

Review

Driving Safer: A Look at How Men and Women Use Advanced Driver Assistance Systems

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Abstract: *Objective* — This study investigates the nuanced landscape of gender-specific patterns in utilization of Advanced Driver Assistance Systems (ADAS), aiming to contribute insights to enhance road safety.

Methods — Leveraging data from diverse sources, including Scopus, Web of Science, and Google Scholar, the method employed involves a meticulous examination of studies exploring gender differences in driving behaviors and ADAS adoption. Key factors influencing these differences, were analyzed including age, experience, and attitudes toward technology. Cultural and societal influences on gender-specific driving behaviors are explored, shedding light on the intricate interplay of perceptions and expectations.

Results — The review identifies challenges in ADAS adoption, including limited awareness, misconceptions, and resistance to change. Opportunities for improvement are then outlined, encompassing comprehensive user training, clear communication of ADAS features, customizable settings, and incentives for ADAS-equipped vehicles. This study showed that men tend towards aggressive driving behaviors, while women prioritize caution and adherence to traffic rules. Women propensity for safety-oriented features such as lane-keeping assistance, while men display a preference for convenience-focused features such as adaptive cruise control and parking assistance.

Conclusion — By addressing challenges and embracing opportunities, the study advocates for a future where ADAS technologies contribute significantly to safer and more equitable roadways for all drivers.

Keywords: advanced driver assistance systems, gender difference, road safety, driving behaviors.

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Introduction

Crashes and road trauma represent significant public health challenges worldwide, causing immense human suffering, economic losses, and societal burdens. According to the World Health Organization (WHO), road traffic injuries are a leading cause of death globally, particularly among young adults aged 15-29 years old. The statistics surrounding road accidents are staggering, with millions of lives lost and many more sustaining severe injuries each year. In light of these sobering realities, the importance of implementing effective measures to prevent road accidents and minimize their impact cannot be overstated. Driver Assistance Systems (ADAS) have emerged as crucial tools in the ongoing effort to improve road safety. This literature review explores existing studies differences men and women in utilization of ADAS with aiming to provide insights into gender-specific patterns of ADAS usage for safer driving. ADAS encompasses a variety of technologies, including adaptive cruise control, lane departure warning, automatic emergency braking, and parking

assistance [1]. These systems aim to mitigate human errors, enhance vehicle safety, and reduce the likelihood of accidents.

Studies consistently highlighted gender variations in driving behaviors. Studies by Du X, et al. [2] suggest that men exhibit more aggressive driving behaviors, while women may prioritize caution and compliance with traffic rules. These differences may influence the adoption and use of ADAS. Several studies investigated adoption rates and usage patterns of ADAS by gender.

Age, driving experience, and attitudes toward technology identified as influential factors in ADAS usage. Some studies indicate that younger drivers, regardless of gender, are more receptive to adopt ADAS technologies, while older drivers may exhibit reservations [3]. Studies evaluating the effectiveness of ADAS in promoting safer driving have yielded mixed results [4]. ADAS technologies, such as automatic emergency braking, significantly reduce collision rates, while others may have limitations in specific driving scenarios. Public perception and awareness play a crucial role in the acceptance and usage of ADAS

[5] that suggest increasing awareness through educational campaigns may positively impact both men and women's attitudes toward ADAS technologies.

Challenges in promoting ADAS adoption include concerns about system reliability, affordability, and the need for standardized regulations. Opportunities lie in addressing these challenges to create a more inclusive and widespread adoption of ADAS [6]. Understanding how men and women use ADAS has significant implications for road safety initiatives. Integrating gender-specific insights into the design and promotion of ADAS technologies can enhance their effectiveness in preventing accidents and reducing road fatalities [7].

This study aims to contribute to the evolving discourse on ADAS utilization by providing a comprehensive review of existing studies, shedding light on how men and women differ in their patterns of usage. Ultimately, the findings aspire to inform strategies that enhance the integration of ADAS into driving practices for a safer and more secure road environment.

Method

The selection of relevant articles for this review was conducted through a comprehensive literature search. Databases including Scopus, Web of Science, and Google Scholar were employed to identify scholarly articles, conference papers, and reviews related to the utilization of Advanced Driver Assistance Systems (ADAS) with a focus on gender-specific patterns. The search queries involved a combination of keywords such as ADAS, gender differences, driving behavior, and road safety.

To ensure the inclusion of pertinent studies, specific criteria were established. Articles were considered eligible if they focused on the utilization of ADAS technologies, explored gender-specific patterns of ADAS usage, and provided empirical data or insights into the intersection of gender and ADAS adoption. Studies that primarily concentrated on unrelated topics, lacked empirical data, or were not available in English were excluded.

The databases chosen for the literature search, namely Scopus, Web of Science, and Google Scholar, were selected for their comprehensive coverage of scholarly articles across various disciplines. The search encompassed articles published from 2010 to 2023, ensuring the inclusion of recent advancements in ADAS technologies and gender-related studies.

The search strategy involved the use of Boolean operators (AND, OR) to refine the search queries and obtain the most relevant results. Initial searches were conducted with broad terms, followed by more specific queries to narrow down the focus on gender-specific patterns of ADAS utilization. The searches were performed independently by two researchers to minimize bias, and any discrepancies that were resolved through discussion and consensus.

The initial search yielded a pool of articles, which underwent a multi-stage screening process. The titles and abstracts of retrieved articles were initially reviewed to assess their relevance to the research question. Subsequently, full-text reviews were conducted to further refine the selection, ensuring that the chosen articles met the predetermined inclusion criteria.

Data extraction involved the systematic retrieval of key information from selected articles, including study objectives, methodologies, gender-related findings, and any implications for ADAS usage. The synthesized data were organized to facilitate a

structured analysis of the literature, allowing for the identification of trends, patterns, and gaps in current research.

Given that this review involves the analysis of previously published research, ethical considerations primarily revolved around ensuring the accurate representation of findings and acknowledging the original authors' contributions. Proper citation practices and adherence to ethical guidelines were maintained throughout the review process. The stages of method show in bellow diagram.

Results and discussion

Gender Differences in Driving Behavior:

Exploration of existing research on how men and women may differ in their driving habits

The exploration of gender differences in driving habits is a crucial avenue of research that contributes to a nuanced understanding of driver behavior and informs various aspects of road safety. This discussion delves into existing research findings, drawing insights from seminal studies to elucidate the multifaceted nature of gender-based distinctions in driving behaviors.

Numerous studies reported that men tend to exhibit more aggressive driving behaviors compared to women [8]. Aggressive behaviors including higher average speeds, increased likelihood of tailgating, and a propensity for rapid lane changes. Gender disparity in aggressive driving behaviors has implications for road safety, influencing traffic flow dynamics and the risk of accidents.

Contrastingly, research suggests that women often prioritize caution and compliance with traffic rules [9]. Studies indicate that women are more likely to adhere to speed limits, maintain safer following distances, and exhibit increased vigilance at intersections [10]. This cautious approach contributes to a more conservative driving style and potentially reduces the risk of accidents.

Gender differences influence on decision-making and risk perception further contribute to variations in driving habits. Some studies, such as [11], showed that men may have a higher tolerance for risk, influencing their willingness to engage in behaviors such as overtaking on busy roads. In contrast, women often demonstrate a more risk-averse approach, impacting their decision-making processes while driving.

The choice of vehicle types reflects gender-related differences in driving habits. Some studies [12] exhibited a preference for larger and more powerful vehicles, associating them with status and masculinity. Women, on the other hand, may lean towards smaller and fuel-efficient vehicles, prioritizing practicality and environmental considerations.

Spatial awareness and navigation skills are additional dimensions where gender differences manifest in driving behaviors. Some studies, such as [13], suggested that men tend to demonstrate better spatial awareness, influencing their performance in tasks such as parking and orientation. However, women may exhibit greater attention to details and landmarks during navigation.

It's crucial to acknowledge that gender differences in driving habits are not solely determined by biological factors but are also significantly influenced by sociocultural norms and expectations. Cultural perceptions of masculinity and femininity contribute to shaping driving behaviors [14]. These influences underscore the

importance of considering broader societal contexts in understanding gender-specific patterns in driving.

Understanding gender differences in driving habits is important for the development of effective road safety initiatives. Tailoring educational programs and interventions to address specific behaviors associated with each gender can contribute to more targeted and impactful campaigns [15]. For instance, promoting defensive driving practices among men and emphasizing the importance of rule adherence to women may enhance overall road safety. [Table 1](#) summarizes the key differences in driving habits between male and female drivers.

Factors Influencing Gender Differences in Driving Behaviors

The identification of factors influencing gender differences in driving behaviors is a complex undertaking, shaped by a myriad of biological, psychological, social, and cultural factors. This discussion aims to explore and analyze key determinants that contribute to the observed variations in how men and women approach driving, drawing insights from pertinent research studies.

Biological and neurological differences between men and women have been explored as potential influencers of driving behaviors. Some studies, such as [16], suggested that hormonal variations, brain structure, and cognitive differences may contribute to disparities in risk perception and decision-making. For example, testosterone levels in men have been associated with higher risk tolerance, potentially influencing driving behaviors that lean towards aggression [17].

Socialization plays a pivotal role in shaping gender-specific driving behaviors. Cultural norms and societal expectations regarding masculinity and femininity contribute to the development of driving habits [18]. Some studies, such as [19], highlight how societal expectations may influence men to adopt more assertive driving behaviors as a demonstration of masculinity, while women may internalize expectations of caution and adherence to traffic rules.

Traditional gender roles and responsibilities within societies contribute to the divergence in driving behaviors. For instance, women have historically been associated with caregiving responsibilities, leading to perceptions of driving as a means to ensure the safety of passengers [20]. Men, conversely, may associate driving with autonomy and exhibit behaviors reflecting a desire for control and assertiveness.

Driving experience and exposure to various driving situations can influence behaviors drivers. Some studies, such as [21], suggested that men, on average, accumulate more driving experience and exposure to challenging driving conditions, potentially impacting their confidence and risk-taking tendencies.

Psychological traits and personality characteristics play a role in shaping driving behaviors. Some studies [22] pointed out that personality traits such as sensation-seeking and impulsivity may be more prevalent in men, influencing their driving habits. Women, on the other hand, may exhibit traits associated with caution and conscientiousness.

Economic and environmental considerations also come into play. Some studies, such as [23], emphasized that economic factors, such as affordability, fuel efficiency, and may influence vehicle choices and subsequently impact driving behaviors.

Additionally, environmental awareness may influence women to select for more eco-friendly driving practices.

Usage Patterns of ADAS by Gender

Gender-Specific Utilization of ADAS Technologies: Insights from Existing Research

Understanding how men and women utilize specific Advanced Driver Assistance Systems (ADAS) technologies is pivotal for tailoring safety interventions and optimizing the effectiveness of these systems. This discussion synthesizes insights from relevant studies to shed light on the nuanced ways in which men and women engage with distinct ADAS features.

There are data [24] revealing notable gender-specific patterns in the utilization of lane-keeping assistance and collision avoidance systems. Women demonstrate a higher propensity to engage with these technologies, leveraging lane-keeping assistance for enhanced stability and collision avoidance for preventive safety. This aligns with their generally cautious driving behavior, emphasizing a proactive approach to avoid potential hazards on the road.

Studies exploring the use of Adaptive Cruise Control (ACC) highlight distinctive preferences between men and women [25]. Men, known for more assertive driving behaviors, exhibit a higher preference for ACC, which allows for a dynamic adjustment of vehicle speeds based on traffic conditions. This choice reflects a desire for greater control and adaptability, aligning with their driving habits.

The utilization of parking assistance features, as identified in [26], showcases a higher preference among men. This gender-specific tendency aligns with studies suggesting that men may favor assertive driving behaviors and seek precision in maneuvering. Parking assistance technologies cater to this preference, offering support in spatial awareness and precise parking maneuvers.

Automatic Emergency Braking (AEB) technologies have been scrutinized for gender-specific adoption, revealing nuanced findings [27]. While women exhibit a higher inclination towards safety-oriented features, such as AEB, men also recognize the benefits of collision mitigation technologies. The utilization of AEB may be influenced by the perceived urgency of braking interventions, providing an additional layer of safety for both genders.

The variations in the utilization of specific ADAS technologies can be influenced by several factors [28]. highlight those attitudes toward technology, driving experience, and cultural perceptions play pivotal roles. For instance, women may exhibit greater trust in safety-oriented ADAS features, influenced by their cautious driving tendencies and attitudes towards risk. Men, driven by a desire for control and adaptability, may gravitate towards technologies that align with their assertive driving styles.

Age and driving experience also emerge as factors shaping gender-specific utilization patterns. Younger drivers, regardless of gender, may exhibit higher receptivity to adopting ADAS technologies [29]. Understanding how age intersects with gender in ADAS adoption is crucial for tailoring educational initiatives and marketing strategies to different demographic segments. [Table 2](#) summarizes the insights from the text regarding how engage with distinct ADAS features.

Table 1. Driving habits according to gender in driver

Driving Habit	Male Drivers	Female Drivers
Aggressive Driving Behaviors [8]	Higher average speeds, tailgating, rapid lane changes	Lower tendency towards aggressive behaviors
Caution and Compliance with Rules [9, 10]	Less likely to adhere to speed limits, maintain distances	More likely to adhere to speed limits, maintain distances
Decision-Making and Risk Perception [11]	Higher tolerance for risk, overtaking on busy roads	More risk-averse, cautious decision-making
Vehicle Type Preferences [12]	Prefer larger, powerful vehicles for status/masculinity	Prefer smaller, fuel-efficient vehicles for practicality
Navigation and Spatial Awareness [13]	Better spatial awareness, performance in tasks such as parking	Greater attention to details and landmarks during navigation
Influence of Sociocultural Factors [14]	Shaped by cultural perceptions of masculinity	Shaped by cultural perceptions of femininity
Implications for Road Safety [15]	Tailoring initiatives to address gender-specific behaviors	Targeting campaigns based on gender-specific patterns

Table 2. Driver engages with distinct ADAS features

ADAS Technologies Example	Male	Female
Lane-Keeping Assistance and Collision Avoidance [24]	Lower engagement, less preference for stability	Higher engagement, preference for stability and preventive safety
Adaptive Cruise Control (ACC) [25]	Higher preference for ACC, desire for control and adaptability	Lower preference for ACC, potentially seeking a more cautious approach
Parking Assistance Features [26]	Higher preference, aligns with assertive driving behaviors	Lower preference, potential emphasis on cautious driving
Automatic Emergency Braking (AEB) [27]	Recognition of benefits, adoption influenced by perceived urgency	Higher inclination towards safety-oriented features, such as AEB



Figure 1. Challenges hindering the widespread adoption of ADAS among drivers.

Influential Factors on ADAS Usage

An In-Depth Discussion with Reference to Age, Experience, and Attitudes Toward Technology

The utilization of Advanced Driver Assistance Systems (ADAS) is influenced by a complex interplay of factors that encompass age, driving experience, and attitudes toward technology. This discussion delves into the existing literature, drawing insights from relevant studies, to unravel the intricate relationships between these key variables and ADAS usage patterns.

Research consistently highlights the impact of age on ADAS usage patterns. Younger drivers, often characterized by higher technological proficiency, tend to exhibit greater receptivity toward ADAS technologies [29]. Certain studies [6] found that younger individuals, regardless of gender are more likely to adopt and utilize ADAS features compared to their older counterparts. This inclination is attributed to the familiarity of younger generations with technology and their openness to incorporating it into their driving experience.

The role of driving experience in shaping ADAS usage is nuanced: while one might assume that more experienced drivers

would readily adopt these technologies, the relationship is not always straightforward [30], thereby suggesting that experienced drivers may initially be hesitant to embrace ADAS, possibly due to a perceived disruption of established driving habits. However, as they become familiar with the benefits and functionalities, experienced drivers are likely to integrate ADAS into their driving routines.

Individual attitudes toward technology significantly influence ADAS adoption and usage. Some studies, such as [5], emphasize that individuals with positive attitudes toward technology are more likely to explore and utilize ADAS features. Positive attitudes are associated with a willingness to learn and adapt to new technologies, fostering a proactive engagement with ADAS functionalities. Conversely, individuals with technological skepticism may exhibit slower adoption rates and less frequent use of these systems.

Trust in ADAS technologies is a critical factor influencing usage patterns. Some research [31] indicated that individuals who trust the accuracy and reliability of ADAS features that are more likely to engage with and rely on these technologies consistently. Trust is often cultivated through positive experiences, effective system performance, and a clear understanding of how ADAS enhances overall driving safety.

The perceived utility and effectiveness of ADAS technologies play a pivotal role in shaping usage behavior. Some studies [30] suggest that individuals are more likely to adopt and consistently use ADAS features when they perceive tangible benefits, such as enhanced safety, convenience and efficiency. Understanding user perceptions of ADAS utility is crucial for manufacturers and policymakers to design systems that align with user expectations.

Cultural and societal factors also contribute to the adoption of ADAS technologies [32], emphasizing that societal norms and cultural values influence individuals' perceptions of technological advancements. Societal acceptance of ADAS technologies and the integration of these systems into broader cultural narratives can impact user attitudes and subsequently, usage patterns.

Educational initiatives and awareness campaigns are instrumental in shaping attitudes toward ADAS and fostering

informed usage. Some studies, such as [33], revealed that targeted educational programs that can enhance users' understanding of ADAS functionalities, addressing misconceptions and promoting positive attitudes. Increased awareness contributes to informed decision-making and a more seamless integration of ADAS into driving practices.

Public Perception and Awareness

Public Awareness and Perception of Advanced Driver Assistance Systems (ADAS): An In-Depth Analysis with Reference to Relevant Studies

The widespread adoption and effective utilization of Advanced Driver Assistance Systems (ADAS) hinge not only on the technological advancements but also on public awareness and perception. This discussion delves into the existing literature, drawing insights from relevant studies, to comprehensively analyze how public awareness and perception shape the acceptance and integration of ADAS technologies.

Public awareness regarding ADAS technologies is a critical factor influencing their adoption. Studies by [34] emphasize that despite the increasing prevalence of ADAS in modern vehicles, there remains a notable gap in public awareness. Many individuals may not be fully informed about the functionalities, benefits, and limitations of ADAS systems. This lack of awareness can lead to skepticism, misconceptions, and hinder the broader acceptance of these technologies.

Several factors contribute to the level of public awareness regarding ADAS. Some research [35] suggests that media coverage, educational initiatives, and promotional campaigns play pivotal roles in shaping public awareness. Positive and informative media portrayals, coupled with targeted educational programs, can enhance public understanding of ADAS technologies and their potential impact on road safety.

Demographic factors, such as age, education, and socioeconomic status identified as influencers public awareness. The study [5] discovered that younger individuals and those with higher education levels tend to be more aware of ADAS technologies. Addressing demographic disparities in awareness is crucial for ensuring equitable dissemination of information and fostering a more informed public discourse on ADAS.

Public perception of the safety benefits offered by ADAS is a key determinant of acceptance. Some studies, such as [36], indicate that individuals who perceive ADAS as contributing to overall road safety are more likely to view these technologies positively. Public awareness campaigns should thus emphasize the safety advantages of ADAS, debunking misconceptions and fostering a positive safety-oriented perception.

Public perception of ADAS is not solely positive, as concerns and misconceptions may hinder acceptance [5]. found that common concerns include over-reliance on technology, potential system malfunctions, and privacy issues. Addressing these concerns through transparent communication, effective education, and continuous improvement of ADAS technologies is essential for building public trust.

Individual experiences with ADAS technologies significantly influence perception [37]. Highlighting positive personal experiences, such as successful interventions by ADAS systems, contribute to more favorable perceptions. Conversely, negative experiences or system failures can lead to skepticism and erode

public confidence. Real-world user experiences play a crucial role in shaping overall public perception.

Challenges and Opportunities

Identification of Challenges in Promoting ADAS Adoption Among Both Genders: An In-Depth Analysis with Reference to Relevant Studies

While Advanced Driver Assistance Systems (ADAS) hold great promise for enhancing road safety.

The promotion of their adoption presents various challenges that cut across both genders. This discussion explores existing literature and draws insights from relevant studies to comprehensively identify the challenges hindering the widespread adoption of ADAS among both men and women.

One of the foremost challenges is the limited public awareness and understanding of ADAS technologies. Some research [38] suggests that many individuals, regardless of gender, may not have a comprehensive understanding of how ADAS systems function and their potential benefits. Lack of awareness can lead to skepticism, hindering the willingness to adopt these technologies.

Cost considerations remain a significant barrier to ADAS adoption for both genders [39]. The perceived high cost of vehicles equipped with ADAS features can deter potential buyers. Despite the potential long-term safety benefits, individuals may face financial constraints or perceive ADAS technologies as an optional luxury rather than a necessity.

Misconceptions and fear of technology pose challenges to ADAS adoption. The study [40] revealed that individuals, both men and women, may harbor concerns about the reliability and effectiveness of ADAS systems. Fear of technology failure, misunderstandings about the limitations of ADAS, and a general reluctance to trust automated systems can impede adoption efforts.

The lack of standardization and interoperability among ADAS technologies is a notable challenge. The study [41] emphasize that varying implementations of ADAS across different manufacturers can lead to inconsistencies in user experiences. Standardization efforts are necessary to ensure a seamless and user-friendly integration of ADAS technologies across diverse vehicles.

The technological complexity of ADAS systems and user interface design can be challenging for widespread adoption [37]. It is worth noting that complex interfaces or poorly designed user experiences may result in confusion and frustration, deterring individuals, both men and women, from fully engaging with ADAS features.

Habitual driving behaviors and resistance to change present challenges [42], which suggests that individuals, regardless of gender, may be resistant to altering established driving habits. Overcoming this inertia requires strategies that effectively communicate the benefits of ADAS adoption in terms of safety and convenience. [Figure 1](#) summarizes the challenges hindering the widespread adoption of ADAS among both male and female drivers.

In conclusion, promoting ADAS adoption among both genders faces multifaceted challenges encompassing awareness gaps, cost concerns, misconceptions, gender-specific perceptions, standardization issues, privacy concerns, educational gaps, regulatory considerations, technological complexity, and resistance to change. Addressing these challenges requires

collaborative efforts from manufacturers, policymakers, educators, and other stakeholders to create a supportive environment for the widespread acceptance and integration of ADAS technologies.

Implications for Road Safety

Contributions of Understanding Gender-Specific ADAS Usage to Road Safety Initiatives: An In-Depth Analysis with Reference to Relevant Studies

Understanding how men and women differ in their utilization of Advanced Driver Assistance Systems (ADAS) holds significant implications for enhancing road safety. This discussion explores existing literature and draws insights from relevant studies to comprehensively analyze how gender-specific ADAS usage patterns can contribute to road safety initiatives.

The study [43] highlighted the importance of targeted intervention strategies that consider gender-specific preferences in ADAS usage. By understanding the features that each gender is more likely to engage with, road safety initiatives can be tailored to promote the adoption of specific ADAS functionalities among both men and women. For instance, educational campaigns can emphasize safety-oriented features for women and adaptive cruise control for men.

Gender-specific ADAS usage patterns can provide insights into how individuals adapt their driving behavior to mitigate risks [44]. Understanding that women may engage more with collision avoidance features, for instance, allows road safety initiatives to emphasize the potential risk reduction associated with these technologies. Similarly, highlighting how men use adaptive cruise control can underscore the benefits of maintaining consistent speeds for overall road safety.

Educational programs that align with gender-specific preferences can be developed based on insights into ADAS usage patterns [45]. If women are more inclined toward lane-keeping assistance, educational initiatives can emphasize the advantages of staying within designated lanes for safety. Tailored programs increase the likelihood of resonating with diverse, leading to greater awareness and adherence to safe driving practices.

User-centric design improvements can be implemented based on gender-specific ADAS usage data [46]. Manufacturers can optimize interfaces, control layouts, and feedback mechanisms to better suit the preferences of men and women. Improved usability encourages more effective engagement with ADAS features, reducing distractions and enhancing overall safety on the road.

Understanding gender-specific ADAS usage allows for the targeted addressing of specific safety concerns associated with each gender [47]. If women are more prone to using parking assistance features, road safety initiatives can focus on reducing parking-related incidents. Similarly, if men favor adaptive cruise control, campaigns can underscore its benefits in preventing collisions and maintaining safe following distances.

Gender-specific ADAS usage patterns can inform strategies to build trust in these technologies [48]. Knowing which features resonate more with each gender allows for emphasizing those features in communication and education efforts. This targeted approach contributes to dispelling fears and increasing confidence in the reliability and effectiveness of ADAS systems.

Road safety initiatives can actively contribute to reducing gender disparities in driving-related incidents by leveraging insights into ADAS usage [49]. If certain ADAS features prove more

effective for one gender, promoting their adoption across the board can lead to more balanced and equitable road safety landscape.

Understanding gender-specific ADAS usage can inform policy decisions related to road safety [50]. Policymakers can use this data to develop regulations that encourage the adoption of specific ADAS features or set standards for manufacturers to prioritize safety-oriented functionalities. Informed policy decisions contribute to a holistic approach to road safety.

Road safety initiatives can use gender-specific ADAS usage data for long-term impact evaluation [51]. By monitoring changes in driving behavior and incident rates over time, stakeholders can assess the effectiveness of interventions and refine strategies for continuous improvement.

This study has delved into a myriad of research findings, shedding light on how men and women engage with ADAS technologies and the implications for safer driving practices. The synthesis of these results paints a nuanced picture, paving the way for a more informed and targeted approach to promoting road safety through ADAS. The literature consistently emphasizes the gender variations in driving behaviors, portraying men as exhibiting more aggressive tendencies while women lean towards caution and compliance with traffic rules. Examining the adoption rates and usage preferences, researchers discovered distinct inclinations among men and women. Women showed a higher likelihood of engaging with features such as lane-keeping assistance and collision avoidance, aligning with their safety-oriented approach. In contrast, men exhibited a preference for adaptive cruise control and parking assistance, reflecting a penchant for features that enhance driving convenience. The exploration extended to factors influencing these differences, uncovering the roles of age, experience, and attitudes towards technology. It became evident that a holistic understanding of these factors is essential for tailoring interventions that resonate with diverse demographic groups, ensuring that ADAS technologies cater to the specific needs and concerns of both men and women. Cultural and societal influences emerged as pivotal aspects influencing gender-specific driving behaviors, with studies illustrating how perceptions and expectations associated with gender roles shape the acceptance and utilization of ADAS technologies. This cultural dimension underscores the importance of a nuanced approach in designing awareness campaigns and educational initiatives that address diverse societal perspectives. The analysis delved into the public's awareness and perception of ADAS, revealing that a lack of understanding and misconceptions can hinder widespread acceptance. This insight reinforces the need for robust public awareness campaigns that demystify ADAS technologies, highlighting their benefits and dispelling myths to foster trust and acceptance. By embracing the nuanced interplay of gender, attitudes, and societal influences, stakeholders have the opportunity to shape a future where ADAS technologies contribute significantly to safer, more inclusive, and efficient roadways.

Conclusion

This study identifies key gender differences in driving behaviors and the use of Advanced Driver Assistance Systems (ADAS), which are vital for improving road safety. Men generally exhibit more aggressive driving styles, while women tend to prioritize caution. Women are more likely to engage with safety features such as lane-keeping assistance, whereas men prefer

technologies that enhance control, such as adaptive cruise control. These preferences are shaped by factors such as age, experience, and cultural norms. To enhance road safety initiatives, it is crucial to tailor educational programs that address these gender-specific behaviors and improve public awareness of ADAS technologies. By understanding these dynamics, stakeholders can develop targeted strategies that promote safer driving for all.

Ethical approval and consent to participate

The authors affirm that all referenced studies were conducted in accordance with ethical standards, including proper citation practices to avoid plagiarism and to explicitly demonstrate respect for intellectual property.

Availability of data and materials

The datasets used or analyzed in the course of this study are available from the corresponding author on a reasonable request.

Conflict of interest

None declared by the authors.

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Author contributions

AA, MG, SD and KH were involved in all aspects of study concept and design, data collection and analysis, interpretation of the results, draft manuscript preparation, and critical revision of the manuscript; MY, AR, SD and KH helped with general design of the study, data analysis, interpretation of the results, co-authoring draft manuscript, and final editing. All authors read and approved the final version of the manuscript.

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