.2362</b>	0.000	1.6126	0.031
Car Access (2019) = Low Access	1.5562	0.085	1.3819	0.029	0.4487	0.498	<b>1.3370</b>	0.001	0.7031	0.373
Walking Time (2019) = Walk >=30m	0.0880	0.834	-0.1133	0.560	-0.0374	0.821	-0.0972	0.486	-0.4775	0.030
Walking Time (2019) = No Walking	0.8781	0.170	-0.0650	0.811	-0.6007	0.029	-0.3955	0.072	-0.5137	0.127
Biking Time (2019) = About 2-3 hours	1.3513	0.193	-0.3551	0.696	0.2985	0.675	-0.2886	0.667	0.7498	0.390
Biking Time (2019) = About 20 minutes	0.0322	0.969	-0.3600	0.424	-0.4188	0.319	0.0584	0.865	0.3065	0.576
Biking Time (2019) = About 30-40 minutes	0.3485	0.668	-0.5512	0.246	-0.4863	0.263	-0.4446	0.219	-0.1277	0.827
Biking Time (2019) = About 45-60 minutes	0.6299	0.430	-0.7336	0.183	-0.4875	0.317	-0.1837	0.642	0.0904	0.883
Biking Time (2019) = More than 3 hours	-0.4878	0.698	-0.8855	0.206	-1.2352	0.074	-0.9111	0.105	-0.0360	0.961
Biking Time (2019) = No time	1.0306	0.169	-0.3792	0.335	-0.0538	0.883	-0.2869	0.356	0.0181	0.971
Bus Travel Time (2019) = Bus <=40m	0.0762	0.909	-0.2390	0.515	-0.0330	0.909	-0.0797	0.726	-0.4768	0.246
Bus Travel Time (2019) = Bus >=45m	0.0464	0.939	-0.5419	0.197	-0.7387	0.036	-0.4255	0.098	-0.3950	0.337
Rail Travel Time (2019) = Rail <=40m	0.3543	0.606	-0.4918	0.267	-0.3105	0.358	-0.1791	0.472	0.1133	0.788
Rail Travel Time (2019) = Rail >=45m	<b>1.9943</b>	0.001	0.0527	0.917	0.2598	0.506	0.3684	0.227	0.6182	0.193
Car Travel Time (2019) = Car >=45m	0.7388	0.087	-0.0233	0.903	0.0498	0.766	-0.0408	0.778	0.2732	0.201

Table 39. MNL analysis results for mobility variables in 2019 (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers		
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	
<b>Other Modes Travel Time (2019) = Other Modes &lt;=40m</b>	1.3601	0.025	-0.2388	0.647	-0.1193		0.777	-	0.579	-	0.913
<b>Confidence in Trip Responses (2019) = Not Confident</b>	0.0695	0.917	-0.1380	0.756	0.0880		0.801	-	0.287	0.3895	0.330
<b>Local Trips Frequency (2019) = Medium Frequency</b>	-	0.954	0.0450	0.828	0.1598		0.386	0.1000	0.504	-	0.765
<b>Local Trips Frequency (2019) = High Frequency</b>	0.5229	0.369	0.1364	0.615	0.3973		0.090	0.0071	0.973	0.2044	0.486
<b>Non-Local Trips Frequency (2019) = Medium Frequency</b>	0.8274	0.076	0.2907	0.170	<b>0.4840</b>		0.010	0.2868	0.063	0.4777	0.048
<b>Non-Local Trips Frequency (2019) = High Frequency</b>	0.5567	0.370	0.5351	0.057	<b>0.8491</b>		0.000	0.2662	0.238	<b>0.9303</b>	0.002

n= 1766, Df residuals: 1636; Df model: 125; Pseudo R2: 0.08560; Log-likelihood: -2483.1

Table 40 presents the full multinomial logit (MNL) results for 2020 risky driving behaviour clusters as a function of mobility variables.

Table 40. MNL analysis results for mobility variables in 2020 (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers).

Explanatory Variable	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Vehicle Type (2020) = SUV/Crossover</b>	0.2537	0.620	0.3035	0.131	0.5942	0.032	<b>0.4366</b>	0.001	0.0948	0.670

Table 40. MNL analysis results for mobility variables in 2020 (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
Vehicle Type (2020) = Minivan/Truck	<b>0.9721</b>	<b>0.187</b>	<b>0.5295</b>	<b>0.127</b>	<b>0.6378</b>	<b>0.030</b>	- <b>0.1270</b>	<b>0.664</b>	<b>0.0340</b>	<b>0.936</b>
Driving Frequency (2020) = Occasional	-0.9525	0.077	<b>-0.7865</b>	0.000	<b>-0.6335</b>	0.000	- <i>0.2914</i>	0.028	- <b>0.7908</b>	0.002
Car Access (2020) = Low Access	0.1208	0.850	<i>-1.3134</i>	0.015	<b>-1.4065</b>	0.002	- <b>1.2331</b>	0.000	- <b>2.0166</b>	0.007
Walking Time (2020) = Walk >=30m	-0.6439	0.215	-0.1644	0.415	-0.1835	0.261	0.0299	0.824	- 0.3176	0.154
Walking Time (2020) = No Walking	1.2180	0.073	-0.2978	0.299	<b>-0.8390</b>	0.002	- 0.2358	0.240	0.0029	0.992
Biking Time (2020) = Bike <=40m	0.8014	0.216	<i>-0.8935</i>	0.017	-0.4763	0.063	0.0469	0.801	0.3406	0.228
Biking Time (2020) = Bike >=45m	<b>1.8392</b>	0.002	-0.1207	0.753	-0.3544	0.290	0.1851	0.442	- 0.4508	0.343
Bus Travel Time (2020) = Bus <=40m	-0.1122	0.885	-0.6742	0.144	<i>-0.8452</i>	0.027	- <i>0.5635</i>	0.031	- 0.7474	0.117
Bus Travel Time (2020) = Bus >=45m	-0.1640	0.845	-0.3082	0.592	-0.2833	0.565	- 0.5091	0.175	- 0.1820	0.753
Rail Travel Time (2020) = Rail <=40m	0.7552	0.355	-0.3701	0.536	-0.1742	0.700	0.2026	0.492	0.2648	0.608
Rail Travel Time (2020) = Rail >=45m	<b>2.3928</b>	0.002	-0.0073	0.991	-1.3178	0.109	- 0.3467	0.460	0.1537	0.819
Car Travel Time (2020) = Car >=45m	0.4056	0.414	<i>0.4084</i>	0.043	0.3431	0.046	0.1534	0.297	<i>0.5245</i>	0.016
Other Modes Travel Time (2020) = Other Modes <=40m	0.6669	0.393	0.1955	0.709	0.1654	0.693	- 0.3549	0.325	0.5242	0.250
Local Trips Frequency (2020) = Medium Frequency	0.2378	0.664	-0.1657	0.444	-0.0374	0.833	0.1606	0.258	0.1870	0.421
Local Trips Frequency (2020) = High Frequency	0.3509	0.630	0.0236	0.934	0.2447	0.295	0.0060	0.977	- 0.1984	0.536



Table 41. MNL analysis results for mobility variables in 2023 (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >	Coeff.	p >	Coeff.	p >  z	Coeff.	p >	Coeff.	p >
		z		z				z		z
Biking Time (2023): No Biking (REF)	-	-	-	-	-	-	-	-	-	-
Bus Travel Time (2023): No Bus (REF)	-	-	-	-	-	-	-	-	-	-
Rail Travel Time (2023): No Rail (REF)	-	-	-	-	-	-	-	-	-	-
Car Travel Time (2023): Car <=40m (REF)	-	-	-	-	-	-	-	-	-	-
Other Modes Travel Time (2023): No Other Modes (REF)	-	-	-	-	-	-	-	-	-	-
Confidence in Trip Responses (2023): Confident (REF)	-	-	-	-	-	-	-	-	-	-
Local Trips Frequency (2023): Low Frequency (REF)	-	-	-	-	-	-	-	-	-	-
Non-Local Trips Frequency (2023): Low Frequency (REF)	-	-	-	-	-	-	-	-	-	-
Vehicle Type (2023) = SUV/Crossover	0.1073	0.824	0.3020	0.111	<b>0.3892</b>	0.012	<b>0.3297</b>	0.019	0.0565	0.789
Vehicle Type (2023) = Minivan/Truck	0.6504	0.447	0.5757	0.113	0.4908	0.114	- 0.0170	0.956	0.4029	0.328
Vehicle Type (2023) = No Driving	-0.8624	0.595	-0.3623	0.783	<b>-0.5366</b>	0.064	- 0.9580	0.109	- 1.3072	0.299
Driving Frequency (2023) = Occasional	-0.8349	0.126	<b>-1.7006</b>	0.000	<b>-1.0659</b>	0.000	- <b>0.5799</b>	0.000	- <b>1.5910</b>	0.000

Table 41. MNL analysis results for mobility variables in 2023 (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Driving Frequency (2023) = Rare/Never</b>	-1.8637	0.141	<b>-3.6914</b>	0.000	<b>-2.8392</b>	0.000	-	0.000	-	0.034
<b>Car Access (2023) = Low Access</b>	0.8086	0.349	-0.3179	0.665	-1.0269	0.079	-	0.956	-	0.191
<b>Walking Time (2023) = Walk &gt;=30m</b>	-0.0115	0.980	-0.3907	0.048	-0.2088	0.179	-	0.257	-	0.040
<b>Walking Time (2023) = No Walking</b>	-0.1907	0.863	0.1524	0.600	-0.0838	0.725	-	0.064	0.1067	0.744
<b>Biking Time (2023) = Bike &lt;=40m</b>	1.0773	0.046	-0.4266	0.156	-0.0552	0.796	-	0.377	-	0.607
<b>Biking Time (2023) = Bike &gt;=45m</b>	1.0398	0.147	-0.0135	0.974	-0.0533	0.869	0.0446	0.872	0.0136	0.975
<b>Bus Travel Time (2023) = Bus &lt;=40m</b>	-1.0666	0.172	-0.9277	0.019	-0.2368	0.339	-	0.577	-	0.032
<b>Bus Travel Time (2023) = Bus &gt;=45m</b>	-0.8515	0.289	-0.3355	0.450	-0.7381	0.039	-	0.854	-	0.419
<b>Rail Travel Time (2023) = Rail &lt;=40m</b>	1.4522	0.040	0.2936	0.500	0.2452	0.431	0.4855	0.054	0.5833	0.176
<b>Rail Travel Time (2023) = Rail &gt;=45m</b>	1.4074	0.069	-0.5565	0.406	-1.3178	0.098	0.0903	0.793	1.0191	0.024
<b>Car Travel Time (2023) = No Car Travel</b>	-0.9428	0.413	0.7611	0.052	0.5045	0.052	-	0.072	0.7313	0.095
<b>Car Travel Time (2023) = Car &gt;=45m</b>	0.4975	0.324	0.0289	0.881	0.2158	0.178	-	0.919	0.5250	0.014
<b>Other Modes Travel Time (2023) = Other Modes &lt;=40m</b>	1.5465	0.017	0.3058	0.472	-0.1126	0.756	0.1116	0.714	0.6601	0.107
<b>Other Modes Travel Time (2023) = Other Modes &gt;=45m</b>	2.7072	0.000	0.2257	0.717	-0.2038	0.702	-	0.842	0.1632	0.784

Table 41. MNL analysis results for mobility variables in 2023 (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Confidence in Trip Responses (2023) = Not Confident</b>	1.3813	0.059	-1.4368	0.098	-1.3079	0.095	-0.5049	0.297	0.2176	0.728
<b>Local Trips Frequency (2023) = Medium</b>	-0.3949	0.474	-0.0206	0.922	0.0581	0.733	0.1844	0.219	-0.2608	0.275
<b>Local Trips Frequency (2023) = High</b>	-0.0713	0.911	0.2195	0.408	0.1919	0.384	0.0646	0.756	0.1609	0.564
<b>Non-Local Trips Frequency (2023) = Medium</b>	<i>1.4030</i>	0.012	0.1771	0.393	0.0582	0.735	-0.0577	0.707	0.2854	0.231
<b>Non-Local Trips Frequency (2023) = High</b>	1.0603	0.136	0.3902	0.183	0.5589	0.098	0.0886	0.709	<i>1.0379</i>	0.021

n= 1766, Df residuals: 1646; Df model: 115; Pseudo R2: 0.08829; Log-likelihood: -2514.9

## Appendix B2-1 Significant mobility variables

Table 42 summarizes only the mobility variables that are statistically significant in the 2019 MNL model.

Table 42. Significant mobility variables from the 2019 MNL analysis for each risky driving behaviour cluster (reference outcome: Safe Drivers)

Risky Behavior	Significant Variables	Direction
High-Risk Drivers	Driving Frequency (2019) = Occasional,	-
	Rail Travel Time (2019) = Rail $\geq 45m$ ,	+
	Other Modes Travel Time (2019) = Other Modes $\leq 40m$	+
Tech-Distracted Speeders	Vehicle Type (2019) = Minivan/Truck,	+
	Driving Frequency (2019) = Occasional,	-
Screen-Distracted Drivers	Driving Frequency (2019) = Rare/Never,	-
	Car Access (2019) = Low Access	+
	Vehicle Type (2019) = Minivan/Truck,	+
	Driving Frequency (2019) = Occasional,	-
	Driving Frequency (2019) = Rare/Never,	-
Chatty Speeders	Walking Time (2019) = No Walking,	-
	Bus Travel Time (2019) = Bus $\geq 45m$ ,	-
	Non-Local Trips Frequency (2019) = Medium Frequency,	+
	Non-Local Trips Frequency (2019) = High Frequency	+
	Vehicle Type (2019) = No Driving,	-
Texting Drivers	Driving Frequency (2019) = Occasional,	-
	Driving Frequency (2019) = Rare/Never,	-
	Car Access (2019) = Low Access	+
	Vehicle Type (2019) = No Driving,	-
	Driving Frequency (2019) = Occasional,	-
	Driving Frequency (2019) = Rare/Never,	-
	Walking Time (2019) = Walk $\geq 30m$ ,	-
	Non-Local Trips Frequency (2019) = Medium Frequency,	+
	Non-Local Trips Frequency (2019) = High Frequency	+

Table 43 summarizes only the mobility variables that are statistically significant in the 2020 MNL model.

Table 43. Significant mobility variables from the 2020 MNL analysis for each risky driving behaviour cluster (reference outcome: Safe Drivers)

Risky Behavior	Significant Variables	Direction
High-Risk Drivers	Biking Time (2020) = Bike $\geq 45m$ ,	+
	Rail Travel Time (2020) = Rail $\geq 45m$ ,	+
	Non-Local Trips Frequency (2020) = Medium Frequency	+
Tech-Distracted Speeders	Driving Frequency (2020) = Occasional,	-
	Car Access (2020) = Low Access,	-
	Biking Time (2020) = Bike $\leq 40m$ ,	-
	Car Travel Time (2020) = Car $\geq 45m$ ,	+
	Non-Local Trips Frequency (2020) = Medium Frequency,	+
Screen-Distracted Drivers	Non-Local Trips Frequency (2020) = High Frequency	+
	Vehicle Type (2020) = SUV/Crossover,	+
	Vehicle Type (2020) = Minivan/Truck, Driving Frequency (2020) = Occasional,	-
	Car Access (2020) = Low Access,	-
	Walking Time (2020) = No Walking,	-
	Bus Travel Time (2020) = Bus $\leq 40m$ ,	-
	Car Travel Time (2020) = Car $\geq 45m$ ,	+
Screen-Distracted Drivers	Non-Local Trips Frequency (2020) = Medium Frequency,	+
	Non-Local Trips Frequency (2020) = High Frequency	+
	Vehicle Type (2020) = SUV/Crossover, Driving Frequency (2020) = Occasional,	-
Chatty Speeders	Car Access (2020) = Low Access,	-
	Bus Travel Time (2020) = Bus $\leq 40m$ ,	-
	Non-Local Trips Frequency (2020) = Medium Frequency	+
	Driving Frequency (2020) = Occasional,	-
	Car Access (2020) = Low Access,	-
Texting Drivers	Bus Travel Time (2020) = Bus $\leq 40m$ ,	-
	Non-Local Trips Frequency (2020) = Medium Frequency	+
	Driving Frequency (2020) = Occasional,	-
	Car Access (2020) = Low Access,	-
	Car Travel Time (2020) = Car $\geq 45m$ ,	+
Texting Drivers	Non-Local Trips Frequency (2020) = Medium Frequency,	+
	Non-Local Trips Frequency (2020) = High Frequency	+
	Car Travel Time (2020) = Car $\geq 45m$ ,	+
	Non-Local Trips Frequency (2020) = Medium Frequency,	+

Table 44 summarizes only the mobility variables that are statistically significant in the 2023 MNL model.

Table 44 Significant mobility variables from the 2023 MNL analysis for each risky driving behaviour cluster (reference outcome: Safe Drivers)

<b>Risky Behavior</b>	<b>Significant Variables</b>	<b>Direction</b>
High-Risk Drivers	Biking Time (2023) = Bike <=40min,	+
	Rail Travel Time (2023) = Rail <=40min,	+
	Other Modes Travel Time (2023) = Other Modes <=40min,	+
	Other Modes Travel Time (2023) = Other Modes >=45min,	+
	Non-Local Trips Frequency (2023) = Medium Frequency	+
Tech-Distracted Speeders	Driving Frequency (2023) = Occasional,	-
	Driving Frequency (2023) = Rare/Never,	-
	Walking Time (2023) = Walk >=30min,	-
	Bus Travel Time (2023) = Bus <=40min	-
Screen-Distracted Drivers	Vehicle Type (2023) = SUV/Crossover,	+
	Driving Frequency (2023) = Occasional,	-
	Driving Frequency (2023) = Rare/Never,	-
	Bus Travel Time (2023) = Bus >=45m	-
Chatty Speeders	Vehicle Type (2023) = SUV/Crossover,	+
	Driving Frequency (2023) = Occasional,	-
	Driving Frequency (2023) = Rare/Never	-
Texting Drivers	Driving Frequency (2023) = Occasional,	-
	Driving Frequency (2023) = Rare/Never,	-
	Walking Time (2023) = Walk >=30m,	-
	Bus Travel Time (2023) = Bus <=40m,	-
	Rail Travel Time (2023) = Rail >=45m,	+
	Car Travel Time (2023) = Car >=45m,	+
	Non-Local Trips Frequency (2023) = High Frequency	+

## Appendix B2-2 VIFs of mobility

Table 45 reports variance inflation factors (VIFs) for the mobility variables included in the 2019, 2020 and 2023 MNL models to assess potential multicollinearity.

Table 45 Variance inflation factors (VIFs) for the mobility variables

Variable	2019 VIF	2020 VIF	2023 VIF
Vehicle Type = No Driving	3.68	3.19	2.34
Driving Frequency = Rare/Never	3.02	2.80	2.63
Car Access = Low Access	2.63	2.40	2.05
Car Travel Time = No Car Travel	2.02	0.35	1.75
Bus Travel Time = Bus <=40m	1.55	1.53	1.53
Bus Travel Time = Bus >=45m	1.54	1.63	1.50
Rail Travel Time = Rail <=40m	1.46	1.48	1.44
Rail Travel Time = Rail >=45m	1.35	1.52	1.35
Biking Time = About 20 minutes (2019) / Bike <=40m	1.63	1.23	1.27
Biking Time = About 30-40 minutes (2019)	1.51	—	—
Biking Time = About 45-60 minutes (2019)	1.37	—	—
Biking Time = Bike >=45m	—	1.26	1.20
Walking Time = No Walking	1.25	1.13	1.13
Other Modes Travel Time = Other Modes >=45m	1.13	1.23	1.19
Other Modes Travel Time = Other Modes <=40m	1.11	1.12	1.10
Confidence in Trip Responses = Not Confident	1.11	1.06	1.08
Vehicle Type = Minivan/Truck	1.11	1.08	1.08
Non-Local Trips Frequency = High Frequency	0.14	1.52	0.04
Local Trips Frequency = Medium Frequency	0.65	0.32	0.56
Driving Frequency = Occasional	0.70	0.16	0.02
Vehicle Type = SUV/Crossover	0.00	0.13	0.33

## Appendix B3 Attitudes

I present the full multinomial logit (MNL) model outputs for attitudinal predictors, along with a summary table of statistically significant variables and variance inflation factor (VIF) diagnostics, for 2019, 2020, and 2023. Table 46 presents the full multinomial logit (MNL) results for 2023 risky driving behaviour clusters as a function of attitudinal variables.

Table 46 Significant variables for this attitude MNL analysis 2023 for each risky driving behaviour cluster (dependent variable: risky driving behaviour cluster membership; independent variables: liberty, risk-taking personality, and acceptability attitudinal clusters; reference outcome: Safe Drivers).

Explanatory Variable	High-Risk Drivers_		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeder		Texting Drivers_	
	Coeff.	p > z	Coeff.	p > z	Coeff.	p > z	Coeff.	p > z	Coeff.	p > z
<b>Liberty:</b>	-	-	-	-	-	-	-	-	-	-
<b>Cluster 2 (Libertarians) (Ref)</b>										
<b>Liberty = Cluster 1 (Conservative)</b>	-1.3736	0.087	0.1158	0.574	<i>0.3285</i>	0.051	0.0971	0.525	-0.0935	0.699
<b>Liberty = Cluster 3 (Liberal)</b>	0.0195	0.966	-0.4366	0.057	0.0969	0.574	0.0019	0.99	0.2829	0.247
<b>Risk-Taking Personality:</b>	-	-	-	-	-	-	-	-	-	-
<b>Cluster 2 (Situational Risk Takers) (Ref)</b>										
<b>Risk-Taking Personality = Cluster 1 (Risk Avoiders)</b>	-0.0075	0.992	0.1714	0.392	0.1728	0.266	0.1324	0.346	<b>0.7614</b>	0.002
<b>Risk-Taking Personality = Cluster 3 (Sensation Seekers)</b>	1.2764	0.068	<b>0.7041</b>	0.01	0.0032	0.99	-0.0218	0.926	<b>1.5851</b>	0.0
<b>Acceptability:</b>	-	-	-	-	-	-	-	-	-	-
<b>Cluster 1 (Rule followers) (Ref)</b>										
<b>Acceptability = Cluster 2 (Speeders)</b>	0.3276	0.779	<b>2.1184</b>	0.0	<b>1.3223</b>	0.0	<b>1.0199</b>	0.0	<b>1.5045</b>	0.0
<b>Acceptability = Cluster 3 (Situational risk takers)</b>	<b>2.1787</b>	0.006	<b>1.9251</b>	0.0	<b>1.2236</b>	0.0	<b>0.7589</b>	0.0	<b>2.356</b>	0.0

Table 46 Significant variables for this attitude MNL analysis 2023 for each risky driving behaviour cluster (dependent variable: risky driving behaviour cluster membership; independent variables: liberty, risk-taking personality, and acceptability attitudinal clusters; reference outcome: Safe Drivers) (continued)

Explanatory Variable	High-Risk Drivers_		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeder		Texting Drivers_	
	Coeff.	p > z	Coeff.	p > z	Coeff.	p > z	Coeff.	p > z	Coeff.	p > z
<b>Acceptability = Cluster 4 (High risk takers)</b> n= 1766, Df residuals: 1726; Df model: 35; Pseudo R2: 0.083; Log-likelihood: -2530	<b>4.4719</b>	0.0	0.5605	0.362	0.7021	0.122	-	0.913	<b>1.7271</b>	0.0
							0.0518			

### Appendix B3-1 Significant attitude variables

Table 47 summarizes only the attitudinal variables that are statistically significant in the 2023 MNL model.

Table 47. Significant variables for this attitude MNL analysis 2023 for each risky driving behavior

Risky Driving Behavior	Significant Variables (p < 0.05)	Direction
<b>High-Risk Drivers</b>	Acceptability = Cluster 3 (Situational Risk Takers),	+
	Acceptability = Cluster 4 (High Risk Takers)	+
<b>Tech-Distracted Speeders</b>	Risk-Taking Personality = Cluster 3 (Sensation Seekers),	+
	Acceptability = Cluster 2 (Speeders),	+
	Acceptability = Cluster 3 (Situational Risk Takers)	+
<b>Screen-Distracted Drivers</b>	Liberty = Cluster 1 (Conservative),	+
	Acceptability = Cluster 2 (Speeders),	+
	Acceptability = Cluster 3 (Situational Risk Takers)	+
<b>Chatty Speeders</b>	Acceptability = Cluster 2 (Speeders),	+
	Acceptability = Cluster 3 (Situational Risk Takers)	+
<b>Texting Drivers</b>	Risk-Taking Personality = Cluster 1 (Risk Avoiders),	+
	Risk-Taking Personality = Cluster 3 (Sensation Seekers),	+
	Acceptability = Cluster 2 (Speeders),	+
	Acceptability = Cluster 3 (Situational Risk Takers),	+
	Acceptability = Cluster 4 (High Risk Takers)	+

### Appendix B3-2 VIFs of attitudes

Table 48 presents the full multinomial logit (MNL) results for 2023 risky driving behaviour clusters as a function of attitudinal variables.

reports variance inflation factors (VIFs) for the attitudinal clusters included in the 2023 MNL model to assess potential multicollinearity.

Table 48 Variance inflation factors (VIFs) for the attitude clusters

Variable	VIF
<b>Acceptability</b>	
Acceptability = Cluster 4 (High risk takers)	1.00
Acceptability = Cluster 2 (Speeders)	0.48
Acceptability = Cluster 3 (Situational Risks takers)	0.19
<b>Liberty</b>	
Liberty = Cluster 3 (Liberal)	0.48
Liberty = Cluster 1 (Conservative)	0.03
<b>Risk-Taking Personality</b>	
Risk-Taking Personality = Cluster 3 (Sensation Seekers)	1.00
Risk-Taking Personality = Cluster 1 (Risk Avoiders)	0.16

### Appendix B4 Crashes and substance

I present the full multinomial logit (MNL) model outputs relating risky driving behaviour cluster membership to crash/near-miss outcomes and substance use, along with a summary table of statistically significant variables and variance inflation factor (VIF) diagnostics, for 2019, 2020, and 2023. Table 49 presents the full multinomial logit (MNL) results for 2019 risky driving behaviour clusters as a function of attitudinal variables.

Table 49 MNL between risky driving behavior clusters with substance use, crash and near-miss experience for 2019.

Explanatory Variable	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Alcohol Consumption (2019) = 0 units</b>	0.5692	0.282	<b>-0.5960</b>	0.005	<b>-0.8747</b>	0.000	-	0.065	-	0.002
<b>Alcohol Consumption (2019) = 1-4 (REF)</b>	0		0		0		0		0	
<b>Alcohol Consumption (2019) = 5-9 units</b>	-	0.394	0.5839	0.012	0.0420	0.843	0.2153	0.244	0.5691	0.029
<b>Alcohol Consumption (2019) = 10 or more units</b>	0.7967						0.0400			
<b>Cannabis Consumption (2019) = 0 (REF)</b>	<b>1.6512</b>	0.006	0.7400	0.021	-0.3306	0.354	-	0.889	0.5378	0.144
<b>Cannabis Consumption (2019) = 1 or 2 times a week</b>	0		0		0		0		0	
<b>Cannabis Consumption (2019) = 3 to 4 times a week</b>	1.9017	0.012	-0.2389	0.598	-0.0984	0.795	-	0.552	-	0.969
<b>Cannabis Consumption (2019) = 5 times or more per week</b>	0.1904						0.1904		0.0191	
<b>Road Crashes (2019) = 0 (REF)</b>	<b>4.0261</b>	0.000	0.4806	0.513	-0.9129	0.404	0.3727	0.514	1.4014	0.034
<b>Road Crashes (2019) = 1 time</b>	3.0241	0.000	0.2123	0.575	-0.9159	0.069	0.0927	0.759	-	0.289
<b>Road Crashes (2019) = 2-3 times</b>									0.5998	
<b>Near-Misses (2019) = 0 (REF)</b>	0		0		0		0		0	
<b>Near-Misses (2019) = 1 time</b>	1.7522	0.016	0.4379	0.225	-0.0362	0.922	0.3310	0.258	0.6226	0.106
<b>Near-Misses (2019) = 2-3 times</b>	<b>4.1161</b>	0.000	-0.2414	0.841	1.4892	0.048	0.2237	0.782	1.9500	0.016
<b>Near-Misses (2019) = 3-4 times</b>	0		0		0		0		0	
<b>Near-Misses (2019) = 1 time</b>	1.3932	0.016	<b>0.9868</b>	0.000	0.5222	0.051	0.3652	0.124	<b>0.9940</b>	0.001
<b>Near-Misses (2019) = 2-3 times</b>	0.8819	0.308	<b>1.1367</b>	0.003	0.4722	0.210	<b>0.8955</b>	0.004	<b>1.1372</b>	0.006
<b>Near-Misses (2019) = 3-4 times</b>	2.0407	0.095	<b>2.3149</b>	0.002	<b>2.2305</b>	0.002	1.1118	0.138	<b>2.8451</b>	0.000

Table 50 presents the full multinomial logit (MNL) results for 2020 risky driving behaviour clusters as a function of attitudinal variables.

Table 50 Significant variables for crashes and substance use MNL analysis 2020 for each risky driving behavior

Explanatory Variable	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Alcohol Consumption (2020) = 0 units</b>	-0.426	0.54	-0.4841	0.035	-0.5382	0.002	-	0.258	-	0.102
<b>Alcohol Consumption (2020) 1-4 (REF)</b>	-	-	-	-	-	-	0.1599	-	0.4139	-
<b>Alcohol Consumption (2020) = 5-9 units</b>	<b>0.4931</b>	<b>0.418</b>	<b>0.1979</b>	<b>0.447</b>	<b>0.1236</b>	<b>0.546</b>	<b>0.059</b>	<b>0.74</b>	<b>0.2474</b>	<b>0.375</b>
<b>Alcohol Consumption (2020) = 10 or more units</b>	0.1618	0.812	<b>0.7954</b>	0.005	0.2134	0.419	0.2391	0.279	<b>0.9773</b>	0.001
<b>Cannabis Consumption (2020) = 0 (REF)</b>	-	-	-	-	-	-	-	-	-	-
<b>Cannabis Consumption (2020) = 1 or 2 times a week</b>	<b>2.1561</b>	0.002	-0.6493	0.161	-0.1715	0.592	-	0.484	-	0.271
<b>Cannabis Consumption (2020) = 3 to 4 times a week</b>	<b>3.415</b>	0.0	0.647	0.235	0.0324	0.953	0.3062	0.489	0.4246	0.502
<b>Cannabis Consumption (2020) = 5 times or more per week</b>	<b>3.6193</b>	0.0	0.1268	0.743	-0.6785	0.119	0.1547	0.587	-	0.678
<b>Road Crashes (2019) = 0 (REF)</b>	-	-	-	-	-	-	-	-	-	-
<b>Road Crashes (2020) = 1 time</b>	<b>2.4573</b>	0.0	0.3384	0.473	0.2942	0.448	0.2948	0.368	<b>1.1287</b>	0.004



Table 51 Significant variables for crashes and substance use MNL analysis 2023 for each risky driving behavior (dependent variable: risky driving behaviour cluster membership; reference outcome: Safe Drivers) (continued)

Explanatory Variable (continued)	High-Risk Drivers		Tech-Distracted Speeders		Screen-Distracted Drivers		Chatty Speeders		Texting Drivers	
	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z	Coeff.	p >  z
<b>Alcohol Consumption (2023) = 5-9 units</b>	-	0.842	0.5223	0.043	0.2315	0.276	0.1843	0.364	<b>0.6816</b>	0.009
<b>Alcohol Consumption (2023) = 10 or more units</b>	0.1340									
<b>Alcohol Consumption (2023) = 10 or more units</b>	0.7140	0.291	<b>1.1674</b>	0.000	0.1899	0.560	0.1955	0.520	0.1555	0.720
<b>Cannabis Consumption (2023) = 0 (REF)</b>	-	-	-	-	-	-	-	-	-	-
<b>Cannabis Consumption (2023) = 1 or 2 times a week</b>	1.6647	0.053	-0.9134	0.103	-0.0380	0.909	-	0.270	0.6453	0.090
<b>Cannabis Consumption (2023) = 3 to 4 times a week</b>	<b>3.5492</b>	0.000	-1.1746	0.080	-0.9211	0.090	-	0.026	-	0.865
<b>Cannabis Consumption (2023) = 5 times or more per week</b>	<b>3.5341</b>	0.000	0.2794	0.518	0.0362	0.932	0.4158	0.242	-	0.903
<b>Road Crashes (2023) = 0 (REF)</b>	-	-	-	-	-	-	-	-	-	-
<b>Road Crashes (2023) = 1 time</b>	1.5891	0.013	0.4356	0.249	<b>0.6418</b>	0.038	0.2803	0.357	0.3704	0.380
<b>Road Crashes (2023) = 2-3 times</b>	<b>2.9039</b>	0.006	0.5210	0.591	1.2309	0.098	0.3545	0.644	0.4077	0.682
<b>Near-Misses (2023) = 0 (REF)</b>	-	-	-	-	-	-	-	-	-	-
<b>Near-Misses (2023) = 1 time</b>	1.0282	0.116	<b>1.2828</b>	0.000	<b>1.0911</b>	0.000	<b>0.8769</b>	0.000	<b>1.3069</b>	0.000
<b>Near-Misses (2023) = 2-3 times</b>	0.9388	0.231	0.6644	0.055	0.6221	0.029	0.4160	0.122	0.8037	0.028
<b>Near-Misses (2023) = 3-4 times</b>	0.7986	0.575	1.0331	0.124	<b>1.5925</b>	0.005	1.2005	0.016	<b>1.6966</b>	0.005

## Appendix B4-1 Significant crashes and substance use variables

Table 52 summarizes only the attitudinal variables that are statistically significant in the 2019 MNL model.

Table 52 Significant variables for crashes and substance use MNL analysis 2019 for each risky driving behavior

Risky Driving Behavior	Significant Variables ( $p < 0.05$ )	Direction
<b>High-Risk Drivers</b>	Alcohol Consumption = 10 or more units,	+
	Cannabis Consumption = 1 or 2 times a week,	+
	Cannabis Consumption = 3 to 4 times a week,	+
	Cannabis Consumption = 5 times or more per week,	+
	Road Crashes = 1 time,	+
	Road Crashes = 2-3 times,	+
	Near-Misses = 3-4 times	+
<b>Tech-Distracted Speeders</b>	Alcohol Consumption = 0 units,	-
	Alcohol Consumption = 5-9 units,	+
	Alcohol Consumption = 10 or more units,	+
	Near-Misses = 1 time,	+
	Near-Misses = 2-3 times,	+
	Near-Misses = 3-4 times	+
<b>Screen-Distracted Drivers</b>	Alcohol Consumption = 0 units,	-
	Near-Misses = 3-4 times	+
<b>Chatty Speeders</b>	Near-Misses (2019) = 2-3 times	+
<b>Texting Drivers</b>	Alcohol Consumption = 0 units,	-
	Alcohol Consumption = 5-9 units,	+
	Cannabis Consumption = 3 to 4 times a week,	+
	Road Crashes = 2-3 times,	+
	Near-Misses = 1 time,	+
	Near-Misses = 2-3 times,	+
	Near-Misses = 3-4 times	+

Table 53 summarizes only the attitudinal variables that are statistically significant in the 2020 MNL model.

Table 53 Significant variables for crashes and substance use MNL analysis 2020 for each risky driving behavior.

<b>Risky Driving Behavior</b>	<b>Significant Variables (p &lt; 0.05)</b>	<b>Direction</b>
<b>High-Risk Drivers</b>	- Cannabis Consumption (2020) = 1 or 2 times a week	+
	- Cannabis Consumption (2020) = 3 to 4 times a week	+
	- Cannabis Consumption (2020) = 5 times or more per week	+
	- Road Crashes (2020) = 1 time	+
	- Near-Misses (2020) = 1 time	+
	- Near-Misses (2020) = 2-3 times	+
<b>Tech-Distracted Speeders</b>	- Alcohol Consumption (2020) = 10 or more units	+
	- Near-Misses (2020) = 1 time	+
	- Near-Misses (2020) = 2-3 times	+
<b>Screen-Distracted Drivers</b>	- Alcohol Consumption (2020) = 0 units	-
	- Near-Misses (2020) = 1 time	+
<b>Chatty Speeders</b>	- Near-Misses (2020) = 1 time	+
	- Near-Misses (2020) = 2-3 times	+
<b>Texting Drivers</b>	- Alcohol Consumption (2020) = 10 or more units	+
	- Road Crashes (2020) = 1 time	+
	- Near-Misses (2020) = 1 time	+
	- Near-Misses (2020) = 2-3 times	+

Table 54 summarizes only the attitudinal variables that are statistically significant in the 2023 MNL model.

Table 54 Significant variables for crashes and substance use MNL analysis 2023 for each risky driving behavior

<b>Risky Driving Behavior</b>	<b>Significant Variables (p &lt; 0.05)</b>	<b>Directions</b>
<b>High-Risk Drivers</b>	Cannabis Consumption (2023) = 3 to 4 times a week,	+
	Cannabis Consumption (2023) = 5 times or more per week,	+
	Road Crashes (2023) = 1 time,	+
	Road Crashes (2023) = 2-3 times	+
	Near-Misses = 1 time	+
<b>Tech-Distracted Speeders</b>	Alcohol Consumption (2023) = 0 units	+
	Alcohol Consumption (2023) = 10 or more units	+
	Near-Misses (2023) = 1 time	+
<b>Screen-Distracted Drivers</b>	Alcohol Consumption (2023) = 0 units	-
	Road Crashes (2023) = 1 time	+
	Near-Misses (2023) = 1 time	+
	Near-Misses (2023) = 2-3 times	+
	Near-Misses (2023) = 3-4 times	+
<b>Chatty Speeders</b>	Cannabis Consumption (2023) = 3 to 4 times a week	-
	Near-Misses (2023) = 1 time	+
	Near-Misses (2023) = 3-4 times	+
<b>Texting Drivers</b>	Alcohol Consumption (2023) = 0 units	-
	Alcohol Consumption (2023) = 5-9 units	+
	Near-Misses (2023) = 1 time	+
	Near-Misses (2023) = 3-4 times	+

## Appendix B4-2 VIFs of crashes and substance

Table 55 reports variance inflation factors (VIFs) for the attitudinal predictors included in the 2019, 2020 and 2023 MNL models to assess potential multicollinearity.

Table 55 Variance inflation factors (VIFs) of crashes and substance variables

Variable	2019 VIF	2020 VIF	2023 VIF
Near-Misses = 1 time	1.15	1.14	1.14
Near-Misses = 2-3 times	1.12	1.06	1.13
Near-Misses = 3-4 times	1.03	—	1.03
Road Crashes = 1 time	1.13	1.12	1.13
Road Crashes = 2-3 times	1.10	—	1.06
Alcohol Consumption = 10 or more units	1.11	1.14	1.12
Alcohol Consumption = 5-9 units	0.14	0.18	0.07
Alcohol Consumption = 0 units	0.14	0.10	0.14
Cannabis Consumption = 5 times or more per week	1.08	1.10	1.10
Cannabis Consumption = 3 to 4 times a week	1.03	1.04	1.07
Cannabis Consumption = 1 or 2 times a week	1.04	1.06	1.03

## APPENDIX C SAFETY OUTCOME MODELS

### Appendix C1 Logit near-misses 2019

Binary logistic regression results are shown for near-misses involvement (2019, 2020 and 2023), full covariate model results shown in Table 56 to Table 58.

Table 56 reports the estimated coefficients (and associated statistical tests) from a binary logistic regression where the dependent variable is near-misses (0/1) in 2019. Predictors include behavioural cluster membership (reference: Safe Drivers), exposure (weekly driving frequency), age, gender, driving experience, community size, mobility variables, substance use, and attitudinal covariates (risk-taking personality, acceptability of risky driving, and liberty orientation).

Table 56 Logit near-miss model outcome in 2019 (with all predictors)

Variable	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>const</b>	- 2.4556	0.521	- 4.717	0.000	-3.476	-1.435
<b>Gender = Female (ref.)</b>	-	-	-	-	-	-
<b>Gender = Male</b>	0.0159	0.143	0.111	0.911	-0.265	0.297
<b>Age Group = 65 years and older (ref.)</b>	-	-	-	-	-	-
<b>Age Group = 22-24 years</b>	0.8974	0.475	1.890	0.059	-0.033	1.828
<b>Age Group = 25-34 years</b>	0.5489	0.302	1.817	0.069	-0.043	1.141
<b>Age Group = 35-44 years</b>	0.2082	0.284	0.733	0.463	-0.348	0.765
<b>Age Group = 45-54 years</b>	0.2906	0.279	1.043	0.297	-0.256	0.837
<b>Age Group = 55-64 years</b>	0.2106	0.251	0.840	0.401	-0.281	0.702
<b>Household Income = \$50-75k (ref.)</b>	-	-	-	-	-	-
<b>Household Income = &lt; \$25k</b>	- 0.0618	0.296	- 0.209	0.835	-0.642	0.518
<b>Household Income = \$25-49k</b>	- 0.4879	0.241	- 2.023	0.043	-0.961	-0.015
<b>Household Income = \$75-99k</b>	- 0.3340	0.221	- 1.511	0.131	-0.767	0.099
<b>Household Income = \$100-125k</b>	- 0.3245	0.226	- 1.436	0.151	-0.768	0.119
<b>Household Income = ≥ \$126k</b>	- 0.2706	0.209	- 1.292	0.196	-0.681	0.140
<b>Education Level = Bachelor (ref.)</b>	-	-	-	-	-	-
<b>Education Level = ≤ High-School / Voc.</b>	0.3663	0.197	1.859	0.063	-0.020	0.752
<b>Education Level = CÉGEP / College</b>	0.1266	0.180	0.702	0.483	-0.227	0.480
<b>Education Level = Master+</b>	0.3128	0.207	1.512	0.130	-0.093	0.718
<b>Region = Montréal (ref.)</b>	-	-	-	-	-	-
<b>Region = Montérégie</b>	- 0.1195	0.263	- 0.454	0.649	-0.635	0.396

Table 56 Logit near-miss model outcome in 2019 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Region = Capitale-Nationale</b>	- 0.1412	0.253	- 0.559	0.576	-0.636	0.354
<b>Region = Laval</b>	0.0064	0.244	0.026	0.979	-0.471	0.484
<b>Region = Laurentides</b>	- 0.8779	0.395	- 2.224	0.026	-1.652	-0.104
<b>Region = Other</b>	- 0.0899	0.208	- 0.433	0.665	-0.497	0.317
<b>Region = Remote North</b>	- 0.9881	0.801	- 1.233	0.217	-2.558	0.582
<b>Community Size = 0 (ref.)</b>	-	-	-	-	-	-
<b>Community Size = 1</b>	0.0171	0.241	0.071	0.943	-0.455	0.489
<b>Community Size = 2</b>	0.0398	0.195	0.204	0.839	-0.343	0.423
<b>Driving Experience = More than 10 years (ref.)</b>	-	-	-	-	-	-
<b>Driving Experience = ≤ 5 years</b>	0.1090	0.375	0.290	0.772	-0.627	0.845
<b>Driving Experience = 6-10 years</b>	- 0.2504	0.282	- 0.888	0.374	-0.803	0.302
<b>Clean Driving Record = Yes (ref.)</b>	-	-	-	-	-	-
<b>Clean Driving Record = No</b>	0.1210	0.213	0.567	0.571	-0.297	0.539
<b>Clean Driving Record = Other</b>	0.3274	0.304	1.076	0.282	-0.269	0.924
<b>Professional Driver = No (ref.)</b>	-	-	-	-	-	-
<b>Professional Driver = Yes</b>	- 0.0891	0.197	- 0.453	0.650	-0.474	0.296
<b>Employment Status (2019) = Full-time worker (ref.)</b>	-	-	-	-	-	-
<b>Employment Status (2019) = Part-time / Self-emp.</b>	0.0634	0.217	0.292	0.771	-0.363	0.490
<b>Employment Status (2019) = Student</b>	- 0.1716	0.307	- 0.558	0.577	-0.774	0.431
<b>Employment Status (2019) = Not in labour force</b>	- 0.1554	0.238	- 0.654	0.513	-0.621	0.310
<b>Cannabis Consumption (2019) = No Cannabis Use (ref.)</b>	-	-	-	-	-	-
<b>Cannabis Consumption (2019) = Occasional</b>	- 0.0499	0.326	- 0.153	0.878	-0.690	0.590
<b>Cannabis Consumption (2019) = Frequent</b>	- 0.2831	0.297	- 0.953	0.341	-0.865	0.299
<b>Alcohol Consumption (2019) = No Alcohol Use (ref.)</b>	-	-	-	-	-	-
<b>Alcohol Consumption (2019) = Occasional</b>	0.1623	0.161	1.010	0.313	-0.153	0.477
<b>Alcohol Consumption (2019) = Frequent</b>	0.1440	0.193	0.747	0.455	-0.234	0.522
<b>Vehicle Type (2019) = Sedan/Small Car (ref.)</b>	-	-	-	-	-	-
<b>Vehicle Type (2019) = SUV/Crossover</b>	0.0731	0.156	0.468	0.639	-0.233	0.379
<b>Vehicle Type (2019) = Minivan/Truck</b>	- 0.1068	0.301	- 0.355	0.723	-0.696	0.483
<b>Vehicle Type (2019) = No Driving</b>	- 1.1571	0.538	- 2.151	0.031	-2.211	-0.103
<b>Driving Frequency (2019) = Frequent (ref.)</b>	-	-	-	-	-	-
<b>Driving Frequency (2019) = Occasional</b>	- 0.0564	0.194	- 0.291	0.771	-0.436	0.323
<b>Driving Frequency (2019) = Rare/Never</b>	0.2261	0.442	0.511	0.609	-0.641	1.093
<b>Car Access (2019) = High Access (ref.)</b>	-	-	-	-	-	-

Table 56 Logit near-miss model outcome in 2019 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Car Access (2019) = Low Access</b>	0.7935	0.370	2.144	0.032	0.068	1.519
<b>Walking Time (2019) = Walk &lt;=29m (ref.)</b>	-	-	-	-	-	-
<b>Walking Time (2019) = Walk &gt;=30m</b>	0.1516	0.145	1.042	0.297	-0.134	0.437
<b>Walking Time (2019) = No Walking</b>	-	0.247	-	0.755	-0.562	0.407
	0.0773		0.313			
<b>Biking Time (2019) = Ref (not categorical) (ref.)</b>	-	-	-	-	-	-
<b>Biking Time (2019) = About 1.5 hours-2 hours</b>	-	0.593	-	0.545	-1.521	0.803
	0.3591		0.606			
<b>Biking Time (2019) = About 2-3 hours</b>	-	0.659	-	0.392	-1.855	0.728
	0.5638		0.856			
<b>Biking Time (2019) = About 20 minutes</b>	-	0.389	-	0.434	-1.066	0.457
	0.3042		0.783			
<b>Biking Time (2019) = About 30-40 minutes</b>	-	0.410	-	0.312	-1.219	0.390
	0.4146		1.010			
<b>Biking Time (2019) = About 45-60 minutes</b>	-	0.422	-	0.949	-0.853	0.799
	0.0269		0.064			
<b>Biking Time (2019) = More than 3 hours</b>	-	0.654	-	0.110	-2.326	0.237
	1.0446		1.598			
<b>Biking Time (2019) = No time</b>	-	0.354	-	0.485	-0.942	0.446
	0.2475		0.699			
<b>Bus Travel Time (2019) = No Bus (ref.)</b>	-	-	-	-	-	-
<b>Bus Travel Time (2019) = Bus &lt;=40m</b>	-	0.252	-	0.592	-0.629	0.359
	0.1350		0.536			
<b>Bus Travel Time (2019) = Bus &gt;=45m</b>	-	0.267	-	0.733	-0.614	0.432
	0.0909		0.341			
<b>Rail Travel Time (2019) = No Rail (ref.)</b>	-	-	-	-	-	-
<b>Rail Travel Time (2019) = Rail &lt;=40m</b>	0.7915	0.252	3.142	0.002	0.298	1.285
<b>Rail Travel Time (2019) = Rail &gt;=45m</b>	0.4675	0.299	1.565	0.118	-0.118	1.053
<b>Car Travel Time (2019) = Car &lt;=40m (ref.)</b>	-	-	-	-	-	-
<b>Car Travel Time (2019) = No Car Travel</b>	-	0.297	-	0.434	-0.815	0.350
	0.2324		0.782			
<b>Car Travel Time (2019) = Car &gt;=45m</b>	0.2834	0.152	1.868	0.062	-0.014	0.581
<b>Other Modes Travel Time (2019) = No Other Modes (ref.)</b>	-	-	-	-	-	-
<b>Other Modes Travel Time (2019) = Other Modes &lt;=40m</b>	-	0.361	-	0.650	-0.870	0.543
	0.1635		0.454			
<b>Other Modes Travel Time (2019) = Other Modes &gt;=45m</b>	0.1599	0.418	0.383	0.702	-0.659	0.979
<b>Local Trips Frequency (2019) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Local Trips Frequency (2019) = Medium Frequency</b>	-	0.161	-	0.984	-0.319	0.313
	0.0032		0.020			
<b>Local Trips Frequency (2019) = High Frequency</b>	0.0222	0.202	0.110	0.912	-0.374	0.418
<b>Non-Local Trips Frequency (2019) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Non-Local Trips Frequency (2019) = Medium Frequency</b>	0.1397	0.162	0.862	0.389	-0.178	0.457

Table 56 Logit near-miss model outcome in 2019 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Non-Local Trips Frequency (2019) = High Frequency</b>	0.3442	0.206	1.674	0.094	-0.059	0.747
<b>Liberty = Cluster 2 (Libertarians) (ref.)</b>	-	-	-	-	-	-
<b>Liberty = Cluster 1 (Conservative)</b>	0.1071	0.165	0.649	0.516	-0.216	0.430
<b>Liberty = Cluster 3 (Liberal)</b>	0.1316	0.168	0.783	0.433	-0.198	0.461
<b>Risk-Taking Personality = Cluster 2 (Situational Risk Takers) (ref.)</b>	-	-	-	-	-	-
<b>Risk-Taking Personality = Cluster 1 (Risk Avoiders)</b>	-	0.157	-	0.784	-0.350	0.264
	0.0430		0.274			
<b>Risk-Taking Personality = Cluster 3 (Sensation Seekers)</b>	0.0214	0.222	0.096	0.923	-0.413	0.456
<b>Acceptability = Cluster 1 (Rule followers) (ref.)</b>	-	-	-	-	-	-
<b>Acceptability = Cluster 2 (Speeders)</b>	0.1290	0.164	0.787	0.431	-0.192	0.450
<b>Acceptability = Cluster 3 (Situational Risks takers)</b>	-	0.203	-	0.429	-0.557	0.237
	0.1600		0.790			
<b>Acceptability = Cluster 4 (High risk takers)</b>	-	0.387	-	0.982	-0.768	0.751
	0.0088		0.023			
<b>Cluster = Safe Drivers (ref.)</b>	-	-	-	-	-	-
<b>Cluster = High-Risk Drivers</b>	1.6329	0.472	3.460	0.001	0.708	2.558
<b>Cluster = Tech-Distracted Speeders</b>	1.1247	0.246	4.570	0.000	0.642	1.607
<b>Cluster = Screen-Distracted Drivers</b>	0.6173	0.228	2.710	0.007	0.171	1.064
<b>Cluster = Chatty Speeders</b>	0.5403	0.199	2.716	0.007	0.150	0.930
<b>Cluster = Texting Drivers</b>	1.1048	0.272	4.064	0.000	0.572	1.638

## Appendix C2 Logit near-misses 2020

Table 57 reports the estimated coefficients from a binary logistic regression where the dependent variable is near-misses (0/1) in 2020, using the same full set of covariates and reference categories as in the 2019 model. Predictors again include behavioural cluster membership (reference: Safe Drivers), exposure and mobility variables for 2020, socio-demographics (age, gender, driving experience, community size), substance use, and attitudinal covariates (risk-taking personality, acceptability, and liberty).

Table 57 Logit near-miss model outcome in 2020 (with all predictors)

Variable	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>const</b>	-2.5429	0.436	-	0.000	-3.397	-1.689
			5.837			
<b>Gender = Female (ref.)</b>	-	-	-	-	-	-
<b>Gender = Male</b>	0.1641	0.168	0.976	0.329	-0.165	0.494
<b>Age Group = 65 years and older (ref.)</b>	-	-	-	-	-	-
<b>Age Group = 22-24 years</b>	0.1159	0.532	0.218	0.827	-0.926	1.158
<b>Age Group = 25-34 years</b>	0.2462	0.336	0.734	0.463	-0.412	0.904
<b>Age Group = 35-44 years</b>	-0.2732	0.321	-	0.395	-0.902	0.356
			0.851			
<b>Age Group = 45-54 years</b>	-0.1269	0.317	-	0.688	-0.747	0.493
			0.401			
<b>Age Group = 55-64 years</b>	-0.1316	0.285	-	0.644	-0.689	0.426
			0.462			
<b>Household Income = \$50-75k (ref.)</b>	-	-	-	-	-	-
<b>Household Income = &lt; \$25k</b>	0.3892	0.319	1.220	0.222	-0.236	1.014
<b>Household Income = \$25-49k</b>	-0.2249	0.268	-	0.401	-0.750	0.300
			0.840			
<b>Household Income = \$75-99k</b>	-0.4044	0.256	-	0.114	-0.905	0.097
			1.582			
<b>Household Income = \$100-125k</b>	-0.1317	0.253	-	0.603	-0.627	0.364
			0.520			
<b>Household Income = ≥ \$126k</b>	-0.4034	0.246	-	0.100	-0.885	0.078
			1.643			
<b>Education Level = Bachelor (ref.)</b>	-	-	-	-	-	-
<b>Education Level = ≤ High-School / Voc.</b>	0.1746	0.224	0.779	0.436	-0.265	0.614
<b>Education Level = CÉGEP / College</b>	0.2185	0.201	1.088	0.277	-0.175	0.612
<b>Education Level = Master+</b>	0.1712	0.245	0.698	0.485	-0.310	0.652
<b>Region = Montréal (ref.)</b>	-	-	-	-	-	-
<b>Region = Montérégie</b>	-0.4381	0.315	-	0.165	-1.056	0.180
			1.389			
<b>Region = Capitale-Nationale</b>	0.0128	0.271	0.047	0.962	-0.519	0.545

Table 57 Logit near-miss model outcome in 2020 (with all predictors) (continued)

Variable	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Region = Laval</b>	-0.2941	0.296	-	0.321	-0.874	0.286
			0.993			
<b>Region = Laurentides</b>	0.1535	0.357	0.431	0.667	-0.545	0.852
<b>Region = Other</b>	-0.1875	0.233	-	0.420	-0.643	0.268
			0.806			
<b>Region = Remote North</b>	-1.0629	1.072	-	0.321	-3.164	1.038
			0.992			
<b>Community Size = 0 (ref.)</b>	-	-	-	-	-	-
<b>Community Size = 1</b>	-0.1754	0.276	-	0.525	-0.716	0.366
			0.635			
<b>Community Size = 2</b>	-0.0630	0.222	-	0.776	-0.498	0.372
			0.284			
<b>Driving Experience = More than 10 years (ref.)</b>	-	-	-	-	-	-
<b>Driving Experience = ≤ 5 years</b>	0.0800	0.416	0.192	0.847	-0.735	0.895
<b>Driving Experience = 6-10 years</b>	-0.1151	0.302	-	0.703	-0.707	0.477
			0.381			
<b>Clean Driving Record = Yes (ref.)</b>	-	-	-	-	-	-
<b>Clean Driving Record = No</b>	0.1492	0.236	0.632	0.527	-0.313	0.612
<b>Clean Driving Record = Other</b>			0.375	-	0.921	-0.772
		0.0372	0.099			0.697
<b>Professional Driver = No (ref.)</b>	-	-	-	-	-	-
<b>Professional Driver = Yes</b>			0.219	-	0.912	-0.453
		0.0242	0.111			0.405
<b>Employment Status (2020) = Full-time worker (ref.)</b>	-	-	-	-	-	-
<b>Employment Status (2020) = Part-time / Self-emp.</b>	0.0085	0.238	0.036	0.971	-0.459	0.476
<b>Employment Status (2020) = Student</b>	0.1563	0.337	0.464	0.643	-0.504	0.817
<b>Employment Status (2020) = Not in labour force</b>			0.277	-	0.006	-1.311
		0.7670	2.765			0.223
<b>Employment Status (2020) = Other</b>	0.8296	0.578	1.435	0.151	-0.303	1.963
<b>Cannabis Consumption (2020) = No Cannabis Use (ref.)</b>	-	-	-	-	-	-
<b>Cannabis Consumption (2020) = Occasional</b>	0.4112	0.303	1.355	0.175	-0.184	1.006
<b>Cannabis Consumption (2020) = Frequent</b>			0.287	-	0.796	-0.636
		0.0742	0.259			0.488
<b>Alcohol Consumption (2020) = No Alcohol Use (ref.)</b>	-	-	-	-	-	-
<b>Alcohol Consumption (2020) = Occasional</b>	0.1147	0.194	0.590	0.555	-0.266	0.496
<b>Alcohol Consumption (2020) = Frequent</b>	0.3528	0.205	1.719	0.086	-0.050	0.755
<b>Vehicle Type (2020) = Sedan/Small Car (ref.)</b>	-	-	-	-	-	-
<b>Vehicle Type (2020) = SUV/Crossover</b>	0.2314	0.169	1.366	0.172	-0.101	0.564
<b>Vehicle Type (2020) = Minivan/Truck</b>			0.362	-	0.691	-0.853
		0.1439	0.398			0.565
<b>Vehicle Type (2020) = No Driving</b>			0.658	-	0.008	-3.045
		1.7547	2.666			0.465
<b>Driving Frequency (2020) = Frequent (ref.)</b>	-	-	-	-	-	-
<b>Driving Frequency (2020) = Occasional</b>	0.0433	0.194	0.223	0.824	-0.337	0.424
<b>Driving Frequency (2020) = Rare/Never</b>	0.8023	0.486	1.650	0.099	-0.151	1.755
<b>Car Access (2020) = High Access (ref.)</b>	-	-	-	-	-	-
<b>Car Access (2020) = Low Access</b>	0.4273	0.420	1.019	0.308	-0.395	1.250

Table 57 Logit near-miss model outcome in 2020 (with all predictors) (continued)

Variable	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Walking Time (2020) = Walk &lt;=29m (ref.)</b>	-	-	-	-	-	-
<b>Walking Time (2020) = Walk &gt;=30m</b>	0.0670	0.167	0.401	0.689	-0.261	0.395
<b>Walking Time (2020) = No Walking</b>	-	0.268	-	0.760	-0.608	0.444
	0.0820		0.305			
<b>Biking Time (2020) = No Biking (ref.)</b>	-	-	-	-	-	-
<b>Biking Time (2020) = Bike &lt;=40m</b>	0.2092	0.227	0.922	0.356	-0.235	0.654
<b>Biking Time (2020) = Bike &gt;=45m</b>	0.2388	0.292	0.816	0.414	-0.334	0.812
<b>Bus Travel Time (2020) = No Bus (ref.)</b>	-	-	-	-	-	-
<b>Bus Travel Time (2020) = Bus &lt;=40m</b>	-	0.345	-	0.235	-1.086	0.267
	0.4096		1.187			
<b>Bus Travel Time (2020) = Bus &gt;=45m</b>	0.3677	0.389	0.945	0.345	-0.395	1.131
<b>Rail Travel Time (2020) = No Rail (ref.)</b>	-	-	-	-	-	-
<b>Rail Travel Time (2020) = Rail &lt;=40m</b>	0.7657	0.341	2.245	0.025	0.097	1.434
<b>Rail Travel Time (2020) = Rail &gt;=45m</b>	0.3326	0.480	0.693	0.489	-0.609	1.274
<b>Car Travel Time (2020) = Car &lt;=40m (ref.)</b>	-	-	-	-	-	-
<b>Car Travel Time (2020) = No Car Travel</b>	-	0.277	-	0.079	-1.027	0.057
	0.4852		1.754			
<b>Car Travel Time (2020) = Car &gt;=45m</b>	0.1091	0.180	0.606	0.544	-0.244	0.462
<b>Other Modes Travel Time (2020) = No Other Modes (ref.)</b>	-	-	-	-	-	-
<b>Other Modes Travel Time (2020) = Other Modes &lt;=40m</b>	0.3751	0.367	1.023	0.306	-0.344	1.094
<b>Other Modes Travel Time (2020) = Other Modes &gt;=45m</b>	-	0.512	-	0.551	-1.308	0.698
	0.3048		0.596			
<b>Local Trips Frequency (2020) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Local Trips Frequency (2020) = Medium Frequency</b>	-	0.180	-	0.467	-0.485	0.222
	0.1311		0.727			
<b>Local Trips Frequency (2020) = High Frequency</b>	-	0.238	-	0.626	-0.583	0.351
	0.1159		0.487			
<b>Non-Local Trips Frequency (2020) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Non-Local Trips Frequency (2020) = Medium Frequency</b>	-	0.193	-	0.736	-0.444	0.314
	0.0652		0.337			
<b>Non-Local Trips Frequency (2020) = High Frequency</b>	0.2168	0.256	0.848	0.397	-0.284	0.718
<b>Liberty = Cluster 2 (Libertarians) (ref.)</b>	-	-	-	-	-	-
<b>Liberty = Cluster 1 (Conservative)</b>	-	0.188	-	0.719	-0.436	0.301
	0.0677		0.360			
<b>Liberty = Cluster 3 (Liberal)</b>	-	0.191	-	0.690	-0.451	0.299
	0.0762		0.398			
<b>Risk-Taking Personality = Cluster 2 (Situational Risk Takers) (ref.)</b>	-	-	-	-	-	-
<b>Risk-Taking Personality = Cluster 1 (Risk Avoiders)</b>	-	0.183	-	0.497	-0.482	0.234
	0.1239		0.678			
<b>Risk-Taking Personality = Cluster 3 (Sensation Seekers)</b>	0.1529	0.241	0.635	0.525	-0.319	0.625
<b>Acceptability = Cluster 1 (Rule followers) (ref.)</b>	-	-	-	-	-	-

Table 57 Logit near-miss model outcome in 2020 (with all predictors) (continued)

Variable	coef	std err	z	P> z	CI 0.025	CI 0.975
Acceptability = Cluster 2 (Speeders)		0.2747	0.185	1.482	0.138	-0.089 0.638
Acceptability = Cluster 3 (Situational Risks takers)	-	0.0975	0.230	-	0.672	-0.548 0.353
Acceptability = Cluster 4 (High risk takers)	0.4544	0.381	1.191	0.234	-0.293	1.202
Cluster = Safe Drivers (ref.)	-	-	-	-	-	-
Cluster = High-Risk Drivers	1.1945	0.577	2.071	0.038	0.064	2.325
Cluster = Tech-Distracted Speeders	0.9986	0.287	3.482	0.000	0.436	1.561
Cluster = Screen-Distracted Drivers	0.7628	0.253	3.009	0.003	0.266	1.260
Cluster = Chatty Speeders	0.7246	0.220	3.290	0.001	0.293	1.156
Cluster = Texting Drivers	1.1096	0.302	3.678	0.000	0.518	1.701

### Appendix C3 Logit near-misses 2023

Table 58 reports the estimated coefficients from a binary logistic regression where the dependent variable is near-misses (0/1) in 2023, using the same full set of covariates and reference categories as in the 2019 model. Predictors again include behavioural cluster membership (reference: Safe Drivers), exposure and mobility variables for 2023, socio-demographics (age, gender, driving experience, community size), substance use, and attitudinal covariates (risk-taking personality, acceptability, and liberty).

Table 58 Logit near-miss model outcome in 2023 (with all predictors)

Variable	coef	std err	z	P> z	CI 0.025	CI 0.975
const	-	0.371	-	0.000	-2.788	-1.333
	<b>2.0602</b>		5.550			
Gender = Female (ref.)	-	-	-	-	-	-
Gender = Male	-	0.128	-	0.350	-0.370	0.131
	0.1195		0.934			
Age Group = 65 years and older (ref.)	-	-	-	-	-	-
Age Group = 22-24 years	0.8379	0.416	2.012	0.044	0.022	1.654
Age Group = 25-34 years	0.3490	0.279	1.250	0.211	-0.198	0.896
Age Group = 35-44 years	0.1797	0.266	0.675	0.499	-0.342	0.701
Age Group = 45-54 years	-	0.266	-	0.494	-0.703	0.339
	0.1819		0.684			
Age Group = 55-64 years	-	0.210	-	0.571	-0.531	0.293
	0.1190		0.566			
Household Income = \$50-75k (ref.)	-	-	-	-	-	-
Household Income = < \$25k	0.1684	0.275	0.613	0.540	-0.370	0.707
Household Income = \$25-49k	-	0.209	-	0.686	-0.495	0.326
	0.0847		0.404			

Table 58 Logit near-miss model outcome in 2023 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Household Income = \$75-99k</b>	-	0.202	-	0.282	-0.612	0.179
	0.2167		1.075			
<b>Household Income = \$100-125k</b>	-	0.208	-	0.281	-0.633	0.184
	0.2244		1.077			
<b>Household Income = ≥ \$126k</b>	0.0202	0.191	0.106	0.916	-0.354	0.394
<b>Education Level = Bachelor (ref.)</b>	-	-	-	-	-	-
<b>Region = Montérégie</b>	-	0.241	-	0.350	-0.698	0.247
	0.2253		0.934			
<b>Region = Capitale-Nationale</b>	-	0.226	-	0.483	-0.600	0.284
	0.1583		0.702			
<b>Region = Laval</b>	-	0.225	-	0.719	-0.522	0.360
	0.0809		0.359			
<b>Region = Laurentides</b>	-	0.304	-	0.568	-0.768	0.422
	0.1732		0.571			
<b>Region = Other</b>	-	0.184	-	0.417	-0.509	0.211
	0.1489		0.811			
<b>Region = Remote North</b>	0.1134	0.567	0.200	0.841	-0.997	1.224
<b>Community Size = 0 (ref.)</b>	-	-	-	-	-	-
<b>Community Size = 1</b>	-	0.215	-	0.531	-0.555	0.286
	0.1344		0.626			
<b>Community Size = 2</b>	-	0.174	-	0.616	-0.429	0.254
	0.0874		0.501			
<b>Driving Experience = More than 10 years (ref.)</b>	-	-	-	-	-	-
<b>Driving Experience = ≤ 5 years</b>	-	0.316	-	0.902	-0.659	0.581
	0.0390		0.123			
<b>Driving Experience = 6-10 years</b>	-	0.251	-	0.111	-0.891	0.091
	0.3999		1.596			
<b>Clean Driving Record = Yes (ref.)</b>	-	-	-	-	-	-
<b>Clean Driving Record = No</b>	0.0336	0.195	0.173	0.863	-0.348	0.415
<b>Clean Driving Record = Other</b>	-	0.290	-	0.793	-0.645	0.493
	0.0761		0.262			
<b>Professional Driver = No (ref.)</b>	-	-	-	-	-	-
<b>Professional Driver = Yes</b>	-	0.188	-	0.118	-0.661	0.074
	0.2936		1.564			
<b>Employment Status (2023) = Full-time worker (ref.)</b>	-	-	-	-	-	-
<b>Employment Status (2023) = Part-time / Self-emp.</b>	0.1366	0.208	0.657	0.511	-0.271	0.544
<b>Employment Status (2023) = Student</b>	-	0.370	-	0.423	-1.023	0.429
	0.2968		0.801			
<b>Employment Status (2023) = Not in labour force</b>	-	0.218	-	0.786	-0.487	0.369
	0.0592		0.271			
<b>Cannabis Consumption (2023) = No Cannabis Use (ref.)</b>	-	-	-	-	-	-
<b>Cannabis Consumption (2023) = Occasional</b>	-	0.312	-	0.427	-0.860	0.364
	0.2480		0.794			
<b>Cannabis Consumption (2023) = Frequent</b>	-	0.268	-	0.214	-0.859	0.193
	0.3334		1.242			
<b>Alcohol Consumption (2023) = No Alcohol Use (ref.)</b>	-	-	-	-	-	-
<b>Alcohol Consumption (2023) = Occasional</b>	0.0292	0.145	0.201	0.841	-0.255	0.314
<b>Alcohol Consumption (2023) = Frequent</b>	0.2569	0.165	1.557	0.120	-0.067	0.580

Table 58 Logit near-miss model outcome in 2023 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Vehicle Type (2023) = Sedan/Small Car (ref.)</b>	-	-	-	-	-	-
<b>Vehicle Type (2023) = SUV/Crossover</b>	-	0.133	-	0.869	-0.283	0.239
	0.0219		0.164			
<b>Vehicle Type (2023) = Minivan/Truck</b>	-	0.293	-	0.431	-0.805	0.343
	0.2306		0.787			
<b>Vehicle Type (2023) = No Driving</b>	-	0.501	-	0.070	-1.888	0.074
	0.9069		1.812			
<b>Driving Frequency (2023) = Frequent (ref.)</b>	-	-	-	-	-	-
<b>Driving Frequency (2023) = Occasional</b>	0.0120	0.158	0.076	0.939	-0.298	0.323
<b>Driving Frequency (2023) = Rare/Never</b>	0.3352	0.429	0.781	0.435	-0.506	1.176
<b>Car Access (2023) = High Access (ref.)</b>	-	-	-	-	-	-
<b>Car Access (2023) = Low Access</b>	0.4589	0.350	1.313	0.189	-0.226	1.144
<b>Walking Time (2023) = Short Walk (ref.)</b>	-	-	-	-	-	-
<b>Walking Time (2023) = Walk &gt;=30m</b>	-	0.130	-	0.797	-0.289	0.222
	0.0335		0.257			
<b>Walking Time (2023) = No Walking</b>	-	0.229	-	0.558	-0.584	0.315
	0.1343		0.585			
<b>Biking Time (2023) = No Biking (ref.)</b>	-	-	-	-	-	-
<b>Biking Time (2023) = Bike &lt;=40m</b>	0.3378	0.173	1.953	0.051	-0.001	0.677
<b>Biking Time (2023) = Bike &gt;=45m</b>	-	0.309	-	0.010	-1.400	-0.189
	0.7946		2.571			
<b>Bus Travel Time (2023) = No Bus (ref.)</b>	-	-	-	-	-	-
<b>Bus Travel Time (2023) = Bus &lt;=40m</b>	-	0.218	-	0.338	-0.636	0.218
	0.2089		0.958			
<b>Bus Travel Time (2023) = Bus &gt;=45m</b>	0.4158	0.249	1.672	0.095	-0.072	0.903
<b>Rail Travel Time (2023) = No Rail (ref.)</b>	-	-	-	-	-	-
<b>Rail Travel Time (2023) = Rail &lt;=40m</b>	0.2670	0.235	1.136	0.256	-0.194	0.728
<b>Rail Travel Time (2023) = Rail &gt;=45m</b>	-	0.305	-	0.619	-0.749	0.446
	0.1516		0.497			
<b>Car Travel Time (2023) = Short Car Travel (ref.)</b>	-	-	-	-	-	-
<b>Car Travel Time (2023) = No Car Travel</b>	-	0.254	-	0.550	-0.648	0.345
	0.1515		0.598			
<b>Car Travel Time (2023) = Car &gt;=45m</b>	0.1209	0.133	0.907	0.364	-0.140	0.382
<b>Other Modes Travel Time (2023) = No Other Modes (ref.)</b>	-	-	-	-	-	-
<b>Other Modes Travel Time (2023) = Other Modes &lt;=40m</b>	-	0.296	-	0.239	-0.928	0.232
	0.3481		1.177			
<b>Other Modes Travel Time (2023) = Other Modes &gt;=45m</b>	0.2884	0.363	0.795	0.426	-0.422	0.999
<b>Local Trips Frequency (2023) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Local Trips Frequency (2023) = Medium Frequency</b>	0.0309	0.141	0.218	0.827	-0.246	0.308
<b>Local Trips Frequency (2023) = High Frequency</b>	0.0906	0.175	0.518	0.605	-0.253	0.434
<b>Non-Local Trips Frequency (2023) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Non-Local Trips Frequency (2023) = Medium Frequency</b>	-	0.142	-	0.922	-0.293	0.265
	0.0139		0.098			
<b>Non-Local Trips Frequency (2023) = High Frequency</b>	0.1819	0.185	0.982	0.326	-0.181	0.545

Table 58 Logit near-miss model outcome in 2023 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
Using Navigation App = Frequent (ref.)	-	-	-	-	-	-
Using Navigation App = Occasional	- 0.2157	0.239	- 0.904	0.366	-0.683	0.252
Using Navigation App = Rare/Never	- 0.1019	0.174	- 0.584	0.559	-0.444	0.240
Liberty = Cluster 2 (Libertarians) (ref.)	-	-	-	-	-	-
Liberty = Cluster 1 (Conservative)	0.1937	0.149	1.299	0.194	-0.098	0.486
Liberty = Cluster 3 (Liberal)	0.3278	0.151	2.178	0.029	0.033	0.623
Risk-Taking Personality = Cluster 2 (Situational Risk Takers) (ref.)	-	-	-	-	-	-
Risk-Taking Personality = Cluster 1 (Risk Avoiders)	0.1352	0.140	0.968	0.333	-0.138	0.409
Risk-Taking Personality = Cluster 3 (Sensation Seekers)	0.4798	0.200	2.401	0.016	0.088	0.871
Acceptability = Cluster 1 (Rule followers) (ref.)	-	-	-	-	-	-
Acceptability = Cluster 2 (Speeders)	0.0154	0.147	0.105	0.916	-0.272	0.303
Acceptability = Cluster 3 (Situational Risks takers)	- 0.3117	0.184	- 1.690	0.091	-0.673	0.050
Acceptability = Cluster 4 (High risk takers)	- 0.3841	0.367	- 1.046	0.296	-1.104	0.336
Cluster = Safe Drivers (ref.)	-	-	-	-	-	-
Cluster = High-Risk Drivers	<b>1.7834</b>	0.519	3.436	0.001	0.766	2.801
Cluster = Tech-Distracted Speeders	<b>1.1021</b>	0.240	4.584	0.000	0.631	1.573
Cluster = Screen-Distracted Drivers	<b>1.0457</b>	0.202	5.168	0.000	0.649	1.442
Cluster = Chatty Speeders	<b>0.8640</b>	0.184	4.692	0.000	0.503	1.225
Cluster = Texting Drivers	<b>1.0879</b>	0.264	4.120	0.000	0.570	1.605

## Appendix C4 Logit crash 2019

Binary logistic regression results are shown for crash involvement (2019, 2020 and 2023), full covariate model results shown in Table 59 to Table 61 .

Table 59 reports the estimated coefficients (and associated statistical tests) from a binary logistic regression where the dependent variable is crash (0/1) in 2019. Predictors include behavioural cluster membership (reference: Safe Drivers), exposure (weekly driving frequency), age, gender, driving experience, community size, mobility variables, substance use, and attitudinal covariates (risk-taking personality, acceptability of risky driving, and liberty orientation).

Table 59 Logit crash model outcome in 2019 (with all predictors)

Variable	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>const</b>	- <b>3.6922</b>	0.733	- 5.034	0.000	-5.130	-2.255
<b>Gender = Female (ref.)</b>	-	-	-	-	-	-
<b>Gender = Male</b>	- 0.1519	0.207	- 0.734	0.463	-0.558	0.254
<b>Age Group = 65 years and older (ref.)</b>	-	-	-	-	-	-
<b>Age Group = 22-24 years</b>	0.8096	0.654	1.237	0.216	-0.473	2.092
<b>Age Group = 25-34 years</b>	0.1509	0.448	0.337	0.736	-0.727	1.028
<b>Age Group = 35-44 years</b>	0.1413	0.408	0.346	0.729	-0.659	0.941
<b>Age Group = 45-54 years</b>	- 0.0902	0.417	- 0.216	0.829	-0.907	0.727
<b>Age Group = 55-64 years</b>	- 0.1933	0.383	- 0.504	0.614	-0.945	0.558
<b>Household Income = \$50-75k (ref.)</b>	-	-	-	-	-	-
<b>Household Income = &lt; \$25k</b>	- 0.0387	0.469	- 0.082	0.934	-0.957	0.880
<b>Household Income = \$25-49k</b>	- 0.1407	0.351	- 0.401	0.689	-0.829	0.548
<b>Household Income = \$75-99k</b>	0.0614	0.316	0.194	0.846	-0.559	0.682
<b>Household Income = \$100-125k</b>	0.0772	0.326	0.236	0.813	-0.563	0.717
<b>Household Income = ≥ \$126k</b>	0.1143	0.307	0.372	0.710	-0.487	0.716
<b>Education Level = Bachelor (ref.)</b>	-	-	-	-	-	-
<b>Education Level = ≤ High-School / Voc.</b>	- 0.0615	0.304	- 0.202	0.840	-0.656	0.534
<b>Education Level = CÉGEP / College</b>	0.4181	0.252	1.658	0.097	-0.076	0.912
<b>Education Level = Master+</b>	0.2359	0.297	0.795	0.427	-0.346	0.818
<b>Region = Montréal (ref.)</b>	-	-	-	-	-	-
<b>Region = Montérégie</b>	- <i>0.8400</i>	0.417	- 2.015	0.044	-1.657	-0.023
<b>Region = Capitale-Nationale</b>	- 0.4213	0.373	- 1.131	0.258	-1.152	0.309
<b>Region = Laval</b>	- 0.2107	0.353	- 0.597	0.550	-0.902	0.481

Table 59 Logit crash model outcome in 2019 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Region = Laurentides</b>	-	0.608	-	0.038	-2.451	-0.067
	1.2592		2.071			
<b>Region = Other</b>	-	0.287	-	0.364	-0.823	0.302
	0.2602		0.907			
<b>Region = Remote North</b>	-	0.847	-	0.929	-1.735	1.584
	0.0753		0.089			
<b>Community Size = 0 (ref.)</b>	-	-	-	-	-	-
<b>Community Size = 1</b>	-	0.355	-	0.587	-0.889	0.503
	0.1930		0.544			
<b>Community Size = 2</b>	0.0628	0.279	0.225	0.822	-0.483	0.609
<b>Driving Experience = More than 10 years (ref.)</b>	-	-	-	-	-	-
<b>Driving Experience = ≤ 5 years</b>	0.2684	0.511	0.525	0.599	-0.733	1.270
<b>Driving Experience = 6-10 years</b>	0.1789	0.376	0.476	0.634	-0.558	0.916
<b>Clean Driving Record = Yes (ref.)</b>	-	-	-	-	-	-
<b>Clean Driving Record = No</b>	0.6605	0.278	2.377	0.017	0.116	1.205
<b>Clean Driving Record = Other</b>	0.3379	0.441	0.767	0.443	-0.526	1.201
<b>Professional Driver = No (ref.)</b>	-	-	-	-	-	-
<b>Professional Driver = Yes</b>	0.0252	0.278	0.090	0.928	-0.520	0.571
<b>Employment Status (2019) = Full-time worker (ref.)</b>	-	-	-	-	-	-
<b>Employment Status (2019) = Part-time / Self-emp.</b>	-	0.335	-	0.706	-0.783	0.531
	0.1263		0.377			
<b>Employment Status (2019) = Student</b>	-	0.434	-	0.281	-1.317	0.382
	0.4675		1.078			
<b>Employment Status (2019) = Not in labour force</b>	-	0.353	-	0.836	-0.765	0.619
	0.0733		0.208			
<b>Cannabis Consumption (2019) = No Cannabis Use (ref.)</b>	-	-	-	-	-	-
<b>Cannabis Consumption (2019) = Occasional</b>	0.0450	0.434	0.104	0.917	-0.806	0.896
<b>Cannabis Consumption (2019) = Frequent</b>	0.2745	0.368	0.746	0.455	-0.446	0.995
<b>Alcohol Consumption (2019) = No Alcohol Use (ref.)</b>	-	-	-	-	-	-
<b>Alcohol Consumption (2019) = Occasional</b>	0.3229	0.237	1.360	0.174	-0.143	0.788
<b>Alcohol Consumption (2019) = Frequent</b>	0.1905	0.286	0.665	0.506	-0.371	0.752
<b>Vehicle Type (2019) = Sedan/Small Car (ref.)</b>	-	-	-	-	-	-
<b>Vehicle Type (2019) = SUV/Crossover</b>	0.3483	0.221	1.574	0.115	-0.085	0.782
<b>Vehicle Type (2019) = Minivan/Truck</b>	0.2715	0.426	0.638	0.524	-0.563	1.106
<b>Vehicle Type (2019) = No Driving</b>	-	0.784	-	0.700	-1.838	1.234
	0.3017		0.385			
<b>Driving Frequency (2019) = Frequent (ref.)</b>	-	-	-	-	-	-
<b>Driving Frequency (2019) = Occasional</b>	0.1333	0.273	0.488	0.625	-0.402	0.668
<b>Driving Frequency (2019) = Rare/Never</b>	-	0.641	-	0.909	-1.329	1.183
	0.0732		0.114			
<b>Car Access (2019) = High Access (ref.)</b>	-	-	-	-	-	-
<b>Car Access (2019) = Low Access</b>	0.7890	0.518	1.523	0.128	-0.226	1.804
<b>Walking Time (2019) = Walk ≤29m (ref.)</b>	-	-	-	-	-	-
<b>Walking Time (2019) = Walk ≥30m</b>	0.2493	0.209	1.194	0.233	-0.160	0.659
<b>Walking Time (2019) = No Walking</b>	-	0.381	-	0.690	-0.898	0.594
	0.1517		0.398			
<b>Biking Time (2019) = Ref (not categorical) (ref.)</b>	-	-	-	-	-	-

Table 59 Logit crash model outcome in 2019 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Biking Time (2019) = About 1.5 hours-2 hours</b>	- 0.5501	0.884	- 0.622	0.534	-2.283	1.183
<b>Biking Time (2019) = About 2-3 hours</b>	0.0895	0.737	0.121	0.903	-1.355	1.535
<b>Biking Time (2019) = About 20 minutes</b>	- 0.8068	0.546	- 1.478	0.139	-1.876	0.263
<b>Biking Time (2019) = About 30-40 minutes</b>	0.0916	0.531	0.172	0.863	-0.950	1.133
<b>Biking Time (2019) = About 45-60 minutes</b>	- 0.4960	0.586	- 0.847	0.397	-1.644	0.652
<b>Biking Time (2019) = More than 3 hours</b>	- 0.3571	0.788	- 0.453	0.651	-1.902	1.188
<b>Biking Time (2019) = No time</b>	- 0.3125	0.472	- 0.662	0.508	-1.237	0.612
<b>Bus Travel Time (2019) = No Bus (ref.)</b>	-	-	-	-	-	-
<b>Bus Travel Time (2019) = Bus &lt;=40m</b>	0.8059	0.325	2.479	0.013	0.169	1.443
<b>Bus Travel Time (2019) = Bus &gt;=45m</b>	0.2535	0.382	0.663	0.507	-0.495	1.002
<b>Rail Travel Time (2019) = No Rail (ref.)</b>	-	-	-	-	-	-
<b>Rail Travel Time (2019) = Rail &lt;=40m</b>	- 0.4221	0.385	- 1.095	0.273	-1.178	0.333
<b>Rail Travel Time (2019) = Rail &gt;=45m</b>	- 0.2282	0.444	- 0.514	0.607	-1.098	0.641
<b>Car Travel Time (2019) = Car &lt;=40m (ref.)</b>	-	-	-	-	-	-
<b>Car Travel Time (2019) = No Car Travel</b>	- 0.9584	0.498	- 1.924	0.054	-1.935	0.018
<b>Car Travel Time (2019) = Car &gt;=45m</b>	0.4578	0.217	2.108	0.035	0.032	0.883
<b>Other Modes Travel Time (2019) = No Other Modes (ref.)</b>	-	-	-	-	-	-
<b>Other Modes Travel Time (2019) = Other Modes &lt;=40m</b>	0.1586	0.465	0.341	0.733	-0.752	1.070
<b>Other Modes Travel Time (2019) = Other Modes &gt;=45m</b>	0.0712	0.590	0.121	0.904	-1.086	1.228
<b>Local Trips Frequency (2019) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Local Trips Frequency (2019) = Medium Frequency</b>	- 0.2815	0.232	- 1.213	0.225	-0.736	0.173
<b>Local Trips Frequency (2019) = High Frequency</b>	- 0.3618	0.293	- 1.233	0.218	-0.937	0.213
<b>Non-Local Trips Frequency (2019) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Non-Local Trips Frequency (2019) = Medium Frequency</b>	0.0552	0.240	0.231	0.818	-0.414	0.525
<b>Non-Local Trips Frequency (2019) = High Frequency</b>	0.3763	0.291	1.294	0.196	-0.194	0.946
<b>Liberty = Cluster 2 (Libertarians) (ref.)</b>	-	-	-	-	-	-
<b>Liberty = Cluster 1 (Conservative)</b>	0.1904	0.242	0.785	0.432	-0.285	0.666
<b>Liberty = Cluster 3 (Liberal)</b>	0.3579	0.237	1.509	0.131	-0.107	0.823
<b>Risk-Taking Personality = Cluster 2 (Situational Risk Takers) (ref.)</b>	-	-	-	-	-	-
<b>Risk-Taking Personality = Cluster 1 (Risk Avoiders)</b>	0.2459	0.227	1.084	0.278	-0.199	0.691

Table 59 Logit crash model outcome in 2019 (with all predictors) (continued)

<b>Variable (continued)</b>	<b>coef</b>	<b>std err</b>	<b>z</b>	<b>P&gt; z </b>	<b>CI</b> 0.025	<b>CI</b> 0.975
<b>Risk-Taking Personality = Cluster 3 (Sensation Seekers)</b>	0.1467	0.320	0.459	0.647	-0.480	0.774
<b>Acceptability = Cluster 1 (Rule-Followers) (ref.)</b>	-	-	-	-	-	-
<b>Acceptability = Cluster 2 (Speeders)</b>	0.3405	0.243	1.399	0.162	-0.136	0.817
<b>Acceptability = Cluster 3 (Situational Risks takers)</b>	0.1662	0.283	0.587	0.557	-0.389	0.721
<b>Acceptability = Cluster 4 (High risk takers)</b>	<b>1.3493</b>	0.434	3.108	0.002	0.498	2.200
<b>Cluster = Safe Drivers (ref.)</b>	-	-	-	-	-	-
<b>Cluster = High-Risk Drivers</b>	1.2363	0.574	2.153	0.031	0.111	2.362
<b>Cluster = Tech-Distracted Speeders</b>	0.5903	0.365	1.617	0.106	-0.125	1.306
<b>Cluster = Screen-Distracted Drivers</b>	0.3242	0.336	0.966	0.334	-0.334	0.982
<b>Cluster = Chatty Speeders</b>	0.5067	0.286	1.770	0.077	-0.054	1.068
<b>Cluster = Texting Drivers</b>	0.8479	0.372	2.277	0.023	0.118	1.578

## Appendix C5 Logit crash 2020

Table 60 presents the corresponding full-model binary logistic regression results for crash involvement in 2020 (0/1), using the same set of predictors and the same reference categories as the 2019 model. Coefficients should therefore be interpreted as changes in the log-odds of reporting a crash in 2020 relative to the reference groups, holding all other covariates constant.

Table 60 Logit crash model outcome in 2020 (with all predictors)

Variable	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>const</b>	- 3.4114	0.644	- 5.300	0.000	-4.673	-2.150
<b>Gender = Female (ref.)</b>	-	-	-	-	-	-
<b>Gender = Male</b>	0.1883	0.246	0.766	0.444	-0.294	0.670
<b>Age Group = 65 years and older (ref.)</b>	-	-	-	-	-	-
<b>Age Group = 22-24 years</b>	0.5934	0.751	0.790	0.429	-0.878	2.065
<b>Age Group = 25-34 years</b>	0.1570	0.498	0.315	0.753	-0.819	1.133
<b>Age Group = 35-44 years</b>	- 0.3368	0.482	- 0.699	0.485	-1.282	0.608
<b>Age Group = 45-54 years</b>	- 0.4146	0.485	- 0.856	0.392	-1.364	0.535
<b>Age Group = 55-64 years</b>	- 0.2758	0.427	- 0.646	0.519	-1.113	0.561
<b>Household Income = \$50-75k (ref.)</b>	-	-	-	-	-	-
<b>Household Income = &lt; \$25k</b>	0.2015	0.477	0.423	0.673	-0.733	1.136
<b>Household Income = \$25-49k</b>	- 0.4163	0.404	- 1.031	0.303	-1.208	0.375
<b>Household Income = \$75-99k</b>	- 0.3269	0.363	- 0.900	0.368	-1.039	0.385
<b>Household Income = \$100-125k</b>	0.0817	0.345	0.237	0.813	-0.594	0.757
<b>Household Income = ≥ \$126k</b>	- 0.6348	0.370	- 1.714	0.087	-1.361	0.091
<b>Education Level = Bachelor (ref.)</b>	-	-	-	-	-	-
<b>Education Level = ≤ High-School / Voc.</b>	- 0.1800	0.319	- 0.564	0.573	-0.805	0.445
<b>Education Level = CÉGEP / College</b>	- 0.1103	0.286	- 0.385	0.700	-0.671	0.450
<b>Education Level = Master+</b>	- 0.2970	0.374	- 0.794	0.427	-1.030	0.437
<b>Region = Montréal (ref.)</b>	-	-	-	-	-	-
<b>Region = Montérégie</b>	- 0.2507	0.452	- 0.555	0.579	-1.136	0.635
<b>Region = Capitale-Nationale</b>	- 0.7475	0.471	- 1.586	0.113	-1.671	0.176
<b>Region = Laval</b>	0.0055	0.397	0.014	0.989	-0.772	0.783
<b>Region = Laurentides</b>	- 0.3433	0.577	- 0.595	0.552	-1.473	0.787
<b>Region = Other</b>	- 0.1083	0.333	- 0.325	0.745	-0.761	0.545

Table 60 Logit crash model outcome in 2020 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Region = Remote North</b>	-	1.148	-	0.650	-2.772	1.729
	0.5215		0.454			
<b>Community Size = 0 (ref.)</b>	-	-	-	-	-	-
<b>Community Size = 1</b>	-	0.381	-	0.976	-0.758	0.735
	0.0114		0.030			
<b>Community Size = 2</b>	-	0.348	-	0.124	-1.219	0.147
	0.5358		1.538			
<b>Driving Experience = More than 10 years (ref.)</b>	-	-	-	-	-	-
<b>Driving Experience = ≤ 5 years</b>	-	0.630	-	0.742	-1.442	1.027
	0.2073		0.329			
<b>Driving Experience = 6-10 years</b>	0.0953	0.417	0.229	0.819	-0.721	0.912
<b>Clean Driving Record = Yes (ref.)</b>	-	-	-	-	-	-
<b>Clean Driving Record = No</b>	0.3372	0.333	1.011	0.312	-0.316	0.991
<b>Clean Driving Record = Other</b>	0.5066	0.457	1.109	0.267	-0.389	1.402
<b>Professional Driver = No (ref.)</b>	-	-	-	-	-	-
<b>Professional Driver = Yes</b>	-	0.340	-	0.221	-1.083	0.250
	0.4164		1.224			
<b>Employment Status (2020) = Full-time worker (ref.)</b>	-	-	-	-	-	-
<b>Employment Status (2020) = Part-time / Self-emp.</b>	-	0.357	-	0.706	-0.834	0.565
	0.1345		0.377			
<b>Employment Status (2020) = Student</b>	-	0.476	-	0.548	-1.220	0.647
	0.2861		0.601			
<b>Employment Status (2020) = Not in labour force</b>	-	0.404	-	0.239	-1.266	0.316
	0.4752		1.177			
<b>Employment Status (2020) = Other</b>	0.5356	0.880	0.608	0.543	-1.190	2.261
<b>Cannabis Consumption (2020) = No Cannabis Use (ref.)</b>	-	-	-	-	-	-
<b>Cannabis Consumption (2020) = Occasional</b>	0.0287	0.444	0.065	0.948	-0.842	0.900
<b>Cannabis Consumption (2020) = Frequent</b>	-	0.422	-	0.663	-1.010	0.643
	0.1838		0.436			
<b>Alcohol Consumption (2020) = No Alcohol Use (ref.)</b>	-	-	-	-	-	-
<b>Alcohol Consumption (2020) = Occasional</b>	0.4445	0.289	1.539	0.124	-0.122	1.011
<b>Alcohol Consumption (2020) = Frequent</b>	0.5059	0.311	1.625	0.104	-0.104	1.116
<b>Vehicle Type (2020) = Sedan/Small Car (ref.)</b>	-	-	-	-	-	-
<b>Vehicle Type (2020) = SUV/Crossover</b>	0.5544	0.247	2.248	0.025	0.071	1.038
<b>Vehicle Type (2020) = Minivan/Truck</b>	0.5273	0.462	1.140	0.254	-0.379	1.434
<b>Vehicle Type (2020) = No Driving</b>	-	1.004	-	0.107	-3.588	0.349
	1.6194		1.613			
<b>Driving Frequency (2020) = Frequent (ref.)</b>	-	-	-	-	-	-
<b>Driving Frequency (2020) = Occasional</b>	-	0.289	-	0.395	-0.812	0.321
	0.2457		0.850			
<b>Driving Frequency (2020) = Rare/Never</b>	-	0.783	-	0.344	-2.277	0.794
	0.7414		0.946			
<b>Car Access (2020) = High Access (ref.)</b>	-	-	-	-	-	-
<b>Car Access (2020) = Low Access</b>	1.2976	0.549	2.364	0.018	0.222	2.374
<b>Walking Time (2020) = Walk ≤29m (ref.)</b>	-	-	-	-	-	-
<b>Walking Time (2020) = Walk ≥30m</b>	-	0.243	-	0.763	-0.549	0.403
	0.0731		0.301			

Table 60 Logit crash model outcome in 2020 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Walking Time (2020) = No Walking</b>	-	0.405	-	0.659	-0.974	0.616
	0.1788		0.441			
<b>Biking Time (2020) = No Biking (ref.)</b>	-	-	-	-	-	-
<b>Biking Time (2020) = Bike &lt;=40m</b>	0.2525	0.318	0.793	0.428	-0.371	0.876
<b>Biking Time (2020) = Bike &gt;=45m</b>	-	0.461	-	0.929	-0.945	0.863
	0.0414		0.090			
<b>Bus Travel Time (2020) = No Bus (ref.)</b>	-	-	-	-	-	-
<b>Bus Travel Time (2020) = Bus &lt;=40m</b>	0.1948	0.472	0.413	0.680	-0.730	1.120
<b>Bus Travel Time (2020) = Bus &gt;=45m</b>	0.1185	0.577	0.205	0.837	-1.013	1.250
<b>Rail Travel Time (2020) = No Rail (ref.)</b>	-	-	-	-	-	-
<b>Rail Travel Time (2020) = Rail &lt;=40m</b>	-	0.621	-	0.143	-2.129	0.308
	0.9105		1.465			
<b>Rail Travel Time (2020) = Rail &gt;=45m</b>	-	0.701	-	0.965	-1.405	1.343
	0.0308		0.044			
<b>Car Travel Time (2020) = Car &lt;=40m (ref.)</b>	-	-	-	-	-	-
<b>Car Travel Time (2020) = No Car Travel</b>	-	0.407	-	0.407	-1.135	0.461
	0.3373		0.829			
<b>Car Travel Time (2020) = Car &gt;=45m</b>	0.1865	0.259	0.721	0.471	-0.320	0.693
<b>Other Modes Travel Time (2020) = No Other Modes (ref.)</b>	-	-	-	-	-	-
<b>Other Modes Travel Time (2020) = Other Modes &lt;=40m</b>	0.3644	0.512	0.711	0.477	-0.640	1.369
<b>Other Modes Travel Time (2020) = Other Modes &gt;=45m</b>	0.5703	0.597	0.955	0.339	-0.600	1.740
<b>Local Trips Frequency (2020) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Local Trips Frequency (2020) = Medium Frequency</b>	0.2019	0.261	0.772	0.440	-0.311	0.714
<b>Local Trips Frequency (2020) = High Frequency</b>	0.2603	0.340	0.765	0.444	-0.407	0.927
<b>Non-Local Trips Frequency (2020) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Non-Local Trips Frequency (2020) = Medium Frequency</b>	0.1515	0.268	0.566	0.571	-0.373	0.676
<b>Non-Local Trips Frequency (2020) = High Frequency</b>	0.0271	0.383	0.071	0.943	-0.723	0.777
<b>Liberty = Cluster 2 (Libertarians) (ref.)</b>	-	-	-	-	-	-
<b>Liberty = Cluster 1 (Conservative)</b>	-	0.290	-	0.898	-0.606	0.531
	0.0373		0.129			
<b>Liberty = Cluster 3 (Liberal)</b>	0.4700	0.264	1.783	0.075	-0.047	0.987
<b>Risk-Taking Personality = Cluster 2 (Situational Risk Takers) (ref.)</b>	-	-	-	-	-	-
<b>Risk-Taking Personality = Cluster 1 (Risk Avoiders)</b>	-	0.273	-	0.377	-0.777	0.294
	0.2415		0.884			
<b>Risk-Taking Personality = Cluster 3 (Sensation Seekers)</b>	-	0.355	-	0.853	-0.760	0.629
	0.0655		0.185			
<b>Acceptability = Cluster 1 (Rule followers) (ref.)</b>	-	-	-	-	-	-
<b>Acceptability = Cluster 2 (Speeders)</b>	0.3257	0.292	1.115	0.265	-0.247	0.898
<b>Acceptability = Cluster 3 (Situational Risks takers)</b>	0.8116	0.311	2.611	0.009	0.202	1.421
<b>Acceptability = Cluster 4 (High risk takers)</b>	1.4395	0.467	3.080	0.002	0.523	2.356
<b>Cluster = Safe Drivers (ref.)</b>	-	-	-	-	-	-

Table 60 Logit crash model outcome in 2020 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Cluster = High-Risk Drivers</b>	1.6535	0.640	2.585	0.010	0.400	2.907
<b>Cluster = Tech-Distracted Speeders</b>	-	0.487	-	0.673	-1.160	0.749
	0.2057		0.422			
<b>Cluster = Screen-Distracted Drivers</b>	0.2991	0.354	0.844	0.399	-0.395	0.994
<b>Cluster = Chatty Speeders</b>	0.2479	0.312	0.795	0.427	-0.363	0.859
<b>Cluster = Texting Drivers</b>	0.5763	0.410	1.407	0.160	-0.227	1.379

### Appendix C6 Logit crash 2023

Table 61 reports the full-model binary logistic regression results for crash involvement in 2023 (0/1), estimated with the same covariates and reference categories to allow direct comparison across periods. Differences in coefficient magnitude and statistical significance across years indicate which associations persisted, weakened, or emerged after the pandemic restrictions.

Table 61 Logit crash model outcome in 2023 (with all predictors)

Variable	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>const</b>	- 3.1876	0.586	- 5.442	0.000	-4.336	-2.040
<b>Gender = Female (ref.)</b>	-	-	-	-	-	-
<b>Gender = Male</b>	- 0.4184	0.206	- 2.033	0.042	-0.822	-0.015
<b>Age Group = 65 years and older (ref.)</b>	-	-	-	-	-	-
<b>Age Group = 22-24 years</b>	0.4059	0.663	0.612	0.541	-0.894	1.706
<b>Age Group = 25-34 years</b>	- 0.2319	0.438	- 0.530	0.596	-1.090	0.626
<b>Age Group = 35-44 years</b>	- 0.1702	0.412	- 0.413	0.680	-0.978	0.638
<b>Age Group = 45-54 years</b>	- 0.1928	0.409	- 0.472	0.637	-0.994	0.609
<b>Age Group = 55-64 years</b>	- 0.4154	0.348	- 1.194	0.233	-1.097	0.267
<b>Household Income = \$50-75k (ref.)</b>	-	-	-	-	-	-
<b>Household Income = &lt; \$25k</b>	0.7528	0.397	1.894	0.058	-0.026	1.532
<b>Household Income = \$25-49k</b>	0.0886	0.327	0.271	0.786	-0.552	0.729
<b>Household Income = \$75-99k</b>	- 0.1276	0.319	- 0.399	0.690	-0.754	0.499
<b>Household Income = \$100-125k</b>	- 0.2443	0.330	- 0.741	0.459	-0.890	0.402
<b>Household Income = ≥ \$126k</b>	- 0.1954	0.311	- 0.628	0.530	-0.806	0.415
<b>Education Level = Bachelor (ref.)</b>	-	-	-	-	-	-
<b>Education Level = ≤ High-School / Voc.</b>	0.2965	0.274	1.083	0.279	-0.240	0.833
<b>Education Level = CÉGEP / College</b>	0.0828	0.262	0.317	0.752	-0.430	0.596
<b>Education Level = Master+</b>	0.4171	0.290	1.437	0.151	-0.152	0.986
<b>Region = Montréal (ref.)</b>	-	-	-	-	-	-
<b>Region = Montérégie</b>	0.5022	0.344	1.459	0.145	-0.173	1.177
<b>Region = Capitale-Nationale</b>	- 0.1956	0.371	- 0.527	0.598	-0.923	0.532
<b>Region = Laval</b>	- 0.2659	0.381	- 0.697	0.486	-1.014	0.482
<b>Region = Laurentides</b>	- 0.4334	0.545	- 0.796	0.426	-1.501	0.634
<b>Region = Other</b>	- 0.0861	0.294	- 0.293	0.770	-0.662	0.490
<b>Region = Remote North</b>	1.1379	0.734	1.551	0.121	-0.300	2.576

Table 61 Logit crash model outcome in 2023 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Community Size = 0 (ref.)</b>	-	-	-	-	-	-
<b>Community Size = 1</b>	-	0.346	-	0.289	-1.046	0.311
	0.3671		1.060			
<b>Community Size = 2</b>	-	0.281	-	0.301	-0.842	0.260
	0.2910		1.035			
<b>Driving Experience = More than 10 years (ref.)</b>	-	-	-	-	-	-
<b>Driving Experience = ≤ 5 years</b>	-	0.510	-	0.272	-1.560	0.440
	0.5600		1.098			
<b>Driving Experience = 6-10 years</b>	-	0.412	-	0.096	-1.493	0.121
	0.6856		1.665			
<b>Clean Driving Record = Yes (ref.)</b>	-	-	-	-	-	-
<b>Clean Driving Record = No</b>	0.3471	0.291	1.194	0.232	-0.222	0.917
<b>Clean Driving Record = Other</b>	0.3699	0.427	0.865	0.387	-0.468	1.207
<b>Professional Driver = No (ref.)</b>	-	-	-	-	-	-
<b>Professional Driver = Yes</b>	0.2013	0.267	0.754	0.451	-0.322	0.724
<b>Employment Status (2023) = Full-time worker (ref.)</b>	-	-	-	-	-	-
<b>Employment Status (2023) = Part-time / Self-emp.</b>	-	0.325	-	0.687	-0.767	0.506
	0.1309		0.403			
<b>Employment Status (2023) = Student</b>	-	0.642	-	0.237	-2.017	0.498
	0.7592		1.183			
<b>Employment Status (2023) = Not in labour force</b>	-	0.351	-	0.209	-1.128	0.247
	0.4403		1.255			
<b>Cannabis Consumption (2023) = No Cannabis Use (ref.)</b>	-	-	-	-	-	-
<b>Cannabis Consumption (2023) = Occasional</b>	-	0.683	-	0.053	-2.662	0.017
	1.3222		1.935			
<b>Cannabis Consumption (2023) = Frequent</b>	0.3324	0.350	0.949	0.343	-0.354	1.019
<b>Alcohol Consumption (2023) = No Alcohol Use (ref.)</b>	-	-	-	-	-	-
<b>Alcohol Consumption (2023) = Occasional</b>	0.0237	0.229	0.103	0.918	-0.426	0.473
<b>Alcohol Consumption (2023) = Frequent</b>	0.2039	0.257	0.792	0.428	-0.301	0.708
<b>Vehicle Type (2023) = Sedan/Small Car (ref.)</b>	-	-	-	-	-	-
<b>Vehicle Type (2023) = SUV/Crossover</b>	0.2397	0.212	1.133	0.257	-0.175	0.654
<b>Vehicle Type (2023) = Minivan/Truck</b>	0.0747	0.451	0.166	0.868	-0.808	0.958
<b>Vehicle Type (2023) = No Driving</b>	-	0.744	-	0.422	-2.056	0.862
	0.5971		0.802			
<b>Driving Frequency (2023) = Occasional</b>	-	0.253	-	0.409	-0.706	0.287
	0.2093		0.826			
<b>Driving Frequency (2023) = Rare/Never</b>	0.9569	0.644	1.487	0.137	-0.305	2.219
<b>Car Access (2023) = High Access (ref.)</b>	-	-	-	-	-	-
<b>Car Access (2023) = Low Access</b>	0.2729	0.553	0.494	0.622	-0.811	1.356
<b>Walking Time (2023) = Short Walk (ref.)</b>	-	-	-	-	-	-
<b>Walking Time (2023) = Walk ≥30m</b>	0.1501	0.203	0.739	0.460	-0.248	0.548
<b>Walking Time (2023) = No Walking</b>	-	0.460	-	0.133	-1.593	0.211
	0.6911		1.502			
<b>Biking Time (2023) = No Biking (ref.)</b>	-	-	-	-	-	-
<b>Biking Time (2023) = Bike ≤40m</b>	0.5608	0.253	2.219	0.026	0.066	1.056
<b>Biking Time (2023) = Bike ≥45m</b>	0.1510	0.384	0.393	0.694	-0.602	0.904
<b>Bus Travel Time (2023) = No Bus (ref.)</b>	-	-	-	-	-	-
<b>Bus Travel Time (2023) = Bus ≤40m</b>	0.1061	0.333	0.319	0.750	-0.546	0.758

Table 61 Logit crash model outcome in 2023 (with all predictors) (continued)

Variable (continued)	coef	std err	z	P> z	CI 0.025	CI 0.975
<b>Bus Travel Time (2023) = Bus &gt;=45m</b>	0.7791	0.356	2.192	0.028	0.082	1.476
<b>Rail Travel Time (2023) = No Rail (ref.)</b>	-	-	-	-	-	-
<b>Rail Travel Time (2023) = Rail &lt;=40m</b>	0.1136	0.365	0.312	0.755	-0.601	0.828
<b>Rail Travel Time (2023) = Rail &gt;=45m</b>	0.0254	0.436	0.058	0.953	-0.830	0.881
<b>Car Travel Time (2023) = Short Car Travel (ref.)</b>	-	-	-	-	-	-
<b>Car Travel Time (2023) = No Car Travel</b>	-	0.456	-	0.152	-1.548	0.240
	0.6538		1.433			
<b>Car Travel Time (2023) = Car &gt;=45m</b>	0.2062	0.207	0.995	0.320	-0.200	0.612
<b>Other Modes Travel Time (2023) = No Other Modes (ref.)</b>	-	-	-	-	-	-
<b>Other Modes Travel Time (2023) = Other Modes &lt;=40m</b>	0.1978	0.394	0.502	0.615	-0.574	0.970
<b>Other Modes Travel Time (2023) = Other Modes &gt;=45m</b>	0.4849	0.483	1.004	0.315	-0.461	1.431
<b>Local Trips Frequency (2023) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Local Trips Frequency (2023) = Medium Frequency</b>	-	0.226	-	0.205	-0.730	0.156
	0.2866		1.268			
<b>Local Trips Frequency (2023) = High Frequency</b>	-	0.274	-	0.238	-0.862	0.214
	0.3239		1.181			
<b>Non-Local Trips Frequency (2023) = Low Frequency (ref.)</b>	-	-	-	-	-	-
<b>Non-Local Trips Frequency (2023) = Medium Frequency</b>	0.1784	0.225	0.792	0.428	-0.263	0.620
<b>Non-Local Trips Frequency (2023) = High Frequency</b>	0.1403	0.291	0.482	0.630	-0.431	0.711
<b>Using Navigation App = Frequent (ref.)</b>	-	-	-	-	-	-
<b>Using Navigation App = Occasional</b>	-	0.438	-	0.097	-1.583	0.132
	0.7256		1.658			
<b>Using Navigation App = Rare/Never</b>	-	0.307	-	0.117	-1.085	0.120
	0.4823		1.570			
<b>Liberty = Cluster 2 (Libertarians) (ref.)</b>	-	-	-	-	-	-
<b>Liberty = Cluster 1 (Conservative)</b>	0.2393	0.241	0.994	0.320	-0.232	0.711
<b>Liberty = Cluster 3 (Liberal)</b>	0.4441	0.235	1.888	0.059	-0.017	0.905
<b>Risk-Taking Personality = Cluster 2 (Situational Risk Takers) (ref.)</b>	-	-	-	-	-	-
<b>Risk-Taking Personality = Cluster 1 (Risk Avoiders)</b>	0.2865	0.221	1.294	0.196	-0.147	0.720
<b>Risk-Taking Personality = Cluster 3 (Sensation Seekers)</b>	0.3619	0.313	1.155	0.248	-0.252	0.976
<b>Acceptability = Cluster 1 (Rule followers) (ref.)</b>	-	-	-	-	-	-
<b>Acceptability = Cluster 2 (Speeders)</b>	0.0484	0.231	0.209	0.834	-0.405	0.502
<b>Acceptability = Cluster 3 (Situational Risks takers)</b>	-	0.305	-	0.108	-1.088	0.108
	0.4902		1.607			
<b>Acceptability = Cluster 4 (High risk takers)</b>	1.0261	0.450	2.279	0.023	0.144	1.909
<b>Cluster = Safe Drivers (ref.)</b>	-	-	-	-	-	-
<b>Cluster = High-Risk Drivers</b>	1.3033	0.687	1.897	0.058	-0.043	2.650
<b>Cluster = Tech-Distracted Speeders</b>	0.8677	0.392	2.211	0.027	0.098	1.637
<b>Cluster = Screen-Distracted Drivers</b>	1.0679	0.318	3.354	0.001	0.444	1.692

Table 61 Logit crash model outcome in 2023 (with all predictors) (continued)

<b>Variable (continued)</b>	<b>coef</b>	<b>std err</b>	<b>z</b>	<b>P&gt; z </b>	<b>CI 0.025</b>	<b>CI 0.975</b>
<b>Cluster = Chatty Speeders</b>	<i>0.7076</i>	0.303	2.339	0.019	0.115	1.301
<b>Cluster = Texting Drivers</b>	0.7852	0.422	1.862	0.063	-0.041	1.612

## APPENDIX D CHI SQUARE TESTS

### Appendix D1 Age-clean driving record

I report contingency tables and corresponding Pearson chi-square tests for the association between age group and clean driving record, and I provide Cramer's V as an effect size measure, for 2019, 2020, and 2023.

Table 62 presents the contingency table of age and clean driving record.

Table 62 Contingency table of age- clean driving record

*Contingency Tables*

Age		Clean Driving Record		Total
		No	Yes	
22-24 years	Count	17.00	82.00	99.00
	Expected count	14.30	84.70	99.00
	% within row	17.17 %	82.83 %	100.00 %
25-34 years	Count	69.00	251.00	320.00
	Expected count	46.21	273.79	320.00
	% within row	21.56 %	78.44 %	100.00 %
35-44 years	Count	60.00	237.00	297.00
	Expected count	42.89	254.11	297.00
	% within row	20.20 %	79.80 %	100.00 %
45-54 years	Count	49.00	212.00	261.00
	Expected count	37.69	223.31	261.00
	% within row	18.77 %	81.23 %	100.00 %
55-64 years	Count	28.00	291.00	319.00
	Expected count	46.06	272.94	319.00
	% within row	8.78 %	91.22 %	100.00 %
65 years and older	Count	32.00	438.00	470.00
	Expected count	67.87	402.13	470.00
	% within row	6.81 %	93.19 %	100.00 %
Total	Count	255.00	1511.00	1766.00
	Expected count	255.00	1511.00	1766.00
	% within row	14.44 %	85.56 %	100.00 %

Table 63 presents the chi-squared test of age and clean driving record.

Table 63 Chi-Squared test of age- clean driving record

<i>Chi-Squared Tests</i>			
	Value	df	p
X <sup>2</sup>	56.12	5	< .001
N	1766		

*Note.* Continuity correction is available only for 2x2 tables.

Table 64 presents the Cramer's V test of age and clean driving record.

Table 64 Cramer's V test of age- clean driving record

<i>Nominal</i>	
	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.178

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

## Appendix D2 Risky driving BEHAVIORS (11)

I report contingency tables and corresponding Pearson chi-square tests examining differences in the distribution of the 11 risky driving behaviours across groups, and I provide Cramer's V as an effect size measure, for 2019, 2020, and 2023.

### Contingency Tables

Table 65 presents the contingency table of the risky driving behavior (alcohol).

Table 65 Contingency table of the risky driving behavior (alcohol)

#### Contingency Tables

Year		Alcohol					Total
		1- 4 times a week	1-3 times a month	5 or more times a week	Less than 1 time per month	Never	
2019	Count	18.00	95.00	4.00	197.0	1452	1766
	% within row	1.02 %	5.38 %	0.23 %	11.16 %	82.22 %	100.00 %
2020	Count	11.00	33.00	1.00	156.0	1565	1766
	% within row	0.62 %	1.87 %	0.06 %	8.83 %	88.62 %	100.00 %
2023	Count	17.00	60.00	4.00	240.0	1445	1766
	% within row	0.96 %	3.40 %	0.23 %	13.59 %	81.82 %	100.00 %
Total	Count	46.00	188.00	9.00	593.0	4462	5298
	% within row	0.87 %	3.55 %	0.17 %	11.19 %	84.22 %	100.00 %

Table 66 presents the chi-squared test of risky driving behavior (alcohol).

Table 66 Chi-Squared test of risky driving behavior (alcohol)

<i>Chi-Squared Tests</i>			
	Value	df	p
X <sup>2</sup>	58.66	8	< .001
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 67 presents the Cramer's V test of risky driving behavior (alcohol).

Table 67 Cramer's V test for risky driving behavior (alcohol)

<i>Nominal</i>	
	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.074

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

Table 68 presents the contingency table of the risky driving behavior (seatbelt).

Table 68 Contingency table of the risky driving behavior (seatbelt)

*Contingency Tables*

Year		Seatbelt					Total
		1- 4 times a week	1-3 times a month	5 or more times a week	Less than 1 time per month	Never	
2019	Count	11.00	22.00	10.00	37.00	1686	1766
	% within row	0.62 %	1.25 %	0.57 %	2.10 %	95.47 %	100.00 %
2020	Count	16.00	20.00	4.00	31.00	1695	1766
	% within row	0.91 %	1.13 %	0.23 %	1.76 %	95.98 %	100.00 %
2023	Count	12.00	29.00	5.00	34.00	1686	1766
	% within row	0.68 %	1.64 %	0.28 %	1.93 %	95.47 %	100.00 %
Total	Count	39.00	71.00	19.00	102.00	5067	5298
	% within row	0.74 %	1.34 %	0.36 %	1.93 %	95.64 %	100.00 %

Table 69 presents the chi-squared test of risky driving behavior (seatbelt).

Table 69 Chi-Squared test of risky driving behavior (seatbelt)

*Chi-Squared Tests*

	Value	df	p
X <sup>2</sup>	6.789	8	.560
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 70 presents the Cramer's V test of risky driving behavior (seatbelt).

Table 70 Cramer's V test for risky driving behavior (seatbelt)

<i>Nominal</i>	
	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.025

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

Table 71 presents the contingency table of the risky driving behavior (drug).

Table 71 Contingency table of the risky driving behavior (drug)

*Contingency Tables*

Year		Drug					Total
		1- 4 times a week	1-3 times a month	5 or more times a week	Less than 1 time per month	Never	
2019	Count	13.00	21.00	5.00	24.00	1703	1766
	% within row	0.74 %	1.19 %	0.28 %	1.36 %	96.43 %	100.00 %
2020	Count	11.00	17.00	5.00	21.00	1712	1766
	% within row	0.62 %	0.96 %	0.28 %	1.19 %	96.94 %	100.00 %
2023	Count	11.00	18.00	6.00	25.00	1706	1766
	% within row	0.62 %	1.02 %	0.34 %	1.42 %	96.60 %	100.00 %
Total	Count	35.00	56.00	16.00	70.00	5121	5298
	% within row	0.66 %	1.06 %	0.30 %	1.32 %	96.66 %	100.00 %

Table 72 presents the chi-squared test of risky driving behavior (drug).

Table 72 Chi-Squared test of risky driving behavior (drug)

*Chi-Squared Tests*

	Value	df	p
X <sup>2</sup>	1.214	8	.997
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 73 presents the Cramer's V test of risky driving behavior (drug).

Table 73 Cramer's V test for risky driving behavior (drug)

*Nominal*

	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.011

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

Table 74 presents the contingency table of the risky driving behavior (speeding 1-10 KM/H).

Table 74 Contingency table of the risky driving behavior (speeding 1-10 KM/H)

*Contingency Tables*

Year		Speed_1_10					Total
		1- 4 times a week	1-3 times a month	5 or more times a week	Less than 1 time per month	Never	
2019	Count	266.0	383.0	289.0	355.0	473.0	1766
	% within row	15.06 %	21.69 %	16.36 %	20.10 %	26.78 %	100.00 %
2020	Count	233.0	363.0	241.0	403.0	526.0	1766
	% within row	13.19 %	20.55 %	13.65 %	22.82 %	29.78 %	100.00 %
2023	Count	278.0	382.0	333.0	356.0	417.0	1766
	% within row	15.74 %	21.63 %	18.86 %	20.16 %	23.61 %	100.00 %
Total	Count	777.0	1128.0	863.0	1114.0	1416.0	5298
	% within row	14.67 %	21.29 %	16.29 %	21.03 %	26.73 %	100.00 %

Table 75 presents the chi-squared test of risky driving behavior (speeding 1-10 KM/H).

Table 75 Chi-Squared test of risky driving behavior (speeding 1-10 KM/H)

*Chi-Squared Tests*

	Value	df	p
X <sup>2</sup>	36.23	8	< .001
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 76 presents the Cramer's V test of risky driving behavior (speeding 1-10 KM/H).

Table 76 Cramer's V test for risky driving behavior (speeding 1-10 KM/H)

<i>Nominal</i>	
	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.058

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

Table 77 presents the contingency table of the risky driving behavior (speeding 11 KM/H plus).

Table 77 Contingency table of the risky driving behavior (speeding 11 KM/H plus)

*Contingency Tables*

Year		Speed_11_plus					Total
		1- 4 times a week	1-3 times a month	5 or more times a week	Less than 1 time per month	Never	
2019	Count	107.0	219.0	93.00	354.0	993.0	1766
	% within row	6.06 %	12.40 %	5.27 %	20.05 %	56.23 %	100.00 %
2020	Count	102.0	192.0	81.00	363.0	1028.0	1766
	% within row	5.78 %	10.87 %	4.59 %	20.55 %	58.21 %	100.00 %
2023	Count	103.0	194.0	94.00	392.0	983.0	1766
	% within row	5.83 %	10.99 %	5.32 %	22.20 %	55.66 %	100.00 %
Total	Count	312.0	605.0	268.00	1109.0	3004.0	5298
	% within row	5.89 %	11.42 %	5.06 %	20.93 %	56.70 %	100.00 %

Table 78 presents the chi-squared test of risky driving behavior (speeding 11 KM/H plus).

Table 78 Chi-Squared test of risky driving behavior (speeding 11 KM/H plus)

*Chi-Squared Tests*

	Value	df	p
X <sup>2</sup>	6.800	8	.558
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 79 presents the Cramer's V test of risky driving behavior (speeding 11 KM/H plus).

Table 79 Cramer's V test for risky driving behavior (speeding 11 KM/H plus)

<i>Nominal</i>	
Value <sup>a</sup>	
Phi-coefficient	NaN
Cramer's V	0.025

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

Table 80 presents the contingency table of the risky driving behavior (red-light).

Table 80 Contingency table of the risky driving behavior (red-light)

*Contingency Tables*

Year		Red-light					Total
		1- 4 times a week	1-3 times a month	5 or more times a week	Less than 1 time per month	Never	
2019	Count	22.00	33.00	6.00	118.0	1587	1766
	% within row	1.25 %	1.87 %	0.34 %	6.68 %	89.86 %	100.00 %
2020	Count	21.00	25.00	5.00	117.0	1598	1766
	% within row	1.19 %	1.42 %	0.28 %	6.63 %	90.49 %	100.00 %
2023	Count	14.00	26.00	6.00	147.0	1573	1766
	% within row	0.79 %	1.47 %	0.34 %	8.32 %	89.07 %	100.00 %
Total	Count	57.00	84.00	17.00	382.0	4758	5298
	% within row	1.08 %	1.59 %	0.32 %	7.21 %	89.81 %	100.00 %

Table 81 presents the chi-squared test of risky driving behavior (red-light).

Table 81 Chi-Squared test of risky driving behavior (red-light)

*Chi-Squared Tests*

	Value	df	p
X <sup>2</sup>	8.233	8	.411
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 82 presents the Cramer's V test of risky driving behavior (red-light).

Table 82 Cramer's V test for risky driving behavior (red-light)

*Nominal*

	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.028

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

Table 83 presents the contingency table of the risky driving behavior (texting).

Table 83 Contingency table of the risky driving behavior (texting)

*Contingency Tables*

Year		Texting					Total
		1- 4 times a week	1-3 times a month	5 or more times a week	Less than 1 time per month	Never	
2019	Count	55.00	93.00	26.00	148.0	1444	1766
	% within row	3.11 %	5.27 %	1.47 %	8.38 %	81.77 %	100.00 %
2020	Count	53.00	80.00	23.00	153.0	1457	1766
	% within row	3.00 %	4.53 %	1.30 %	8.66 %	82.50 %	100.00 %
2023	Count	57.00	91.00	27.00	185.0	1406	1766
	% within row	3.23 %	5.15 %	1.53 %	10.48 %	79.61 %	100.00 %
Total	Count	165.00	264.00	76.00	486.0	4307	5298
	% within row	3.11 %	4.98 %	1.43 %	9.17 %	81.29 %	100.00 %

Table 84 presents the chi-squared test of risky driving behavior (texting).

Table 84 Chi-Squared test of risky driving behavior (texting)

*Chi-Squared Tests*

	Value	df	p
X <sup>2</sup>	7.555	8	.478
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 85 presents the Cramer's V test of risky driving behavior (texting).

Table 85 Cramer's V test for risky driving behavior (texting)

<i>Nominal</i>	
	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.027

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

Table 86 presents the contingency table of the risky driving behavior (talking handheld).

Table 86 Contingency table of the risky driving behavior (talking handheld)

*Contingency Tables*

Year		Talking handheld					Total
		1- 4 times a week	1-3 times a month	5 or more times a week	Less than 1 time per month	Never	
2019	Count	26.00	65.00	15.00	131.0	1529	1766
	% within row	1.47 %	3.68 %	0.85 %	7.42 %	86.58 %	100.00 %
2020	Count	24.00	51.00	13.00	128.0	1550	1766
	% within row	1.36 %	2.89 %	0.74 %	7.25 %	87.77 %	100.00 %
2023	Count	19.00	56.00	13.00	144.0	1534	1766
	% within row	1.08 %	3.17 %	0.74 %	8.15 %	86.86 %	100.00 %
Total	Count	69.00	172.00	41.00	403.0	4613	5298
	% within row	1.30 %	3.25 %	0.77 %	7.61 %	87.07 %	100.00 %

Table 87 presents the chi-squared test of risky driving behavior (talking handheld).

Table 87 Chi-Squared test of risky driving behavior (talking handheld)

*Chi-Squared Tests*

	Value	df	p
X <sup>2</sup>	4.315	8	.828
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 88 presents the Cramer's V test of risky driving behavior (talking handheld).

Table 88 Cramer's V test for risky driving behavior (talking handheld)

*Nominal*

	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.020

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

Table 89 presents the contingency table of the risky driving behavior (talking handsfree).

Table 89 Contingency table of the risky driving behavior (talking handsfree)

*Contingency Tables*

Year		Talking_handsfree					Total
		1- 4 times a week	1-3 times a month	5 or more times a week	Less than 1 time per month	Never	
2019	Count	192.0	333.0	121.0	346.0	774.0	1766
	% within row	10.87 %	18.86 %	6.85 %	19.59 %	43.83 %	100.00 %
2020	Count	172.0	319.0	103.0	379.0	793.0	1766
	% within row	9.74 %	18.06 %	5.83 %	21.46 %	44.90 %	100.00 %
2023	Count	230.0	386.0	129.0	382.0	639.0	1766
	% within row	13.02 %	21.86 %	7.30 %	21.63 %	36.18 %	100.00 %
Total	Count	594.0	1038.0	353.0	1107.0	2206.0	5298
	% within row	11.21 %	19.59 %	6.66 %	20.89 %	41.64 %	100.00 %

Table 90 presents the chi-squared test of risky driving behavior (talking handsfree).

Table 90 Chi-Squared test of risky driving behavior (talking handsfree)

*Chi-Squared Tests*

	Value	df	p
X <sup>2</sup>	40.34	8	< .001
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 91 presents the Cramer's V test of risky driving behavior (talking handsfree).

Table 91 Cramer's V test for risky driving behavior (talking handsfree)

<i>Nominal</i>	
	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.062

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

Table 92 presents the contingency table of the risky driving behavior (screen looking).

Table 92 Contingency table of the risky driving behavior (screen looking)

*Contingency Tables*

Year		Screen looking					Total
		1- 4 times a week	1-3 times a month	5 or more times a week	Less than 1 time per month	Never	
2019	Count	170.0	232.0	173.0	274.0	917.0	1766
	% within row	9.63 %	13.14 %	9.80 %	15.52 %	51.93 %	100.00 %
2020	Count	153.0	217.0	156.0	297.0	943.0	1766
	% within row	8.66 %	12.29 %	8.83 %	16.82 %	53.40 %	100.00 %
2023	Count	211.0	229.0	207.0	314.0	805.0	1766
	% within row	11.95 %	12.97 %	11.72 %	17.78 %	45.58 %	100.00 %
Total	Count	534.0	678.0	536.0	885.0	2665.0	5298
	% within row	10.08 %	12.80 %	10.12 %	16.70 %	50.30 %	100.00 %

Table 93 presents the chi-squared test of risky driving behavior (screen looking).

Table 93 Chi-Squared test of risky driving behavior (screen looking)

<i>Chi-Squared Tests</i>			
	Value	df	p
X <sup>2</sup>	32.93	8	< .001
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 94 presents the Cramer's V test of risky driving behavior (screen looking).

Table 94 Cramer's V test for risky driving behavior (screen looking)

<i>Nominal</i>	
	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.056

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

Table 95 presents the contingency table of the risky driving behavior (fatigue).

Table 95 Contingency table of the risky driving behavior (fatigue)

*Contingency Tables*

Year		Fatigue					Total
		1- 4 times a week	1-3 times a month	5 or more times a week	Less than 1 time per month	Never	
2019	Count	23.00	58.00	10.00	217.0	1458	1766
	% within row	1.30 %	3.28 %	0.57 %	12.29 %	82.56 %	100.00 %
2020	Count	24.00	48.00	3.00	176.0	1515	1766
	% within row	1.36 %	2.72 %	0.17 %	9.97 %	85.79 %	100.00 %
2023	Count	18.00	68.00	4.00	292.0	1384	1766
	% within row	1.02 %	3.85 %	0.23 %	16.53 %	78.37 %	100.00 %
Total	Count	65.00	174.00	17.00	685.0	4357	5298
	% within row	1.23 %	3.28 %	0.32 %	12.93 %	82.24 %	100.00 %

Table 96 presents the chi-squared test of risky driving behavior (fatigue).

Table 96 Chi-Squared test of risky driving behavior (fatigue)

*Chi-Squared Tests*

	Value	df	p
X <sup>2</sup>	45.71	8	< .001
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 97 presents the Cramer's V test of risky driving behavior (fatigue).

Table 97 Cramer's V test for risky driving behavior (fatigue)

<i>Nominal</i>	
	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.066

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

### Appendix D3 Alcohol and cannabis usage

I report contingency tables and corresponding Pearson chi-square tests assessing the association between alcohol use and cannabis use, and I provide Cramer's V as an effect size measure, for 2019, 2020, and 2023.

#### Contingency Tables Alcohol

Table 98 presents the contingency table of alcohol.

Table 98 Contingency table of alcohol

		Alcohol				Total
		0	2.5	7	10	
2019	Count	591.0	760.0	295.0	120.0	1766
	% within row	33.47 %	43.04 %	16.70 %	6.80 %	100.00 %
2020	Count	564.0	695.0	308.0	199.0	1766
	% within row	31.94 %	39.35 %	17.44 %	11.27 %	100.00 %
2023	Count	586.0	787.0	273.0	120.0	1766
	% within row	33.18 %	44.56 %	15.46 %	6.80 %	100.00 %
Total	Count	1741.0	2242.0	876.0	439.0	5298
	% within row	32.86 %	42.32 %	16.53 %	8.29 %	100.00 %

Table 99 presents the chi-squared test of alcohol.

Table 99 Chi-Squared test of alcohol

<i>Chi-Squared Tests</i>			
	Value	df	p
X <sup>2</sup>	37.27	6	< .001
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 100 presents the Cramer's V test of alcohol.

Table 100 Cramer's V test of alcohol

<i>Nominal</i>	
	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.059

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

## Contingency Tables Cannabis

Table 101 presents the contingency table of cannabis.

Table 101 Contingency table of cannabis

Year		Cannabis				Total
		0	1.5	3.5	5	
2019	Count	1586	73.00	26.00	81.00	1766
	% within row	89.81 %	4.13 %	1.47 %	4.59 %	100.00 %
2020	Count	1534	101.00	42.00	89.00	1766
	% within row	86.86 %	5.72 %	2.38 %	5.04 %	100.00 %
2023	Count	1571	78.00	45.00	72.00	1766
	% within row	88.96 %	4.42 %	2.55 %	4.08 %	100.00 %
Total	Count	4691	252.00	113.00	242.00	5298
	% within row	88.54 %	4.76 %	2.13 %	4.57 %	100.00 %

Table 102 presents the chi-squared test of cannabis.

Table 102 Chi-Squared test of cannabis

<i>Chi-Squared Tests</i>			
	Value	df	p
X <sup>2</sup>	13.56	6	.035
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 103 presents the Cramer's V test of cannabis.

Table 103 Cramer's V test of cannabis

<i>Nominal</i>	
	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.036

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

### Appendix D4 Crashes and near-misses

I report contingency tables and corresponding Pearson chi-square tests for the association between crash involvement and near-miss involvement, and I provide Cramer's V as an effect size measure, for 2019, 2020, and 2023.

Contingency Tables

Table 104 presents the contingency table of crashes.

Table 104 Contingency tables crash

<i>Contingency Tables</i>		Crash				Total
Year		0	1	2.5	3.5	
2019	Count	1628	103.00	28.00	7.00	1766
	% within row	92.19 %	5.83 %	1.59 %	0.40 %	100.00 %
2020	Count	1659	85.00	17.00	5.00	1766
	% within row	93.94 %	4.81 %	0.96 %	0.28 %	100.00 %
2023	Count	1621	113.00	23.00	9.00	1766
	% within row	91.79 %	6.40 %	1.30 %	0.51 %	100.00 %
Total	Count	4908	301.00	68.00	21.00	5298
	% within row	92.64 %	5.68 %	1.28 %	0.40 %	100.00 %

Table 105 presents the chi-squared test of crashes.

Table 105 Chi-Squared test of crash

*Chi-Squared Tests*

	Value	df	p
X <sup>2</sup>	8.333	6	.215
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 106 presents the Cramer's V test of crashes.

Table 106 Cramer's V test of crash

*Nominal*

	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.028

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables

Table 107 presents the contingency table of near-misses.

Table 107 Contingency tables near-misses

*Contingency Tables*

Year		Near-misses				Total
		0	1	2.5	3.5	
2019	Count	1459	175.0	102.00	30.00	1766
	% within row	82.62 %	9.91 %	5.78 %	1.70 %	100.00 %
2020	Count	1534	145.0	67.00	20.00	1766
	% within row	86.86 %	8.21 %	3.79 %	1.13 %	100.00 %
2023	Count	1357	229.0	135.00	45.00	1766
	% within row	76.84 %	12.97 %	7.64 %	2.55 %	100.00 %
Total	Count	4350	549.0	304.00	95.00	5298
	% within row	82.11 %	10.36 %	5.74 %	1.79 %	100.00 %

Table 108 presents the chi-squared test of near-misses.

Table 108 Chi-Squared test of near-misses

*Chi-Squared Tests*

	Value	df	p
X <sup>2</sup>	63.51	6	< .001
N	5298		

*Note.* Continuity correction is available only for 2x2 tables.

Table 109 presents the Cramer's V test of near-misses.

Table 109 Cramer's V test of near-misses

<i>Nominal</i>	
	Value <sup>a</sup>
Phi-coefficient	NaN
Cramer's V	0.077

<sup>a</sup> Phi coefficient is only available for 2 by 2 contingency Tables