



Final Report

# **Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors**

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*Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

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Mansoureh Jeihani, <a href="https://orcid.org/0000-0001-8052-6931">https://orcid.org/0000-0001-8052-6931</a> Evan M. Taylor			
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## **LIST OF ACRONYMS**

HVE	High Visibility Enforcement
LEL	Law Enforcement Liaison
HSP	Highway Safety Plan
SHSP	Strategic Highway Safety Plan
NHTSA	National Highway Traffic Safety Administration
PSA	Public Service Announcement
CTHSO	Connecticut Highway Safety Office
CPS	Child Passenger Safety
FTSDC	Florida Teen Safe Driving Coalition
SADD	Students Against Destructive Decisions
IHSAA	The Indiana High School Athletic Association
CSPD	Colorado Springs Police Department
GHSP	North Carolina's Governor's Highway Safety Program
LHSC	Louisiana Highway Safety Commission
GHSA	Governors Highway Safety Association
PI&E	Public Information and Education
TSD	New Mexico's Traffic Safety Division
TFI	ThinkFast Interactive Program
MSP	Massachusetts State Police
NSSI	Non-Suicidal Self-Injury
DMN	Default Mode Network
PTSD	Post-Traumatic Stress Disorder
GDL	Graduated Drivers Licensing
SADD	Students Against Destructive Decisions Initiative
IIHS	Insurance Institute for Highway Safety
GDL	Graduated Driver Licensing
CDC	Centers for Disease Control
IIDs	Ignition Interlock Devices
BAC	High Blood Alcohol Concentration
DWI	Driving While Intoxicated
ALR	Administrative License Revocation

## **TABLE OF CONTENTS**

<b>1. INTRODUCTION .....</b>	<b>8</b>
<b>1.1 Problem Statement.....</b>	<b>8</b>
<b>1.2. Goal .....</b>	<b>9</b>
<b>2. COMPARING SPEEDING AND AGGRESSIVE DRIVING PROGRAMS ACROSS STATES .....</b>	<b>9</b>
<b>2.1. Selective Traffic Enforcement Programs and High Visibility Enforcement.....</b>	<b>9</b>
<b>2.2. Paid Media and Campaigns .....</b>	<b>11</b>
<b>2.3. Special Events and Sports Marketing.....</b>	<b>12</b>
<b>2.4. Young Driver Safety Campaigns .....</b>	<b>13</b>
<b>2.5. Public Information and Education.....</b>	<b>14</b>
<b>2.6. Interactive Programming .....</b>	<b>15</b>
<b>2.7. Coalitions and Community Outreach .....</b>	<b>15</b>
<b>2.8. Partnerships with Schools and Targeting Schools .....</b>	<b>16</b>
<b>2.9. Social Media.....</b>	<b>17</b>
<b>2.10. Research and Surveys .....</b>	<b>17</b>
<b>3. Psychological, Social, and Environmental Drivers of Aggressive and Reckless Driving ....</b>	<b>18</b>
<b>3.1. Effectiveness of Civil and Criminal Penalties.....</b>	<b>18</b>
<b>3.2. Psychological, Social, and Neurological Impacts of the COVID-19 .....</b>	<b>21</b>
<b>3.3. Psychological Impacts of Driving in Heavy Traffic.....</b>	<b>24</b>
<b>3.4. Psychological Effects of the Consequences of Climate Change .....</b>	<b>26</b>
<b>4. Best Practices for Highway Safety Laws .....</b>	<b>29</b>
<b>4.1. Occupant Protection Laws: Seat Belt Use .....</b>	<b>29</b>
<b>4.2 Motorcycle Helmet Laws: A Life-Saving Measure .....</b>	<b>30</b>
<b>4.3 Child Passenger Safety Laws: Protecting the Youngest Passengers.....</b>	<b>30</b>
<b>4.4. Teen Driving Laws: Mitigating Risks for Novice Drivers .....</b>	<b>31</b>
<b>4.5. Impaired Driving Laws: Addressing Alcohol-Related Crashes.....</b>	<b>32</b>
<b>4.6. Child Endangerment Laws .....</b>	<b>33</b>
<b>4.7. Open Container and Sobriety Checkpoint Laws .....</b>	<b>33</b>
<b>4.8. Distracted Driving Laws .....</b>	<b>33</b>
<b>4.9. High BAC Sanctions and Addressing Test Refusals.....</b>	<b>34</b>

*Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

4.10. The Role of Administrative License Revocation and Zero Tolerance Laws .....	34
5. <i>DISCUSSION</i> .....	35
5.1 State-Based Initiatives and Policy Changes to Curb Aggressive Driving and Speeding .....	35
5.2 Psychological, Social, and Environmental Drivers of Aggressive and Reckless Driving.....	36
5.3 Best Practice Laws for Promoting Highway Safety .....	37
6. <i>SUMMARY AND CONCLUSION</i> .....	37
5. <i>REFERENCES</i> .....	38

## **ABSTRACT**

Aggressive driving and speeding are significant threats to highway safety, contributing to traffic accidents, injuries, and fatalities. This research examines this issue with three main objectives: identifying effective countermeasures, assessing underlying psychological and environmental drivers of aggressive driving and speeding, and identifying best practice laws for improving road safety. First, the study highlights state programs and initiatives from the past 3-5 years that have effectively reduced speeding and aggressive driving incidents. Second, it explores psychological, social, and environmental factors influencing reckless driving, such as stressors related to the COVID-19 pandemic, heavy traffic, and climate change. Finally, the research identifies and evaluates best practice highway safety laws, including those addressing impaired driving, occupant protection, and distracted driving, to guide more effective interventions and policy decisions. By comprehensively analyzing these strategies, factors, and laws, the study aims to provide valuable insights for enhancing highway safety and reducing dangerous driving behaviors nationwide.

**KEY WORDS:** Aggressive Driving, Speeding, Highway Safety Plans, COVID-19 pandemic, Traffic congestion, Climate Change, Civil and Criminal Penalties, Psychology, Best Practice Laws

# 1. INTRODUCTION

Speeding and aggressive driving are major concerns on U.S. roads, significantly contributing to traffic fatalities, severe injuries, and economic costs. Behaviors like excessive speeding, tailgating, and reckless lane changes pose risks not only to the driver but to all road users. In 2021, speeding was a factor in 29% of traffic deaths, resulting in over 12,000 fatalities, according to the National Highway Traffic Safety Administration (NHTSA) (1). The economic toll is substantial, with speeding-related crashes costing the U.S. approximately \$46 billion annually in medical expenses, property damage, legal fees, and lost productivity (2). Young drivers are particularly impacted, as 43% of all teen driver and passenger fatalities over a five-year period involved speeding, in contrast to 30% of fatalities among drivers and passengers aged 20 and older (3). Beyond direct impacts, these incidents place a burden on public resources, increasing demands on law enforcement, emergency services, and healthcare, while also potentially driving up insurance premiums for all motorists.

Despite ongoing efforts to mitigate speeding and aggressive driving, factors like traffic congestion, time pressure, and a sense of anonymity perpetuate these behaviors. As traffic congestion intensifies, drivers often experience heightened frustration, leading to aggressive maneuvers such as speeding, tailgating, and abrupt lane changes that put everyone on the road at risk. A survey by NHTSA found that 66% of U.S. drivers admitted to aggressive driving at least once in the past year, underscoring the prevalence of the issue (4). Law enforcement and policymakers continue to focus on curbing such behaviors, but limited resources highlight the need for targeted policies and programs. To that end, understanding both the causes of and countermeasures for speeding and aggressive driving is essential.

Aggressive driving is further influenced by a range of factors, from mental health stressors due to the COVID-19 pandemic to environmental influences like traffic congestion and climate change. Specific to COVID-19, the pandemic is estimated to have increased anxiety and depression globally by 25%, affecting emotional regulation and decision-making (5). This mental strain, along with the high mortality rate and disruptions to daily life, may contribute to impulsive and antisocial driving behaviors. Meanwhile, traffic congestion has grown more pervasive, with the average American spending 54 hours in traffic annually, leading to further psychological strain and increased risk of aggression on the road (6). Climate change adds another layer, with extreme weather events, such as heatwaves, causing stressors linked to risky behavior, including a documented 1.90% rise in crime rates when temperatures exceed 90°F (7). All of this brings into question the myriad of factors that must be considered to develop effective interventions aimed at curbing aggressive driving and speeding – ultimately enhancing driver behavior and highway safety.

## 1.1 Problem Statement

The main problem this research considers is the impact of speeding and aggressive driving on road safety, as these behaviors greatly contribute to traffic accidents, severe injuries, and fatalities. Speeding reduces reaction time and increases collision force, while aggressive actions like tailgating, weaving, and running red lights create unpredictable, hazardous conditions. Despite existing measures, these dangerous behaviors remain prevalent, requiring more effective interventions to improve safety and reduce related costs. Additionally, the psychological impacts



of the COVID-19 pandemic, growing traffic congestion, and climate-related stressors have been linked to increased driver aggression, indicating the need to address these influences on driving behavior.

## **1.2. Goal**

The main goal of this research is to examine state-level initiatives and policy changes from the past 3-5 years aimed at reducing speeding and aggressive driving, as well as identifying best practice laws for enhancing overall highway safety. By reviewing state highway safety plans, grant applications, and annual reports from all 50 U.S. states, sourced through the National Highway Traffic Safety Administration, the study seeks to identify the most effective strategies for mitigating risky driving behaviors. It also assesses the effectiveness of civil and criminal penalties while exploring the psychological and environmental factors that contribute to aggressive driving and speeding, including the effects of the COVID-19 pandemic, heavy traffic, and climate change. Lastly, it identifies best practice laws aimed at improving highway safety and reducing dangerous driving behaviors. This comprehensive analysis will highlight successful policy approaches and inform best practices to improve road safety laws and outcomes nationwide.

Key objectives include:

- Comparing state programs and initiatives that have demonstrated success in reducing speeding and aggressive driving incidents;
- Assessing the psychological, social, and environmental drivers of aggressive and reckless driving; and
- Identifying best practice laws that effectively enhance highway safety and reduce dangerous driving behaviors.

## **2. COMPARING SPEEDING AND AGGRESSIVE DRIVING PROGRAMS ACROSS STATES**

### **2.1. Selective Traffic Enforcement Programs and High Visibility Enforcement**

Several states have implemented selective traffic enforcement programs and high visibility enforcement (HVE) strategies to reduce speeding and aggressive driving. In Tennessee, for example, law enforcement agencies leverage Police Traffic Services program area grants to conduct sustained, highly visible enforcement efforts (8). These efforts target a wide range of traffic safety concerns, including impaired driving, distracted driving, and speeding in work zones. HVE in Tennessee focuses on "hot spot" locations identified through crash and citation data, combining proactive tactics like impaired driving patrols, seat belt checkpoints, and speed enforcement (8). These tactics are supported by visible elements such as marked vehicles and signage, as well as public outreach efforts like press releases and billboards, all designed to create a deterrent effect by increasing the perceived risk of being caught. This approach is central

*Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

to Tennessee's overall traffic safety strategy and highlights the state's comprehensive focus on reducing risky driving behaviors.

Similarly, other states have adopted variations of the HVE model tailored to their specific needs. For example, Utah utilizes high visibility enforcement to address crashes resulting from speeding, distracted driving, and failure to move over for stopped vehicles, aiming to reduce the five-year moving average of speed-related fatalities from 84.8 to 82.3 by 2026 (9). Utah's approach involves analyzing crash data and gathering community feedback to identify high-risk areas for enforcement. This data-driven strategy not only helps to target problem areas more effectively but also ensures that the community is engaged in the effort to improve road safety.

Virginia and Maryland both utilize integrated, evidence-based strategies to enhance their enforcement efforts. Virginia's Law Enforcement Liaison (LEL) program plays a critical role in coordinating HVE and other enforcement-based programs (10). By assisting law enforcement agencies across the state, the LEL program ensures a cohesive approach to addressing speeding, aggressive driving, and alcohol-related offenses. Similarly, Maryland employs a data-driven strategy based on NHTSA's Countermeasures that Work, integrating checkpoint inspections, saturation patrols, and media campaigns to address speeding, impairment, and other safety issues (11). These states demonstrate how integrating enforcement with data analysis and public awareness can enhance the effectiveness of their programs, creating a comprehensive framework for traffic safety.

Washington and West Virginia emphasize the role of media in their HVE efforts. Washington's strategy incorporates multilingual, culturally relevant media campaigns to raise awareness about the risks of speeding (12). In addition to traditional enforcement efforts, Washington uses social norm branding to encourage behavior change, highlighting the importance of safety for all road users (12). This innovative approach adds a unique layer to the state's HVE program by leveraging media to shift public perceptions about speeding and road safety. Similarly, West Virginia uses federal funds to purchase media in support of its targeted speed enforcement efforts, yielding more than 3.2 million and 3.3 million impressions in July and September, respectively (13). By following federal guidelines for highway safety messaging, West Virginia ensures that its media campaigns complement its enforcement activities, maximizing the overall deterrent effect.

Several states, including Wisconsin, Georgia, and Missouri, have implemented HVE in conjunction with specific, targeted programs to combat speeding and aggressive driving. Wisconsin's high-visibility enforcement campaigns focus on high-crash areas, using expanded patrols to deter speeding and aggressive driving (14). The goal is to increase the perceived risk of being caught and ticketed, which in turn reduces fatalities. Georgia's "Operation Southern Slow Down" exemplifies a regional approach, with law enforcement from Georgia, South Carolina, Alabama, Florida, and Tennessee teaming up to combat speeding (15). This multi-state initiative involves media events and widespread enforcement activities, resulting in thousands of speeding citations (15). Missouri also prioritizes speeding in its enforcement efforts, partnering with the Missouri State Highway Patrol to ramp up HVE in high-crash corridors and work zones (16). These targeted efforts illustrate how states can tailor HVE to address specific high-risk behaviors and locations.

## **2.2. Paid Media and Campaigns**

Many states utilize paid media campaigns to enhance the effectiveness of their traffic safety programs, with a focus on reducing speeding and aggressive driving. For example, Alaska's Educational Traffic Safety Media Buys program supports its Highway Safety Plan (HSP) and Strategic Highway Safety Plan (SHSP) goals by funding targeted media buys (17). These efforts are designed to raise awareness about speed enforcement conducted by local police departments and the Alaska State Troopers. Alaska also employs a media contractor to develop specific messaging aimed at reducing distracted driving, focusing on younger drivers aged 16-35 in urban areas (18). Through this use of paid media, the state can target specific demographic groups and driving behaviors, complementing broader national campaigns like those promoted by NHTSA.

In a similar vein, states like Arizona and Arkansas also use media campaigns to support their highway safety initiatives. Arizona's Governor's Office of Highway Safety combines earned and paid media to raise public awareness driver safety issues (19). This integrated approach helps the state address road safety by utilizing multiple media platforms to deliver consistent messaging. Arkansas, on the other hand, has embraced newer digital platforms to reach its audience, delivering the "Speeding Slows You Down" message via streaming services such as PlayStation Vue, Roku, and Apple TV (20). By using both traditional and digital media, these states can reach wider audiences and promote safer driving behaviors.

Colorado and Connecticut have taken a more strategic approach to paid media, ensuring that their campaigns are data-driven and highly targeted. For example, Colorado's "Shift into Safe" campaign focused on educating the public on driver safety issues and changing the traffic safety culture – leveraging social media and public service announcements (PSAs) to increase engagement (21). A public service announcement contest also helped generate significant earned media, with millions of impressions across social and traditional media platforms (21). Connecticut similarly supports its Speed and Aggressive Driving High Visibility Enforcement campaigns with bilingual media targeting high-crash areas, particularly in communities identified as part of the Justice40 and Environmental Justice initiatives (22). These campaigns highlight how media can be tailored to specific geographic and demographic factors to maximize reach and effectiveness.

Other states, like Delaware and Florida, emphasize the importance of integrating paid media with law enforcement efforts. Delaware's Office of Highway Safety (OHS) promotes its annual Safe Family Holiday campaign, combining paid ads and social media to support traffic safety efforts—such as speeding, impaired driving, and distracted driving—while providing funding to 34 municipal agencies and the Delaware State Police for a total of 147 patrols (23). The campaign's success is tied to its ability to reinforce enforcement efforts with consistent public messaging. Florida, meanwhile, contracts with a media vendor to purchase advertisements aimed at promoting a "Stop Speeding" campaign across the state (24). The use of various mediums like radio, videos, and social media ensures that the campaign's message reaches drivers through multiple channels, reinforcing the state's focus on curbing speeding and promoting road safety.

States like Kansas and Illinois also use paid media as a cornerstone of their traffic safety strategies, often collaborating with neighboring states for larger, regional campaigns. For instance, Kansas partnered with Arkansas, Missouri, Iowa, and Nebraska in 2023 for a joint

## *Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

campaign targeting aggressive speeding (25). Media partner JNA used Section 402 Funds for media placements across Kansas, utilizing newspapers, social media, and digital media to disseminate the campaign's message – generating more than four million impressions and reaching over 500,000 individual people (25). In Illinois, the state links its paid media efforts directly to its sustained traffic enforcement programs, ensuring that campaigns targeting speeding coincide with enforcement activities, thus creating a stronger deterrent effect (26). Through these regional collaborations, partnering states can create a unified message across state lines, amplifying the overall impact of enforcement efforts.

West Virginia and Missouri provide additional examples of how paid media can be used to support statewide enforcement efforts. In West Virginia, media buys for speed enforcement include billboards and digital ads, which generated millions of impressions in 2023 alone (27). The state's focus on high-impression media platforms highlights the importance of visibility in reinforcing speed enforcement campaigns. Missouri, on the other hand, has prioritized quarterly speed campaigns and uses paid media to support these initiatives (16). The state partners with the Missouri State Highway Patrol to conduct high-visibility enforcement in areas with the highest occurrences of speed-related crashes, ensuring that paid media is used effectively to promote the state's traffic safety goals.

Finally, New Mexico and Michigan underscore the value of sustained media efforts to complement enforcement. New Mexico's "My Story" campaign taps into the fear of regret, using personal narratives to communicate the consequences of dangerous behaviors like speeding, distracted driving, and impaired driving (28). The campaign utilizes a range of platforms, from broadcast and radio to social media, ensuring that the message reaches a broad audience. Michigan similarly uses paid advertising during overtime enforcement periods to publicize enforcement efforts, raising awareness about the dangers of speeding (29). Both states demonstrate how paid media can not only enhance enforcement but also engage the public on an emotional level, making the messaging more impactful and memorable.

### **2.3. Special Events and Sports Marketing**

Special events and sports marketing play an important role in educating the public about safe driving behaviors, particularly in the context of speeding and aggressive driving. For instance, Alaska leverages events like schools, fairs, and sports gatherings to deliver consistent messaging on the dangers of speeding (17). This program includes hands-on demonstrations and peer-to-peer social media engagement, offering attendees an immersive experience designed to increase awareness. The focus on creating interactive environments, where individuals can directly engage with the content, could be an effective way to capture the attention of diverse audiences, including younger drivers, who are often more difficult to reach through traditional media channels.

Alaska also focuses its special events and sports marketing efforts on teens, particularly during the summer months between Memorial Day and Labor Day. The state partnered with the Alliance to produce teen traffic safety ads addressing speeding, distracted driving, and other high-risk behaviors (30). What sets Alaska's initiative apart is the use of localized recordings from teen leaders, which helps enhance community impact by making the messaging more relatable. Similarly, Alaska promotes popular social media platforms like TikTok, YouTube,

## *Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

Facebook, and Instagram, achieving over 2 million impressions (30). Ultimately, Alaska uses this creative approach to reach younger audiences through platforms they frequently use, ensuring that the safety messages resonate more effectively.

Connecticut takes a broader approach by incorporating its highway safety outreach into a wide variety of events, including sports venues, concerts, and racing facilities. The Connecticut Highway Safety Office (CTHSO) delivers messaging on speeding, impaired driving, seatbelt use, and distracted driving at outreach events, including sports venues – ensuring that their audience is exposed to safe driving practices in a high-energy, engaging environment (22). Connecticut’s focus on reaching attendees at such diverse venues helps ensure that their traffic safety messages reach individuals across different age groups and communities. The inclusion of topics such as roadside safety and non-motorized safety further broadens the impact of these efforts, demonstrating a comprehensive approach to addressing multiple aspects of road safety.

### **2.4. Young Driver Safety Campaigns**

States across the U.S. are implementing various strategies to target young driver safety, focusing on risky behaviors such as speeding, distracted driving, and impaired driving. For example, Maine has developed programs that supplement driver education materials and offer young drivers additional resources on dangerous behaviors such as drowsy driving, speeding, and non-use of seat belts (31). By integrating these educational initiatives into existing driver education frameworks, Maine ensures that young drivers receive comprehensive instruction on the hazards of the road. These supplemental programs aim to reinforce the importance of safe driving behaviors early on, providing young drivers with the knowledge they need to make safer choices.

Montana’s approach to young driver safety includes a more engaging, research-based campaign featuring a new mascot, “Andy,” launched in FFY23 (32). This campaign, supported by MDT staff and media contractor Duft Watterson, focuses on reducing roadway crashes by influencing behavior related to impaired driving, seat belt use, and aggressive driving (32). By targeting teens, young adults, and the general public, the campaign supports Montana’s Vision Zero goal of eliminating deaths and serious injuries on its roads. The incorporation of a relatable mascot makes the message more appealing to younger audiences, while the campaign’s alignment with broader traffic safety goals underscores the state’s commitment to long-term safety outcomes.

Texas has taken a creative and targeted approach to addressing speeding among young drivers, who were involved in over half of the state’s speed-related crashes in 2022 (33). To reach this demographic, Texas employed sports marketing, digital TV placements, and video ads on popular platforms like YouTube and dating apps (33). This multi-platform strategy effectively targets young drivers in spaces where they are most likely to engage with the content. By utilizing digital and sports marketing, Texas ensures that its traffic safety messages reach young drivers in a dynamic and relevant manner, further reinforcing the importance of reducing speeding and other dangerous driving behaviors.

Indiana's "Train the Trainers" program offers a unique method for addressing young driver safety by training first responders and other key figures to educate young drivers about reckless and distracted driving (34). The program provides participants with the latest research on teen driving behaviors and translates that data into actionable, evidence-based strategies. By equipping first

## *Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

responders with this information, Indiana ensures that those who are directly involved in traffic safety can effectively educate young drivers. This approach stands out for its focus on practical, research-driven solutions and its ability to disseminate critical safety information to young drivers through trusted community members.

### **2.5. Public Information and Education**

Public Information and Education (PI&E) programs are a critical component of highway safety strategies, addressing key issues such as speeding, distracted driving, and aggressive driving. For example, Vermont's approach to community education is centered around local law enforcement agencies delivering tailored safety programs (35). These agencies engage in community events such as school education programs, driver safety classes, fairs, and local gatherings to address distracted, aggressive, and impaired driving while promoting occupant protection and pedestrian and bicycle safety. The use of peer-reviewed curricula ensures that the educational content is evidence-based, further reinforcing the effectiveness of Vermont's PI&E initiatives (35). Additionally, some agencies in Vermont focus on child seat safety, partnering with the Vermont Department of Health Child Passenger Safety Program to reach families and parents, particularly in underserved communities (35).

Indiana's public education efforts focus on interactive learning, particularly in school settings. The Alliance coordinates impactful presentations featuring real-life highway safety stories, focusing on topics such as seat belt use, impaired driving, and distracted driving (34). What distinguishes Indiana's approach is the integration of hands-on activities like a distracted driving simulator, seat belt games, and a video selfie station where students can create and share safety messages on social media (34). This innovative use of technology not only engages younger drivers but also encourages them to take ownership of their role in promoting highway safety. Indiana's decision to allow students to share messages on platforms they frequently use increases the reach and effectiveness of its safety campaigns, creating a peer-to-peer communication model that resonates with a younger audience.

New Mexico's Traffic Safety Division (TSD) has taken a broader approach to influencing driver behavior through information dissemination and education. The TSD sponsors forums, conferences, and training events to coordinate statewide traffic safety efforts (36). Additionally, it supports public awareness campaigns and media outreach that cover a wide range of topics, including pedestrian, motorcyclist, and bicyclist safety, speeding, and distracted driving (36). New Mexico's multi-faceted strategy highlights the importance of using multiple platforms and events to address a wide range of safety issues. The state's focus on bringing together various stakeholders through training and forums also emphasizes collaboration, ensuring that traffic safety initiatives are supported by a cohesive statewide effort.

Vermont's Rutland SHARP program and Rhode Island's Injury Prevention Center offer additional examples of how PI&E programs can be tailored to specific audiences. Vermont's SHARP program coordinates with local media, daycare centers, and car dealerships to promote messaging on speeding, impaired driving, and distracted driving, particularly through Child Passenger Safety (CPS) messaging (35). A key aspect of this program is its outreach to underserved and limited English-proficiency communities through partnerships with New America and New Refugees programs. Rhode Island, on the other hand, leverages its healthcare



network to spread traffic safety messages (37). The Office on Highway Safety funds the Injury Prevention Center at Rhode Island Hospital to train physicians to deliver messaging on impaired driving, speeding, and other road safety topics (37). By involving clinicians and healthcare professionals in spreading the message, Rhode Island ensures that traffic safety remains a priority across multiple sectors, including healthcare, thereby reinforcing the importance of safe driving behaviors.

## **2.6. Interactive Programming**

Interactive programming is becoming an increasingly popular tool for educating young drivers about the dangers of speeding, aggressive driving, and other risky behaviors. For instance, Colorado has implemented the ThinkFast Interactive (TFI) program, which engages teens with 50 trivia-based sessions throughout FY24 (38). This initiative focuses on safe driving practices, highway safety rules, and the prevention of distracted, impaired, and aggressive driving. The trivia-based format adds an element of fun and competition, encouraging teens to actively participate and retain critical information about traffic safety. This interactive programming has the potential to make road safety education more engaging and memorable for young audiences.

Similarly, Florida has launched a pilot project in historically underserved high schools, utilizing an interactive platform provided by TjohnE Productions, Inc (39). This program is tailored specifically for newly licensed teen drivers, guiding them through important state driving rules, regulations, and fines (39). By focusing on performance measures and real-world consequences of risky driving behaviors, the program prepares teens to handle the challenges they face on the road. Unlike Colorado's trivia-based format, Florida's program takes a more structured, rule-based approach, aligning with state laws to ensure that teens are equipped with the knowledge they need to stay safe. In Massachusetts, the Massachusetts State Police (MSP) use on-site interactive learning sessions to directly engage young drivers on the dangers of driving without a seat belt, driving distracted or impaired, and speeding (40). Through these programs, interactive learning can be customized to fit local needs while maintaining a focus on reducing risky driving behaviors among teens.

## **2.7. Coalitions and Community Outreach**

Coalitions and community outreach programs are pivotal for building awareness and addressing traffic safety issues like speeding and aggressive driving. In Florida, the Florida Teen Safe Driving Coalition (FTSDC), led by a full-time coordinator and part-time specialist at Tallahassee Community College, develops data-driven initiatives to enhance teen traffic safety statewide (41). A key aspect of their outreach involves "Weeks of Awareness" presentations, which will take place at approximately 50 high schools statewide (41). These presentations focus on critical topics such as distracted and impaired driving, peer pressure, speeding, aggressive driving, and passenger safety. By engaging high school students directly, Florida's coalition is focusing on younger drivers, aiming to instill safe driving habits at an early stage. The coalition also organizes quarterly meetings to continually refine strategies based on data, ensuring that their efforts remain effective and relevant (41).

Rhode Island and New Mexico offer slightly different approaches, but both prioritize community engagement. In Rhode Island, the Traffic Safety Resource Prosecutor (TSRP) is an active

## *Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

member of the state's Traffic Safety Coalition, attending monthly meetings and participating in several team workstreams (42). These teams focus on dangerous driving behaviors, including impaired driving, speeding, and young driver safety, ensuring that legal expertise is incorporated into traffic safety initiatives (42). Rhode Island's approach highlights the importance of cross-functional collaboration, integrating legal perspectives into broader traffic safety goals. Meanwhile, in New Mexico, community outreach is deeply rooted in cultural engagement. For example, the Gathering of Nations, a large event celebrating Indigenous cultures, provided a unique platform for traffic safety outreach. At this event, surveys and feedback were collected to gather public opinions on issues such as cannabis-impaired driving, speeding, and occupant protection (36). This engagement allowed New Mexico to incorporate community perspectives into decision-making processes, ensuring that traffic safety initiatives are informed by local voices and tailored to the needs of diverse populations. Both states exemplify how coalitions and community outreach can be customized to fit the specific cultural and legal landscape of a state.

### **2.8. Partnerships with Schools and Targeting Schools**

Partnerships with schools are a key component of many states' strategies for addressing speeding and aggressive driving, with a focus on engaging younger drivers through education and interactive programming. For example, in partnership with Click Media, digital tickets featuring traffic and pedestrian safety messaging will be distributed at over 400 high school events across every county in Alabama, ensuring students receive important safety information in a modern, accessible format (43). The statewide reach of the program ensures that every high school student in the state has access to this important information, making it a comprehensive effort to address risky driving behaviors among teens.

Similarly, Alaska has developed a school-focused traffic safety campaign that leverages technology to deliver key messages to students. The Educational Traffic Safety Media Buys program utilizes social media and geo-fencing around schools and youth events to provide targeted messaging on seat belt use, impaired and distracted driving, speeding, and Alaska's Graduated Drivers Licensing (GDL) laws (43). This digital approach ensures that students are repeatedly exposed to safety messages in the environments they frequent the most. By incorporating geo-fencing technology, Alaska can ensure that the right audiences are reached at the right times, further enhancing the effectiveness of the campaign. This strategy reflects the state's commitment to leveraging modern digital tools to engage with younger drivers on critical traffic safety issues.

In Colorado and Connecticut, school-based traffic safety programs are focused on delivering interactive experiences to engage students more deeply. Colorado offers school-wide presentations that cover a range of teen driving behaviors, and the interactive nature of these presentations ensures that students are not only passive recipients of the information but are actively engaged in learning about safe driving behaviors (38). Similarly, Connecticut's partnership with Matrix Entertainment's Save a Life Tour for the 2023-2024 school year targets Justice40 communities by visiting around 80 schools with interactive experiences, such as driving simulators and safety videos (22). These hands-on tools allow students to experience the potential dangers of driving in a controlled environment, making the lessons more memorable and impactful. The focus on Justice40 communities also ensures that Connecticut's outreach



## *Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

efforts are equitable, reaching underserved populations that may be at higher risk for traffic incidents.

Indiana has taken a unique approach by integrating traffic safety education into school athletic events and creating a sustained, peer-to-peer advocacy program through the Students Against Destructive Decisions (SADD) initiative (34). Indiana's SADD program creates local teen traffic safety advocates by establishing student-led chapters in high schools and colleges across the state (34). These chapters, supported by a full-time coordinator and part-time staff, focus on promoting seat belt use, reducing speed, and eliminating impaired and distracted driving (34). By encouraging peer-to-peer education, Indiana ensures that the message is delivered by individuals students trust, making the program highly effective in influencing teen driving behaviors.

### **2.9. Social Media**

Social media programs have become a key tool for many states in their efforts to raise awareness about speeding, aggressive driving, and other risky behaviors. In Colorado, for example, the Colorado Springs Police Department (CSPD) Public Information Officer distributes traffic safety information twice a month through social media platforms (38). These posts cover the dangers of speeding, the importance of seat belt use, and updates on grant-funded enforcement activities. By consistently engaging with the public on social media, the CSPD ensures that important safety messages remain visible to the community (38). Additionally, many public information offices across the country are leveraging their social media outlets to disseminate critical messages about speeding, distracted driving, and unrestrained occupant safety, further emphasizing the risks associated with these behaviors and encouraging safer driving habits (38).

In Delaware and North Carolina, social media campaigns have been carefully tailored to align with specific enforcement periods and targeted audiences. OHS, in Delaware, created 52 social media posts in FY 2023, timed to coincide with three scheduled enforcement campaigns focusing on occupant protection and distracted driving (44). This strategic alignment helps amplify the impact of enforcement efforts by raising awareness about traffic safety issues in real-time. Meanwhile, North Carolina's Governor's Highway Safety Program (GHSP) took a more comprehensive approach, utilizing social media influencers to reach younger audiences and providing local partners with tools to enhance their social media presence (45). The GHSP also launched a broad "umbrella campaign" that tied together messaging on impaired driving, occupant protection, speeding, and distracted driving, ensuring a cohesive communication strategy (45). North Carolina's refined approach, including the expansion of its "Local Heroes" campaign, demonstrates the state's commitment to creating engaging and creative social media content that resonates with specific demographics while promoting safer driving behaviors (45).

### **2.10. Research and Surveys**

Research and surveys play a critical role in informing state highway safety initiatives, helping to shape policy and enforcement by understanding public attitudes and behaviors around issues such as speeding, distracted driving, and impaired driving. In Iowa, for example, the Governor's Traffic Safety Bureau (GTSB) partnered with The Vernon Research Group (VRG) to conduct an extensive online survey targeting drivers aged 16-65+ (46). With a median age of 47 and

## *Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

representation from all 99 counties—both rural and urban—the survey offers comprehensive insight into driver behaviors and will cover critical areas such as seat belt use, speeding, and exposure to traffic safety messaging (46). This data enables Iowa to address traffic safety issues with a clear understanding of the statewide driving culture, tailoring interventions to the specific needs of its rural and urban populations.

Similarly, Oregon leverages surveys to inform community outreach efforts specifically related to the dangers of speeding. The state is funding a community outreach survey designed to gather public feedback and educate the public on speeding through a variety of media outlets (47). This project integrates public service announcements, social media, and print media to reinforce the dangers of speeding, creating a feedback loop that not only educates but also assesses public awareness and behavior (47). The focus on both outreach and research ensures that Oregon can measure the effectiveness of its media campaigns and adjust based on real-world data, aligning messaging with the public's attitudes and perceptions about speeding.

Louisiana takes a dual approach to research, conducting both observational surveys and attitudinal studies to gain a comprehensive view of driver behaviors. Through its partnership with Preusser Research Group, the Louisiana Highway Safety Commission (LHSC) conducts observational surveys to track seat belt usage (both day and night) and to gather attitudinal data on issues such as impaired driving, speeding, and distracted driving (48). This approach allows Louisiana to pinpoint problematic areas, enabling targeted interventions where they are most needed. Additionally, the LHSC conducts annual attitudinal surveys through phone and computer-based methods, giving Louisiana the ability to track changes in driver attitudes and behaviors over time (48). This continuous feedback helps shape Louisiana's policy and enforcement strategies, ensuring they remain relevant and effective.

Missouri and New Hampshire also utilize comprehensive surveys to guide traffic safety efforts. In Missouri, the Department of Transportation surveyed over 3,400 residents from all seven MoDOT districts in 2021 (49). The survey focused on public attitudes around seat belt usage, speeding, and distracted driving, ensuring that the sample represented Missouri's geographic, age, and gender diversity (49). This data helps the state develop targeted interventions and media campaigns that resonate with different demographics. Similarly, New Hampshire's annual statewide survey, conducted by the University of New Hampshire or a contractor, follows NHTSA/GHSA guidelines to track changes in public attitudes on key safety topics like speeding and occupant protection (50). This consistency in surveying ensures that both Missouri and New Hampshire can accurately assess the effectiveness of their traffic safety programs and adjust their strategies based on the evolving needs of the public.

## **3. Psychological, Social, and Environmental Drivers of Aggressive and Reckless Driving**

### **3.1. Effectiveness of Civil and Criminal Penalties**

Civil and criminal penalties are key components in traffic safety strategies, designed to deter reckless and aggressive driving. The effectiveness of these penalties, however, is complex and varies based on a range of factors, including the severity of the penalty, the likelihood of

*Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

enforcement, and the behavioral context of drivers. In Portugal, Tavares et al. found that increasing statutory penalties in the mid-1990s significantly reduced traffic accidents and fatalities (51). This policy shift was crucial in a country that had long been noted for high accident rates. The increase in fines and sanctions, particularly for reckless driving offenses, appeared to play a role in reducing dangerous driving behaviors. However, Tavares et al. also highlighted that while the severity of penalties had an impact, the certainty and swiftness of enforcement were less influential (51). This observation is consistent with findings from Davey and Freeman, who argued that while penalty severity is important, certainty—the likelihood of being caught—and swiftness—the immediacy of punishment—are even more crucial in changing driver behavior (52). Together, these studies suggest that harsher penalties can be effective, but only when accompanied by a robust system of enforcement.

The notion that certainty of punishment is more important than severity is further supported by research on deterrence theory in road safety. In their examination of drunk driving sanctions, Nichols and Ross found that increasing the likelihood of being caught through measures like random breath testing was more effective in reducing offenses than simply increasing the penalties (53). This aligns with Tavares et al., who noted that despite raising fines for reckless driving in Portugal, the limited effectiveness of enforcement mechanisms—such as roadside checks—diminished the overall impact of these legal reforms (51). Similarly, Asbridge et al. reviewed strategies for addressing road rage and found that while increasing penalties could help, the real deterrent effect comes from a combination of certainty and swiftness of punishment (54). Their research showed that specialized court programs that process offenders more swiftly and consistently could have a stronger impact than punitive measures alone. All this collectively underscores the importance of enforcement mechanisms that ensure offenders believe they will be apprehended, a factor that appears to weigh more heavily than the severity of the punishment itself.

In terms of recidivism, studies suggest that while penalties may deter some drivers from reoffending, others, particularly repeat offenders, require more than legal deterrents. McDonald et al. studied traffic recidivism in Victoria, Australia, and found that while some drivers—particularly older and more experienced drivers—were deterred by traffic penalties, younger drivers and those with a history of offenses were less likely to change their behavior after receiving fines or points on their license (55). Freeman et al. also studied recidivism among repeat drink drivers and found that although legal sanctions were perceived as severe, they were not seen as sufficiently certain or swift to effectively deter future offenses (56). In fact, self-reported drink driving behaviors and high alcohol consumption were more predictive of recidivism than legal penalties (56). All of this argues that while penalties can reduce offenses among first-time or occasional offenders, they are less effective for individuals with habitual or deep-seated behavioral issues, indicating a need for complementary interventions such as alcohol treatment programs or behavioral therapy.

The relationship between perceived risk of apprehension and behavior change is also reflected in studies on speeding. Truelove et al. examined the impact of legal and non-legal sanctions on speeding behaviors in Queensland, Australia, and found that drivers' perceptions of the likelihood of being caught—certainty of punishment—were the strongest predictors of compliance with speed limits (57). Drivers who believed they were unlikely to be caught were

*Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

more likely to speed, even if they were aware of the legal penalties (57). This finding echoes the work of Freeman et al., who noted that for many drivers, non-legal deterrents—such as the fear of injury or internal feelings of shame—were more powerful than legal penalties in curbing speeding behaviors (56). This indicates that while increasing fines or penalties for speeding may have some effect, ensuring that drivers believe they will be caught is a more effective strategy. These studies collectively highlight the importance of perception in shaping driving behavior: it is not just the existence of penalties that matters, but drivers' beliefs about the likelihood of enforcement and the personal risks associated with their actions.

Moreover, the effectiveness of civil and criminal penalties in curbing reckless and aggressive driving is often undermined by a failure to integrate non-legal deterrents. Kaviani et al. explored the use of formal and informal deterrence mechanisms in reducing illegal smartphone use while driving in Victoria, Australia (58). Their findings revealed that drivers often underestimated the consequences of being caught for using smartphones behind the wheel, leading to a low perceived risk of punishment (58). However, they found that informal deterrents—such as the fear of physical harm or social stigma—had a much greater impact on reducing this behavior (58). This finding parallels the results of Asbridge et al., who noted that non-legal strategies, such as public education campaigns and the redesign of road environments to reduce stressors, can have a significant impact on curbing aggressive driving behaviors (54). All these findings suggest that while legal penalties are an important component of road safety strategies, they must be supported by broader social interventions that address the underlying psychological and environmental factors contributing to reckless behavior.

In addition to the psychological dimensions of deterrence, there are also important economic considerations that can influence the effectiveness of penalties. Roberts and Smaglik examined the impact of monetary penalties on speeding behavior in work zones and found that drivers responded to signs indicating potential fines for speeding, with a reduction in mean speeds observed (59). However, the reductions were modest, and only those exceeding the speed limit by a significant margin—10 mph or more—showed substantial behavioral changes (59). This study suggests that while financial penalties can be effective in some cases, their impact may be limited to the most extreme offenders. Freeman et al. also noted that the cost-effectiveness of penalties should be considered, particularly in terms of the administrative burden on law enforcement and the judicial system (60). They argue that in some cases, non-monetary penalties, such as license suspensions or mandatory behavioral programs, may be more effective and less costly than imposing fines, especially for repeat offenders. Taken collectively, these studies highlight the need for a balanced approach that considers both the economic and psychological dimensions of penalty enforcement.

The role of non-legal sanctions in shaping behavior is further demonstrated in studies on tailgating. Ochenasek et al. investigated the effectiveness of deterrence-based strategies in reducing tailgating behavior and found that non-legal deterrents—such as the fear of causing an accident or the knowledge that others had been punished for similar offenses—were significant predictors of compliance (57). Legal penalties, while important, were not as influential as the perceived physical and social risks associated with tailgating (57). This finding aligns with Kaviani et al., who observed that drivers who feared physical harm were more likely to change their behavior than those who were primarily concerned with legal consequences (58).

## *Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

Ultimately, this literature argues that integrating both legal and non-legal deterrents into road safety strategies can be more effective than relying solely on punitive measures.

Overall, while civil and criminal penalties are necessary tools in addressing reckless and aggressive driving, their effectiveness is heavily influenced by factors such as the certainty of enforcement, the swiftness of punishment, and the integration of non-legal deterrents. Research by Tavares et al. and Freeman et al. highlights that penalties alone are often insufficient to change behavior, particularly among repeat offenders or drivers who perceive a low likelihood of being caught (51, 60). To enhance the effectiveness of penalties, road safety strategies must incorporate broader social interventions that address the psychological and environmental factors contributing to reckless behavior. Public education campaigns, improved enforcement mechanisms, and non-legal sanctions—such as social stigma and the fear of physical harm—are critical components of a comprehensive approach to reducing dangerous driving. Ultimately, a multi-faceted strategy that combines legal penalties with broader behavioral interventions is necessary to create lasting change in driver behavior and improve road safety outcomes.

### **3.2. Psychological, Social, and Neurological Impacts of the COVID-19**

The COVID-19 pandemic has profoundly altered human behavior, particularly in the realms of risk-taking, impulsivity, and aggression. A key area where these changes have been observed is in driving behaviors, as demonstrated by multiple studies examining shifts in road aggression. Stephens et al. found that many drivers believed their own aggressive driving had increased during the pandemic, with an even higher percentage perceiving that others on the road had become more aggressive (61). This sense of heightened road aggression was particularly evident during and after pandemic lockdowns, where nearly half of the drivers surveyed reported that others had become riskier and more dangerous (61). The collective stress and anxiety brought on by the pandemic, including social isolation and the disruption of daily routines, likely contributed to this rise in aggressive driving behaviors. Other studies support these findings, showing that despite a decrease in overall traffic volume during lockdowns, the rate of major crashes and severe injuries increased, driven primarily by reckless behaviors such as speeding and impaired driving (62). In all, this research found that the psychological toll of the pandemic manifested in a more dangerous driving environment, with individuals more likely to engage in impulsive, aggressive actions behind the wheel.

The rise in aggressive driving behaviors was not limited to the United States. Vanlaar et al. conducted a comparative study of driving behaviors in Canada and the United States, revealing that while a significant portion of drivers reported no changes in their behavior during the pandemic, a large number admitted to engaging in riskier actions such as speeding, distracted driving, and driving under the influence (63). Notably, U.S. drivers were more likely than their Canadian counterparts to report increases in risky behaviors, a pattern that may reflect differences in public health responses, cultural attitudes towards risk-taking, and the broader social context (63). Similarly, other studies highlight the role of psychological stress and the loosening of social norms in exacerbating reckless driving during the pandemic (61). The sense of freedom on less congested roads, coupled with the emotional strain of prolonged isolation,

*Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

may have driven individuals to engage in more dangerous driving, reflecting a broader trend of pandemic-induced disinhibition and aggression.

Social isolation, one of the defining features of pandemic lockdowns, has also played a significant role in shaping antisocial behaviors. O'Connell et al. explored the link between antisocial traits and adherence to social distancing measures, finding that individuals with higher levels of antisociality were less likely to follow public health guidelines, such as social distancing and mask-wearing (64). These individuals exhibited riskier behaviors, including more frequent outings and closer proximity to others, even after controlling for sociodemographic factors (64). This defiance of public health measures was not limited to those with pre-existing antisocial tendencies; the psychological strain of isolation led many individuals to act out impulsively, disregarding the rules in favor of personal freedoms. Patrono et al. found similar patterns in young adults in Lombardy, Italy, where prolonged social isolation led to increased emotional dysregulation and rule-breaking behaviors, particularly among males (65). Other studies indicate that LGBTQ individuals face an increased risk of mental health issues due to existing social disadvantages and disparities, which have been further intensified by the trauma and isolation brought on by the COVID-19 pandemic (66). All of this shows that isolation not only heightened psychological distress but also fostered an environment where individuals were more likely to externalize their frustration through impulsive or antisocial actions – especially for vulnerable groups.

Impulsivity, a key factor in risky behavior, has been especially pronounced during the pandemic. Albertella et al. investigated the impact of impulsivity and compulsivity on addictive behaviors during Australia's lockdowns, finding that individuals with high impulsivity were more likely to engage in problematic behaviors such as substance abuse and compulsive actions (67). These tendencies were further exacerbated by the stress and psychological strain caused by the pandemic, as individuals sought coping mechanisms to deal with uncertainty and isolation. Other studies explored the genetic predispositions that may have influenced antisocial behavior during the pandemic, finding correlations between antisocial tendencies and increased risk of exposure to COVID-19 (68). Based on this research, individuals with higher levels of impulsivity and a tendency toward rule-breaking were more likely to disregard public health guidelines, thereby increasing their risk of contracting and spreading the virus (68). These findings underscore the role of impulsivity not only in personal risk-taking behaviors but also in the broader social dynamics of pandemic transmission, where individual actions have collective consequences.

Increased substance use has also been a prominent behavioral change during the pandemic, adding to the trend of impulsivity and self-destructive actions previously discussed. Albertella et al. found that stress and psychological distress during lockdowns were strongly associated with compulsive behaviors, including substance abuse (67). The increase in alcohol and drug use during the pandemic has been well-documented, with individuals turning to these substances as coping mechanisms for dealing with the uncertainty and anxiety of the global crisis. Wang et al. further explored the link between impulsivity and self-destructive behaviors, finding that neuroticism and impulsivity were key predictors of non-suicidal self-injury (NSSI) among adolescents during the pandemic (69). The incidence of NSSI increased by 10.3% during the pandemic, with those exhibiting higher levels of impulsivity and emotional dysregulation more likely to engage in self-harming behaviors (69). These findings suggest that the psychological

toll of the pandemic has not only led to increased risk-taking behaviors but also to a rise in harmful actions directed inward, particularly among vulnerable populations.

The neurological impact of the pandemic is another significant factor in understanding these behavioral changes. The stress and social isolation experienced during lockdowns have had profound effects on emotional regulation and decision-making, as noted by Stephens et al. and O'Connell et al. (61, 70). The default mode network (DMN) of the brain, which plays a key role in controlling social behavior, empathy, and moral decision-making, has been disrupted during the pandemic, leading to increased emotional dysregulation and impulsive actions (71). This disruption in the brain's social cognition processes may explain the rise in antisocial behaviors, as individuals become less able to regulate their emotions and actions in socially acceptable ways. The neurological changes triggered by prolonged stress and isolation could have long-term implications for mental health, with potential links to increased rates of aggression, impulsivity, and even cognitive decline (71).

These neurological and psychological disruptions have contributed to a significant rise in aggression, as highlighted by Killgore et al (72). Using the Buss-Perry Aggression Questionnaire, Killgore et al. found that individuals under lockdown reported significantly higher levels of aggression over time, with increases in physical aggression, verbal aggression, and hostility (72). This trend was consistent across all subgroups, suggesting that the emotional strain of lockdowns, combined with broader social and economic disruptions, fueled a general increase in aggressive tendencies. Other studies on aggression during COVID-19 linked pandemic stressors to increased road aggression (61 – 62). All of this highlights a pervasive shift in social behavior, where frustration, fear, and anxiety led to more outward expressions of aggression, both on the road and in other social contexts.

Furthermore, the neurological changes induced by the pandemic may have long-lasting effects on mental health and social behavior. Dubey et al. warned that the disruption of the DMN could lead to a future rise in cognitive decline and dementia, as the prolonged stress of the pandemic takes a toll on brain function (71). This suggests that the behavioral changes observed during the pandemic may not be temporary but could have lasting impacts on individuals' mental health and cognitive abilities. The rise in impulsivity, aggression, and emotional dysregulation seen during the pandemic could, therefore, be early indicators of more severe mental health challenges to come, particularly in individuals who were already vulnerable to stress and emotional instability.

The societal impacts of these behavioral changes have been wide-reaching, creating challenges for public health and social services. The psychological strain caused by the pandemic, as noted by Pedrosa et al., has contributed to a breakdown in social norms, with increased aggression, impulsivity, and antisocial behaviors straining already overburdened systems (73). The rise in reckless driving, substance abuse, and non-compliance with public health guidelines has placed additional pressure on law enforcement, healthcare systems, and mental health services, all of which were already stretched thin by the direct effects of the pandemic (73). This has created a feedback loop where the stress and anxiety of the pandemic contribute to risky behaviors, which in turn exacerbate the societal challenges of managing the pandemic and its long-term consequences.



In totality, the COVID-19 pandemic has had far-reaching effects on human behavior, particularly in terms of increasing risky, impulsive, and antisocial tendencies. The combination of psychological distress, neurological changes, and social isolation has created an environment where individuals are more likely to engage in reckless behaviors, from aggressive driving to substance abuse. Studies by Stephens et al., Vanlaar et al., and O'Connell et al. have documented the ways in which the pandemic has disrupted social norms and led to a rise in disinhibition and rule-breaking behaviors (61, 63, 70). These behavioral shifts have significant implications for public health and societal well-being, as the long-term effects of the pandemic continue to unfold. Understanding the psychological, social, and neurological underpinnings of these changes is crucial for developing effective interventions to mitigate the long-term consequences of the pandemic on both individual behavior and broader societal functioning.

### **3.3. Psychological Impacts of Driving in Heavy Traffic**

Aggressive driving behaviors are strongly influenced by a combination of environmental stressors, psychological traits, and situational pressures, with each contributing to a dangerous and often lethal cocktail of risky actions on the road. Environmental stressors, particularly traffic congestion, are primary triggers for aggressive driving. Shinar and Compton describe how drivers in congested environments are more likely to exhibit frustration, leading to impulsive behaviors like speeding, tailgating, and weaving through traffic (74). This frustration, which builds gradually as drivers face prolonged periods of immobility, can escalate quickly when compounded by factors such as time pressure or perceived injustice from other drivers' actions (74). Hennessy and Wiesenthal further emphasize that traffic congestion directly correlates with elevated levels of stress, which in turn manifests in aggressive driving actions (75). For example, drivers stuck in stop-and-go traffic often take unnecessary risks, such as abrupt lane changes, to regain a sense of control (75). Stress, however, does not work alone. Pre-existing personality traits, especially high levels of aggression and impulsivity, play a pivotal role. Precht et al. found that individuals with these traits are more susceptible to responding aggressively when faced with even minor traffic inconveniences (76). Taken together, these findings suggest that aggressive driving is not solely a result of momentary frustrations but a complex interplay of environmental conditions and individual psychological makeup.

Time pressure is another significant contributor to aggressive driving, especially when combined with stressful driving conditions like congestion. Drivers who feel pressed for time often resort to unsafe practices to mitigate perceived delays. This phenomenon is particularly pronounced in urban environments, where traffic congestion frequently interrupts the flow of travel. Emo et al. highlight that drivers under time pressure are more likely to engage in behaviors such as speeding, tailgating, and running red lights, which are exacerbated by traffic congestion (77). Time pressure acts as an accelerant, intensifying the already heightened stress caused by delays. Hennessy and Wiesenthal found that drivers experiencing both time pressure and traffic stress were more prone to aggressive outbursts, often taking risks that endangered themselves and others (75). What is particularly concerning is how this sense of urgency can transform occasional aggressive driving into a habitual response over time. Drivers may begin to justify their aggressive behaviors as necessary to meet deadlines, even in situations where they have ample time. Reducing this sense of time urgency could significantly mitigate aggressive driving behaviors.



*Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

The lasting impact of traffic-induced stress does not end when drivers leave congested areas. Post-congestion aggression is a well-documented phenomenon where drivers continue to exhibit risky behaviors even after the stressor has been removed. Li et al. observed that many drivers remain in an elevated state of arousal long after exiting high-traffic areas, often continuing to speed or take unnecessary risks (78). This "carryover" effect can be attributed to the emotional toll of congestion, as drivers attempt to compensate for lost time or vent residual frustration (79). Studies also found that individuals with low distress tolerance are particularly prone to both impulsive driving behavior and post-congestion aggression, as their inability to cope with stress leads to prolonged emotional dysregulation (79, 80). This research suggests that the effects of traffic stress are not confined to the immediate driving environment but can extend throughout a driver's day, influencing their behavior in other contexts as well.

Personality traits, particularly high levels of trait aggression, could predict the likelihood of engaging in aggressive driving. For example, some studies demonstrated that aggressive drivers are often linked to aggressive personality traits (76, 81). These drivers are more likely to tailgate, honk excessively, or even engage in dangerous maneuvers like brake-checking or cutting off other vehicles (76, 81). Similarly, another study found that personality traits, such as neuroticism, agreeableness, and conscientiousness, are linked to aggressive driving (82). Interventions targeting personality traits, such as anger management or impulse control strategies, may therefore play a role in reducing aggressive driving behaviors.

Gender differences play an important role in how drivers experience and respond to stress on the road, with men and women exhibiting distinct patterns of aggressive driving behavior. While men are generally more likely to engage in overtly aggressive actions such as speeding, tailgating, and aggressive overtaking, women tend to experience higher levels of stress and anxiety during their commutes, often because of juggling multiple responsibilities such as work, childcare, and responsibilities at home (83). Specifically, women are more likely to report feeling overwhelmed by the demands of commuting, which may contribute to heightened feelings of frustration and emotional fatigue, even if their actual driving behaviors remain more cautious (83). Gee and Takeuchi found that women in high stress commuting environments were more likely to experience negative health outcomes, such as hypertension and chronic fatigue, because of their elevated stress levels (84). Men, on the other hand, are more likely to channel their stress into outward displays of aggression, particularly when they perceive that other drivers are slowing them down or acting in ways that hinder their progress (84). These gender differences highlight the importance of tailoring traffic interventions to address the specific stressors and behavioral patterns of different demographic groups.

Chronic exposure to high-traffic environments has far-reaching consequences for both physical and mental health, with long-term effects that extend beyond the driving experience. Gee and Takeuchi found that individuals who commute regularly through high-traffic areas are at greater risk of developing long-term health issues, particularly those related to stress (84). Other bodies of work show associations between traffic delays and its long-term effect on mental health and well-being (85, 86). Hennessy and Wiesenthal also highlighted that prolonged exposure to traffic delays and congestion elevates blood pressure levels in drivers, increasing the risk of cardiovascular complications (75). This research underscores the need for systemic solutions to the health impacts of commuting, which go beyond individual stress management.

The internal environment of the vehicle can also exacerbate stress levels, contributing to aggressive driving behaviors. Factors such as poor air quality, excessive noise, and uncomfortable seating have all been shown to increase driver stress, particularly during long commutes or periods of heavy traffic (87). Bitkina et al. found that drivers who were exposed to high levels of noise or uncomfortable vehicle conditions were more likely to engage in risky behaviors, as these environmental stressors compounded the frustration of congested traffic (88). Additionally, Stokols et al. demonstrated that factors such as excessive heat, poor ventilation, and noise pollution inside the vehicle can amplify feelings of irritability and frustration, making drivers more likely to act out aggressively (89). These findings highlight the potential benefits of enhancing in-car comfort and ergonomics to mitigate stress and promote safer driving behavior.

Finally, social norms and cultural factors play a significant role in shaping aggressive driving behaviors, with certain regions or driving cultures normalizing actions such as honking, tailgating, or cutting off other drivers. In some areas, these behaviors are not only accepted but are seen as necessary to navigate congested traffic effectively. Ellison-Potter et al. highlight the concept of social contagion in aggressive driving, where drivers who witness others engaging in aggressive behaviors are more likely to do so themselves (90). Similarly, other research identified differences in driver aggression when comparing individuals' perceptions of their own behavior versus others, as well as cross-cultural variations in driver aggression, aberrant behaviors, and positive driving habits across five countries (91).

### **3.4. Psychological Effects of the Consequences of Climate Change**

The psychological consequences of climate change, particularly in relation to aggression and disinhibition, are increasingly becoming a focus of scholarly attention. Several studies, including those by Miles-Novelo and Anderson, have pointed to the direct link between rising temperatures and heightened aggression (92). This relationship is explained through the General Affective Aggression Model, which posits that heat exacerbates hostile emotions and aggressive behavior. Rinderu et al. study this further by suggesting that in hotter climates, individuals may exhibit lower self-control due to reduced seasonal variation, which in turn leads to a higher likelihood of violent behavior (93). Together, these studies highlight the dual impact of climate on both cognitive processes—like self-regulation—and affective responses, creating conditions ripe for disinhibition and aggression. As climate change accelerates, the increased exposure to high temperatures could further heighten these psychological stressors, pushing more individuals toward impulsive and violent actions.

Ecomigration, or the movement of populations due to environmental degradation, further complicates the psychological landscape, as it often leads to group-level aggression. Miles-Novelo and Anderson explore how migration driven by climate change, especially in areas experiencing resource scarcity, exacerbates tensions between communities (94). Migration-induced stressors, including economic displacement, food insecurity, and cultural disruptions, create environments in which aggression is more likely to manifest, as people struggle for limited resources (94). The findings of Palinkas and Wong similarly underscore how climate-related displacement can lead to mental health issues such as anxiety, depression, and even increased violence within host communities (95). Together, these studies emphasize that the pressures of ecomigration can profoundly impact both individual and community well-being,

*Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

heightening the risk of conflict and antisocial behaviors as climate-induced displacement intensifies globally.

High heat not only triggers immediate aggression but also compromises long-term cognitive and emotional stability. Evans argues that prolonged exposure to extreme weather conditions, such as heat waves, affects both physiological and psychological functioning, contributing to an overall increase in psychological distress and emotional dysregulation (96). This is corroborated by findings from Kim et al., who documented a significant rise in assault deaths as temperatures increased, further emphasizing the direct link between ambient temperature and violence (97). Anderson et al. found that high temperatures are associated with increased aggression, both on and off the road, as heat can lead to emotional dysregulation and heightened frustration (98). Thus, climate change-induced heat serves as a persistent factor contributing to long-term psychological degradation.

Heat has also been shown to exacerbate psychiatric emergencies, particularly in vulnerable populations. Studies by Palinkas and Wong reveal that individuals living in low-income regions or in areas frequently exposed to extreme weather are at heightened risk for developing mental health conditions, including aggression and violence (95). Similarly, the work of Walinski et al. demonstrates that chronic exposure to heat waves can aggravate pre-existing mental health conditions, leading to an increase in psychiatric hospitalizations and violent behavior (99). This suggests that extreme weather acts as a trigger for individuals already predisposed to psychological distress, intensifying their symptoms and pushing them toward more aggressive and antisocial behavior. The convergence of climate stressors and existing vulnerabilities ultimately creates a dangerous cycle of escalating mental health crises.

Children and adolescents are particularly vulnerable to the psychological impacts of climate change, as their developmental stages leave them less equipped to handle the stresses associated with environmental degradation. Vergunst and Berry discuss how the cumulative effects of climate-related threats, such as heat waves and natural disasters, increase the likelihood of psychopathology in young people (100). This is supported by Charlson et al., who reviewed global data and found that climate change exacerbates mental health issues in children, including anxiety, depression, and behavioral problems (101). Moreover, children in low-income areas are disproportionately affected, as they have fewer resources to cope with these stressors (95). The psychological strain brought on by climate-related disruptions during crucial developmental periods could have lasting effects, including increased disinhibition and aggressive tendencies, as these individuals age into adulthood.

The indirect effects of climate change on mental health extend beyond just the physical experience of extreme weather. Cianconi et al. emphasize that the loss of community identity due to environmental degradation can contribute to feelings of helplessness, despair, and even antisocial behaviors (102). This is consistent with Trombley et al.'s findings, which suggest that the disintegration of social networks and the destruction of cultural landmarks due to climate change increase the risk of mental health problems, including violence and aggression (103). In both cases, the psychological toll of losing one's sense of place and belonging due to climate change-related phenomena is profound. As such, addressing the psychological effects of climate change will require not just mitigating its physical impacts but will also require investing in

*Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

community resilience and cohesion to preserve social bonds and reduce the likelihood of antisocial behavior.

Moreover, the phenomenon of ecoanxiety, which refers to the chronic fear of environmental doom, has been linked to both direct and indirect pathways of mental health deterioration. Berry et al. propose a framework to explain how climate change exacerbates mental health issues by creating existential threats that affect not only individual psychological well-being but also collective mental health (101). This aligns with the findings of Bourque and Willox, who show that individuals experiencing acute environmental events, like hurricanes or floods, often face post-traumatic stress disorder (PTSD) and generalized anxiety, both of which can lead to aggressive or impulsive behavior (104). Thus, the psychological strain from the constant threat of climate-related disasters potentially leads to widespread emotional instability, making it harder for individuals to uphold social norms and behavioral boundaries.

Social inequality, already a driver of aggression and violence, is further intensified by climate change. Rinderu et al. argue that socioeconomic disparities, compounded by the effects of rising temperatures, lead to higher rates of violence in disadvantaged communities (93). Income inequality, combined with the stressors of living in environmentally degraded areas, amplifies feelings of frustration and anger, potentially resulting in increased aggression (93). This is echoed in studies by Evans, who found that economic stress due to climate-related events such as droughts and floods significantly increases interpersonal conflict and aggression, particularly in low-income communities (96). As climate change continues to disproportionately affect marginalized populations, the psychological strain of coping with these compounded stressors could lead to even greater incidents of aggression and antisocial behavior.

The connection between climate change and mental health also raises concerns about the broader implications for public health. Hayes et al. argue that climate change accelerates mental health risks through a combination of direct (e.g., heat exposure) and indirect (e.g., economic loss, displacement) pathways, disproportionately affecting already vulnerable groups (105). They emphasize that addressing these mental health impacts requires coordinated, systemic interventions that focus not only on immediate physical needs but also on the long-term psychological effects of climate-related stressors. This point is supported by Charlson et al., who call for more research into effective mitigation strategies that address the psychosocial dimensions of climate change (101). Together, these studies highlight the urgent need for holistic public health approaches that incorporate mental health interventions alongside environmental and economic strategies to mitigate the psychological consequences of climate change.

Tying all this literature together, the psychological impacts of climate change are complex, influencing both individuals and communities through direct and indirect effects. Rising temperatures exacerbate aggression and emotional dysregulation, while the broader socioeconomic disruptions caused by climate-related events further contribute to antisocial behaviors. Vulnerable populations, including children, low-income communities, and those with pre-existing mental health conditions, are particularly at risk for heightened psychological distress. The compounding effects of climate change on mental health underscore the need for comprehensive interventions that address not only the physical consequences of environmental degradation but also the complex psychological and social dynamics at play. As climate change

continues to reshape global environments, the mental health challenges it poses will only become more pressing, necessitating a concerted effort from policymakers, mental health professionals, and researchers alike to develop adaptive strategies for coping with these unprecedented challenges.

## **4. Best Practices for Highway Safety Laws**

### **4.1. Occupant Protection Laws: Seat Belt Use**

Seat belts are one of the most basic yet essential safety measures in motor vehicles, providing critical protection in the event of a crash. The stark consequences of failing to use a seat belt are evident in data from fatal crashes, where 81% of fully ejected passenger vehicle occupants were killed (106). In contrast, less than 1% of restrained occupants were fully ejected, compared to a disturbing 26% of unrestrained occupants (106). This significant difference highlights the effectiveness of seat belts in reducing ejection from vehicles, which is often fatal. Lap-shoulder belts significantly reduce risks for all front-seat passengers. When used correctly, they reduce the risk of fatal injury by 45% for front-seat car occupants and by 60% for light truck occupants (106).

The implementation of primary enforcement seat belt laws—where law enforcement officers can stop and ticket a driver solely for not wearing a seat belt—has proven to be a successful strategy for increasing seat belt use. Research suggests that in several states, the enactment of these laws has led to a 10-15% increase in seat belt usage rates and an 8% reduction in fatalities (106-107). A national survey conducted in 2014 demonstrated the overall effectiveness of such laws, with 87% of front-seat occupants wearing seat belts (108). Notably, the compliance rate was significantly higher in states with primary enforcement laws (90%) compared to those without (79%) (108). The result of these higher compliance rates is profound, as nearly 14,000 lives are saved annually due to seat belt use (106). If all passengers over the age of five consistently wore seat belts in fatal crashes, one study estimates that an additional 2,600 lives could be saved every year (106).

While primary enforcement for front-seat belts is widely adopted across states, rear seat belt laws have yet to achieve the same level of adoption, leaving a critical gap in highway safety. The misconception that the rear seat is inherently safer often leads to lower seat belt usage among backseat passengers, contributing to increased risks. Unrestrained rear-seat occupants can become dangerous projectiles in a crash, posing a significant risk to themselves and to front-seat passengers by striking the vehicle's interior or others with force. Despite this danger, only 82% of rear-seat occupants were observed using seat belts in 2022 (109). Research shows that using lap and shoulder belts in the center rear seat reduces the risk of fatal injury by 58% and 75% in cars and SUVs, respectively (110). By implementing primary enforcement for rear seat belts, states can not only close a crucial safety gap but also foster a culture of safety that ensures every passenger is adequately protected, regardless of seating position.

## **4.2 Motorcycle Helmet Laws: A Life-Saving Measure**

Motorcyclists are one of the most vulnerable groups on the road, and helmet use is a critical factor in reducing their risk of fatal injuries. Helmets decrease the chance of fatal injury by 37% for motorcycle operators and by 41% for passengers (106). Moreover, helmets significantly reduce the risk of head injury by 69%, underscoring their role in preventing life-altering traumas (106). Each year, helmet use is credited with saving approximately 1,800 motorcyclist lives (106). However, the potential for saving lives is even greater; an additional 750 motorcyclist fatalities could be prevented annually if all riders wore helmets (106).

Universal helmet laws have proven to be particularly effective in increasing helmet use and reducing motorcycle-related injuries and fatalities. When these laws are in place, compliance rates tend to soar because violations are easily visible and enforceable, creating a clear incentive for riders to wear helmets. For instance, in Australia, the introduction of a universal helmet law resulted in a dramatic increase in helmet use, reaching a reported rate of 99% among motorcycle operators (111). Similarly, other studies show that motorcycle helmet laws increase helmet usage by 40 to 50 percentage points, and even a conservative rise of 40 points leads to a 14.8% reduction in fatalities (112 – 113). This high level of adherence underscores how effective universal laws can be in encouraging safe riding behavior. On a global scale, 90 nations, which account for roughly 77% of the world's population, have adopted mandatory helmet laws that not only require the use of helmets but also set performance standards to ensure they provide adequate protection (108). The widespread adoption of such laws, combined with stringent standards for helmet quality, has consistently demonstrated significant reductions in both fatalities and severe head injuries. The benefits extend beyond individual safety, as increased helmet use also leads to broader public health gains by reducing the burden on emergency services, lowering medical costs, and enhancing overall road safety.

Despite their proven efficacy in reducing injuries and fatalities, all-rider helmet laws frequently encounter resistance and challenges within state legislatures. For instance, a study found that only 17 states and D.C. have all-rider helmet laws, and these laws are threatened every year in state legislatures (114). Efforts to repeal or weaken these laws are not uncommon, often driven by arguments for personal freedom or lobbying from groups opposed to mandated helmet use. However, such rollbacks are problematic because repealing or weakening all-rider helmet laws can quickly and significantly reverse the safety gains achieved through their implementation. When helmet laws are weakened, compliance drops, and the risk of head injuries and deaths among motorcyclists sharply increases, undoing years of progress in improving road safety. In practice, states that have repealed universal helmet laws have seen immediate declines in helmet use and corresponding spikes in fatalities and serious head injuries. (115 – 117). This underscores the critical need not only to maintain these laws but also to reinforce and strengthen them to ensure consistent protection for motorcyclists.

## **4.3 Child Passenger Safety Laws: Protecting the Youngest Passengers**

Children are among the most vulnerable road users, and special laws exist to protect them. In 2019, an average of three children under the age of 14 were killed daily in vehicle crashes in the

## *Enhancing Highway Safety: Exploring the Drivers of Aggressive Driving and Speeding and Best Practices for Reducing Dangerous Driving Behaviors*

U.S., totaling 1,053 fatalities and 183,143 injuries that year (106). Child safety seats play a vital role in reducing these tragic numbers. Properly used, they reduce fatal injuries by 71% for infants and 54% for toddlers in passenger cars (106). Additionally, around 300 lives of children aged four and younger are saved annually because of proper restraint in vehicles (106).

States have enacted various child passenger safety laws to maximize protection. Rear-facing seats are recommended for young children through the age of two, as they provide optimal protection for a child's developing body in a crash. Currently, only 16 states and Washington, D.C., have enacted laws requiring children to remain rear facing until age two. For children who outgrow their forward-facing seats, booster seats are recommended until they reach 57 inches in height or are eight years old. However, only 14 states have adopted optimal booster seat laws (106).

The benefits of expanded child restraint laws are evident. According to the Insurance Institute for Highway Safety (IIHS), these laws have been associated with a 5% reduction in injuries of any severity among children, a 17% reduction in fatal and incapacitating injuries, and a threefold increase in the likelihood that children are in appropriate restraints (106). Furthermore, these laws have led to a 6% increase in the number of booster-seat-aged children seated in the rear of the vehicle, where they are better protected in a crash (106). All of this suggests why rear-facing car seats are recommended as the safest option for young children through the age of two, as they provide crucial support for the head, neck, and spine during a crash. States that have enacted laws mandating rear-facing seats until age two have taken an important step toward improving child passenger safety. However, there is still a need for more states to adopt these regulations to ensure uniform protection across the country.

### **4.4. Teen Driving Laws: Mitigating Risks for Novice Drivers**

Teen drivers are at a substantially higher risk of being involved in fatal crashes compared to other age groups, primarily due to their lack of driving experience and their tendency to engage in risky behaviors. Factors such as speeding, distractions from mobile devices or passengers, and driving under the influence of alcohol contribute to their increased vulnerability on the road. In 2019, there were 4,356 fatalities associated with crashes involving young drivers between the ages of 15 and 20 (106). This alarming figure includes 1,603 young drivers themselves, 880 passengers riding with these young drivers, and an additional 1,873 individuals who were not in the teen drivers' vehicles, such as pedestrians, cyclists, or occupants of other vehicles (106). These statistics highlight the broader impact of teen driving crashes, affecting not only the drivers but also their passengers and other road users, emphasizing the urgent need for interventions focused on improving teen driving safety and behavior.

GDL programs have been identified as a critical intervention to reduce these numbers by providing a staged approach to driver licensing that helps teens gain experience under less risky conditions. Key components of GDL programs include passenger restrictions, nighttime driving curfews, a minimum of 50 hours of supervised driving, a six-month holding period before advancing to a full license and setting the minimum age for obtaining a learner's permit at 16. Studies have shown that GDL programs can reduce teen driver involvement in fatal crashes by up to 11-21% (118). By gradually granting driving privileges as teens gain experience, GDL laws help foster safer driving habits and reduce crash risks.



Several provisions have been recognized as best practices within GDL programs to further minimize risks and enhance safety for teen drivers. One key measure is the implementation of passenger restrictions, which limit the number of young passengers a novice driver can carry. This is crucial because the presence of peers often encourages riskier behaviors, such as speeding or distracted driving, elevating the chances of crashes. Nighttime driving restrictions are another critical component, as teens face higher crash risks during evening hours due to reduced visibility, fatigue, and increased likelihood of impaired driving. By limiting unsupervised driving at night, these restrictions help mitigate potential dangers. Additionally, requiring a minimum holding period of six months before teens can advance to an unrestricted license ensures they have sufficient time to develop their driving skills in low-risk environments, gaining experience and confidence before acquiring full driving privileges. According to the CDC, all 50 states and the District of Columbia have some form of GDL program (119). Based on the Insurance Institute for Highway Safety, if every state adopted the strictest limitations on five components—minimum permit age of 16, minimum intermediate license age of 17, at least 65 hours of supervised driving, nighttime driving restrictions starting at 8 pm, and banning all teen passengers—it could reduce crashes by more than 9,500 and save over 500 lives each year (120). Together, these provisions contribute to a more structured learning process and provide necessary safeguards during the critical period when teens are developing their driving habits.

#### **4.5. Impaired Driving Laws: Addressing Alcohol-Related Crashes**

Impaired driving remains a leading cause of traffic fatalities, accounting for nearly 30% of all road deaths in the U.S. and resulting in approximately 30 deaths per day (106). The economic toll of alcohol-involved crashes, where the BAC was over .08%, is immense, with economic costs reaching \$44 billion and comprehensive societal costs totaling \$201 billion (106). The introduction of .08% BAC laws, a national minimum drinking age of 21, and zero-tolerance BAC laws for youth has been crucial in reducing alcohol-related fatalities, with federal leadership playing a key role in the rapid adoption of these lifesaving measures. Despite these measures, impaired driving continues to pose significant challenges, particularly among certain demographic groups, including young drivers and repeat offenders.

Ignition Interlock Devices (IIDs) have emerged as one of the most effective tools for reducing impaired driving. Studies have shown that IIDs reduce alcohol-involved crash deaths by 15%, and states with mandatory IID laws have seen a reduction in fatalities comparable to the number of lives saved by the deployment of frontal airbags (121). When installed, IIDs are associated with a 70% reduction in arrest rates for impaired driving and reduce recidivism among both first-time and repeat DWI offenders by 50-90% (106). As of 2019, 34 states and Washington, D.C., require IIDs for all offenders, including first-time offenders (106). Utah has one of the most stringent IID laws, requiring anyone convicted of a DUI alcohol violation to be ignition interlock restricted for three years if under 21 and for 18 months if 21 or older (122). These types of comprehensive IID policies significantly contribute to deterring impaired driving and preventing repeat offenses.



## **4.6. Child Endangerment Laws**

As of 2019, child endangerment laws, which create separate offenses or enhance penalties for driving under the influence with a minor in the vehicle, are currently enacted in 48 states and Washington, D.C. (106). The importance of these laws is underscored by the fact that in 2019, 204 children aged 14 and younger were killed in crashes involving alcohol-impaired drivers (106). Moreover, impaired drivers are far less likely to ensure proper child restraint, as data shows that in fatal crashes, only 18% of children were properly restrained by impaired drivers (106). Public support for these laws is high, with over 76% of respondents in a survey by the AAA Foundation for Traffic Safety supporting laws preventing the transport of a minor by an alcohol-impaired driver (106). These child endangerment laws not only act as a deterrent to impaired driving but also emphasize the heightened responsibility of protecting vulnerable passengers. By imposing stricter penalties, they aim to prevent alcohol-impaired driving scenarios that put children at increased risk and promote safer driving behaviors among caregivers.

## **4.7. Open Container and Sobriety Checkpoint Laws**

States with sobriety checkpoint laws have 18.2% lower rates of drinking and driving compared to those without such laws, and states that conduct monthly sobriety checks experience a reduction of 40.6% in drinking-driving incidents (123). While there was no significant link between simply having an open container law and rates of drinking-driving, states that actively enforce open container regulations saw a 17.6% decrease in drinking and driving (123). Open container laws, which prohibit the possession of open alcoholic beverages in vehicles, have proven effective in reducing impaired driving and hit-and-run crashes, with 39 states and D.C. currently meeting federal standards for these laws as of 2019 (106).

## **4.8. Distracted Driving Laws**

Distracted driving has become a significant road safety challenge, contributing to 3,142 fatalities in 2019, marking a 9.9% increase from the previous year (106). Crashes involving distracted drivers impose a heavy economic burden, with costs reaching an estimated \$40 billion in 2010, equivalent to \$48 billion when adjusted for inflation (106). The use of mobile phones while driving is particularly hazardous, increasing crash risk by as much as four times, with no substantial safety difference between hand-held and hands-free devices (106). Beyond mobile phone use, other distractions such as adjusting in-vehicle systems, eating, and interacting with passengers further contribute to driver inattention and the likelihood of crashes.

To mitigate the dangers of distracted driving, 49 states and Washington, D.C., have banned text messaging for all drivers (124). Furthermore, 31 states and D.C. have implemented GDL restrictions on cell phone use for novice drivers, and 14 states and D.C. have banned all drivers from using hand-held cell phones while driving (106). These restrictions play a vital role in reducing distracted driving and improving overall road safety, with some studies indicating that Ohio's ban on handheld phone use resulted in a 7.4% decrease in smartphone distractions seven months after its implementation (125). One of the most effective strategies to reduce distracted driving among young drivers is to incorporate cell phone restrictions into GDL laws. As novice drivers are still developing safe driving habits, limiting their use of mobile devices while driving significantly reduces their risk of distraction-related crashes.

## **4.9. High BAC Sanctions and Addressing Test Refusals**

High Blood Alcohol Concentration (BAC) sanctions are a critical component in tackling the dangers posed by severely impaired drivers, as they specifically target those who present the highest risk on the roads. As of 2015, 45 states and Washington, D.C., have introduced enhanced penalties for drivers with high BAC levels, generally defined as 0.15% or higher, to deter dangerous behaviors (126). These sanctions often include longer license suspensions, mandatory ignition interlock devices, higher fines, and more severe criminal charges. Evaluations of these measures, such as the high BAC law implemented in Minnesota, have shown that they result in tougher legal consequences for offenders and contribute to an initial reduction in recidivism rates (127). Offenders faced greater likelihood of case convictions and stricter sentences, reinforcing the message that driving with a high BAC carries serious repercussions. However, for these sanctions to maintain their deterrent effect, it is imperative that their enforcement remains consistent and their severity is upheld over time. Without sustained enforcement, there is a risk that their effectiveness could diminish, potentially leading to a resurgence in repeat offenses and impaired driving incidents.

Refusal to take a BAC test poses a major challenge in prosecuting impaired driving cases, with an average of 24% of drivers arrested for DWI refusing the test (128). To address this issue, all states have established penalties for refusal, such as license revocation or suspension. However, research indicates that refusal rates are lower in states where the penalties for refusal are more severe than those for test failure, as highlighted by Zwicker, Hedlund, and Northrup (129). This suggests that stronger penalties for refusal can act as an effective deterrent. Moreover, criminalizing BAC test refusal can further reduce refusal rates and increase the likelihood of DWI convictions, as well as ensure that repeat offenders are properly identified during future arrests (128). Although the impact of stronger test refusal penalties on alcohol-impaired crashes has not been directly studied, these measures are believed to enhance enforcement and accountability in impaired driving cases.

Some states issue warrants to compel drivers to provide blood samples when they refuse breath tests, a strategy that has proven to be highly effective in reducing refusal rates and strengthening impaired driving prosecutions. These measures ensure that evidence of impairment can be collected, even in cases where a driver initially refuses to comply with a breath test. For example, in states such as Arizona, Michigan, Oregon, and Utah, the use of warrants has significantly decreased the number of refusals, leading to a more streamlined judicial process (130). This practice not only results in more plea agreements, which help reduce the burden on court systems, but also fewer trials and ultimately higher conviction rates for impaired driving offenses. The overall impact of this approach has enhanced the ability of law enforcement and judicial systems to effectively address and deter impaired driving.

## **4.10. The Role of Administrative License Revocation and Zero Tolerance Laws**

Administrative license revocation (ALR) laws, which allow law enforcement to immediately suspend or revoke the driver's license of individuals who fail or refuse a BAC test, have been shown to significantly decrease alcohol-impaired driving incidents. Research has demonstrated that ALR laws contribute to a reduction in nighttime fatal crashes by about 9%, with overall

nighttime crashes also dropping by 5-9% in states that have enacted these measures (131). These reductions are likely due to the deterrent effect of immediate consequences for impaired driving, which has a stronger impact than delayed judicial proceedings. Alongside ALR laws, zero-tolerance policies targeting underage drinking and driving have also had a substantial impact on road safety. By setting the legal BAC limit for drivers under 21 at zero or near-zero, these laws have led to a 17-24% reduction in alcohol-related fatal crashes among youth. This has contributed to an overall 4% decrease in DUI-related fatalities, highlighting the effectiveness of these laws in both preventing impaired driving among young drivers and improving public safety across all age groups (132 – 133).

## **5. DISCUSSION**

### **5.1 State-Based Initiatives and Policy Changes to Curb Aggressive Driving and Speeding**

In reviewing highway safety plans and annual reports from various states, several common themes emerge regarding strategies to address speeding and aggressive driving. Across the country, states are employing diverse approaches, ranging from public information and education campaigns to high-visibility enforcement and partnerships with private companies and local schools. These efforts are complemented by targeted social media outreach, research, and surveys that provide critical data to guide decision-making. While the core focus remains on reducing dangerous driving behaviors, states tailor their approaches to fit local contexts, ensuring that their initiatives are culturally relevant and data driven.

High-visibility enforcement has been confirmed to be an effective strategy in reducing dangerous driving behaviors, as highlighted by previous studies from the National Highway Traffic Safety Administration (134). HVE combines visible law enforcement activities with public education and communication campaigns, making road users more aware of the presence of law enforcement and the risks of dangerous behaviors like speeding and aggressive driving. Other studies show that such campaigns not only increase seat belt use but also reduce dangerous driving behaviors, such as speeding, by raising public awareness of enforcement activities (135). However, while many states have embraced HVE strategies for other traffic safety issues like seat belt use, the same level of support for educational campaigns specifically targeting speeding and aggressive driving is often lacking.

A critical challenge in addressing speeding and aggressive driving is the lack of consistent educational messaging to match the enforcement efforts. While many states rely heavily on crash data to inform their enforcement campaigns, fewer have comprehensive education campaigns that communicate the dangers of speeding and aggressive driving to the public. Furthermore, some studies show that public attitudes toward speed make it difficult for policymakers to advocate for meaningful speed reduction laws (136). In addition to enforcing specific aggressive driving violations, some states have found success in targeting precursors to aggressive driving, such as blocking intersections or failing to yield. States with policies allowing law enforcement to refer habitual aggressive drivers to state licensing agencies for potential suspension or revocation of driving privileges further demonstrate the multifaceted approach needed to reduce these dangerous behaviors.

Other research on combatting aggressive driving and speeding offered potential interventions that were not clearly reflected in the review of state highway planning documents. For example, some studies suggest that enforcing precursors to aggressive driving—such as blocking failing to yield the right-of-way, and abruptly changing lanes—can be an effective strategy in reducing overall aggressive driving incidents (137). These early interventions address behaviors that often escalate into more dangerous driving patterns. Additionally, referring habitual aggressive drivers to state licensing agencies presents another avenue for reducing road risks. When officers have access to motorists' driving histories, they can identify patterns of aggressive behavior and, if necessary, refer the driver for a license suspension or revocation (137). Such measures allow for targeted enforcement that prioritizes drivers with a consistent history of unsafe driving, offering a more tailored approach to addressing aggressive driving beyond standard traffic stops.

## **5.2 Psychological, Social, and Environmental Drivers of Aggressive and Reckless Driving**

The research underscores that while civil and criminal penalties are essential tools for deterring reckless driving, their effectiveness is limited without adequate enforcement and complementary social interventions. If certainty and swiftness of punishment are indeed more crucial than the severity of penalties in altering driving behaviors, policymakers should recognize that simply increasing fines or legal consequences will not be enough to curb reckless driving. Instead, a focus on improving enforcement mechanisms, such as more frequent roadside checks or specialized court programs, is necessary to ensure drivers perceive a real risk of being caught. The addition of non-legal deterrents, such as public education campaigns and addressing the psychological triggers of aggressive driving, offers a more comprehensive approach to managing road safety.

The findings from this research highlight the significant role that psychological, social, and environmental factors play in shaping aggressive and reckless driving behaviors. The clear influence of the COVID-19 pandemic, with its associated psychological stressors such as isolation, anxiety, and impulsivity, has exacerbated risky driving actions. This suggests that the pandemic not only disrupted social norms but also potentially created a more dangerous driving environment. The rise in impulsive and aggressive behaviors during this time may have long-term implications for road safety as these behaviors become ingrained habits for many drivers. The role of environmental stressors, particularly traffic congestion and extreme heat due to climate change, further adds complexity, suggesting that the future of driving behaviors could be influenced by both psychological and environmental shifts.

One surprising finding is the significant impact of climate change on aggressive driving. While the role of environmental factors such as traffic congestion in driving aggression has been previously studied, the direct link between rising temperatures and increased aggression is a relatively newer area of focus. As climate change accelerates, extreme heat has been shown to lead to emotional dysregulation and heightened frustration, making drivers more prone to risky behaviors. This suggests that future road safety strategies must account for the broader effects of climate change, not just in terms of physical road conditions but also the mental and emotional toll of extreme weather on drivers. The psychological strain caused by climate change could thus become a key factor in future discussions of aggressive driving interventions.

### **5.3 Best Practice Laws for Promoting Highway Safety**

The adoption of effective laws and interventions, including occupant protection laws, motorcycle helmet requirements, child passenger safety laws, and teen driving regulations, has been pivotal in reducing injuries and fatalities. For example, seat belt use is essential in reducing crash-related injuries, with primary enforcement seat belt laws proving highly effective in increasing compliance and reducing fatalities. However, gaps in safety remain, particularly regarding rear seat belt use, where misconceptions about safety and the lack of comprehensive enforcement contribute to lower use rates. Similarly, helmet laws for motorcyclists are associated with significant reductions in fatalities and severe head injuries. The presence of universal helmet laws has consistently resulted in high compliance rates, reduced trauma, and public health benefits through lower medical costs.

To further promote highway safety, the study highlights the importance of teen driving laws and zero-tolerance policies for impaired and distracted driving. GDL programs are crucial for new drivers, providing structured opportunities for skill development in low-risk conditions, ultimately reducing teen driver fatalities. Meanwhile, strong impaired driving laws, such as IIDs and child endangerment regulations, offer comprehensive protection against alcohol-related crashes. Enhanced enforcement of distracted driving laws, through handheld device bans and GDL restrictions on mobile use, serves as an additional measure to promote safer driving habits. Together, these best practice laws provide a framework for reducing risky behaviors, saving lives, and fostering a culture of safe driving practices across all age groups and vehicle occupants.

## **6. SUMMARY AND CONCLUSION**

This research examined the significant threats posed by aggressive driving and speeding to highway safety. The study offered a comprehensive view of the causes and solutions to speeding and aggressive driving by comparing potential state countermeasures from the past 3-5 years, examining the psychological and environmental factors behind reckless driving, and evaluating best practice laws designed to improve road safety. The findings from the study highlight that a multi-faceted approach—encompassing enforcement, public education, partnerships, and targeted interventions—is essential for effectively reducing instances of speeding and aggressive driving.

In conclusion, a comprehensive strategy that integrates robust enforcement, policy reform, and education is necessary to address the behavioral triggers and environmental stressors contributing to dangerous driving. The study emphasizes the importance of evidence-based policies and underscores the need for ongoing research to adapt and refine interventions based on real-time traffic data and behavioral trends. Future research should focus on evaluating the effectiveness of such strategies over time, with the goal of enhancing the sustainability and impact of road safety measures. By doing so, policymakers can develop more adaptable, data-driven solutions to ensure safer roads for all users.



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