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E-Survey of Road users' Attitudes

Young and Aging Drivers

ESRA3 Thematic report Nr. 5

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Young and Aging Drivers

ESRA3 Thematic report Nr. 5

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List of abbreviations

Country codes (in accordance with ISO 3166-1 alpha-2 (International Organization for Standardization (ISO), 2024))

AM	Armenia	KG	Kyrgyzstan
AU	Australia	LV	Latvia
AT	Austria	LU	Luxembourg
BE	Belgium	MX	Mexico
BA	Bosnia and Herzegovina	NL	Netherlands
BR	Brazil	PA	Panama
CA	Canada	PE	Peru
CL	Chile	PL	Poland
CO	Colombia	PT	Portugal
CZ	Czech Republic	RS	Republic of Serbia
DK	Denmark	SI	Slovenia
FI	Finland	ES	Spain
FR	France	SE	Sweden
DE	Germany	CH	Switzerland
EL	Greece	TH	Thailand
IE	Ireland	TR	Türkiye
IL	Israel	UK	United Kingdom
IT	Italy	US	United States
JP	Japan	UZ	Uzbekistan
KZ	Kazakhstan		

Other abbreviations

ESRA E-Survey of Road users' Attitudes

EU European Union

ICW Individual country weight used in ESRA3

HIC High income countries based on World Bank classification 2023, (The World Bank Group, 2023)

UMIC Upper-middle income countries based on World Bank classification 2023, (The World Bank Group, 2023)

LMIC Lower-middle income countries based on World Bank classification 2023, (The World Bank Group, 2023)

Executive summary

Objective and methodology

ESRA (E-Survey of Road users' Attitudes) is a joint initiative of road safety institutes, research centres, public services, and private sponsors from all over the world. The aim is to collect and analyse comparable data on road safety performance and road safety culture. The ESRA data are used to develop a large set of road safety indicators. These provide scientific evidence for policy making at national and international levels.

Vias institute in Brussels (Belgium) initiated and coordinates ESRA, in cooperation with ten steering group partners (BASt (Germany), DTU (Denmark), IATSS (Japan), ITS (Poland), KFV (Austria), NTUA (Greece), PRP (Portugal), SWOV (the Netherlands), TIRF (Canada), and University Gustave Eiffel (France)). At the heart of ESRA is a jointly developed questionnaire survey, which is translated into national language versions. The themes covered include self-declared behaviour, attitudes and opinions on unsafe traffic behaviour, enforcement experiences, and support for policy measures. The survey addresses different road safety topics (e.g., driving under the influence of alcohol, drugs and medicines, speeding, distraction) and targets car occupants, moped riders and motorcyclists, cyclists, pedestrians, and riders of e-scooters. In ESRA3 the questions related to vulnerable road uses (moped riders and motorcyclists, cyclists, pedestrians, and riders of e-scooters) have been expanded and questions on e-scooters and infrastructure have been added.

The present report is based on the third edition of this global survey, which was conducted simultaneously in 39 countries in 2023. In total this survey collected data from more than 37000 road users in 39 countries across five continents. An overview of the ESRA initiative and the project results is available on: www.esranet.eu.

This ESRA thematic report delves into the self-declared behaviours and perceived acceptability (social and personal) related to driving while impaired, speeding, and distraction, among young and aging drivers. It comprehensively addresses these issues considering driver impairment from alcohol, drugs, and prescription medication, driving over the speed limit, and engaging in distracted driving behaviours like listening to music or reading messages. The analyses focus on differences between aging drivers (aged 65-74) and young drivers (aged 18-24) while also making comparisons to other age groups. In addition, factors that increase the likelihood of a crash involvement for aging and young drivers were also compared.

Key results

Self-declared unsafe behaviours in traffic (past 30 days)

Aging drivers, aged 65-74, generally show lower rates of engaging in risky behaviours associated with impairment, such as driving while potentially over the legal alcohol limit or under the influence of drugs, compared to younger age groups. Age is a significant predictor of speeding, with older age groups, especially those aged 65-74, generally admitting to lower rates of speeding compared to younger drivers. Similarly, older drivers consistently demonstrate lower rates of engaging in distracted driving behaviours such as talking on a hand-held mobile phone or reading messages while driving.

Perceived social acceptability

Age significantly influences perceived social acceptability of risky driving behaviours, with a consistent trend across all three regions showing road users 18-24 perceiving behaviours such as driving over the legal alcohol limit, speeding outside built-up areas, using a hand-held mobile phone, and reading messages or checking social media while driving as more socially acceptable than those aged 65-74. Perceptions of acceptance of these behaviours diminish markedly with age, particularly in Europe22[1] where there is a clear decline in the perceived social acceptability of driving under the influence and distracted driving among older road users. Despite regional variations, with Europe22 displaying the strongest age-related decline in perceived social acceptability and AsiaOceania6[2] and America8[3]

[1] *Italy, Luxembourg, Slovenia, Portugal, France, Switzerland, Austria, Ireland, Poland, Netherlands, Greece, Spain, Belgium, Germany, Denmark, United Kingdom, Serbia, Finland, Sweden, Latvia, Bosnia-Herzegovina, Czech Republic*

[2] *Australia, Israel, Türkiye, Thailand, Japan, Kazakhstan*

[3] *United States, Canada, Brazil, Mexico, Panama, Chile, Colombia, Peru*

showing more variability, the general trend underscores the increased perception of a social acceptance of these risk-taking behaviours among younger road users. Perceived social acceptability of speeding similarly decreases with age, though the patterns vary slightly by region, with America8 and AsiaOceania6 showing less consistency.

Personal acceptability of unsafe traffic behaviours

Personal acceptability among road users towards driving while impaired by alcohol, drugs, or prescription medication is low. Although the acceptability rate is slightly higher for speeding, a majority still consider it personally unacceptable.

Interestingly, the percentages of personal acceptability are much lower than the percentages of self-declared behaviours, indicating a significant gap between perception and action regarding risky driving behaviours.

Acceptability levels for alcohol, drugs, and prescription medication impairment are relatively similar, suggesting an understanding among road users that impairment from any of these poses a significant risk.

While age does not significantly predict the personal acceptability of speeding in certain regions, aging road users consistently exhibit the lowest levels of personal acceptability for various risky behaviours, highlighting their cautious stance towards such actions. And, aging road users express low acceptability rates for engaging in distracted driving behaviours like talking on a hand-held mobile phone or reading messages/checking social media/news while driving.

Factors increasing crash risk

Amongst the drivers who responded to the survey, those aged 18-24 have a significantly higher risk of crash involvement compared to 65-74-year-olds, with the probability of being in a crash increasing by 294%. Female drivers show a 20% lower crash risk than their male peers, highlighting gender differences across age groups. Regionally, drivers in America8 (62%) and AsiaOceania6 (42%) are associated with a higher crash risk than drivers in Europe22, and drivers in urban or semi-urban environments are associated with lower crash risk than those in rural areas by 24%. Interestingly, for drivers aged 65-74, those who drive less than four days a week show lower odds of being involved in a crash with an odds ratio of 0.44. This meets expectations as less driving means less exposure to the opportunity for a crash. Conversely, drivers aged 18-24 show higher odds for crash involvement when only driving four days or fewer a week. A possible explanation is that if young drivers are not driving frequently, they are not gaining the experience and skills for safe driving and thus their risk when driving remains elevated. Findings also indicated that drivers who express some personal acceptance of driving faster than the speed limit outside built-up areas (except motorways/freeways) have a 30% higher odds of being involved in a crash. Drivers who express some personal acceptance of driving while talking on a hand-held phone have a 64% increase in odds of crash involvement. Finally, drivers who express some personal acceptance of reading a message or checking social media/news while driving have a 137% increase in odds of crash involvement.

Contextual data

Data from ESRA3 countries confirmed the over-representation of both drivers 18-24 and 65-74 in fatal crashes that is reported in the literature. Elevated concerns for the safety of travel as a driver were not associated with higher rates of road deaths amongst young and aging drivers.

Key recommendations

Policy recommendations

- Begin conversations about safe driving with drivers early in life and focus on fitness to drive rather than focusing strictly on aging. Outreach and communication are essential, as is the provision of information about alternative transportation options and community resources, to those who are required to submit to medical review or those who decide not to pursue licence renewal.
- Emphasize to novice drivers that experience gained through driving is critical to acquiring the skills needed for safe driving. Novice driver programs such as Graduated Licensing should be structured to encourage or require frequent driving during this learning period.

- Modify the licensing process for all drivers to identify the most at-risk drivers due to physical or mental limitations with respect to the driving task and administer tests for assessing their fitness to drive.
- Ensure the existence and availability of alternative transportation options for those for whom a cessation of driving is necessary.

Continue to study the impact of age on crash risk and aim programs at those most at risk. Specific recommendations to particular stakeholders include:

- *[To Non-Governmental Organizations (NGOs)]* Contribute to education and awareness raising campaigns and events against impaired driving, speeding, and distraction.
- *[To vehicle manufacturers, other companies and research organisations]* Continue to develop and promote low-cost solutions that can be incorporated in vehicles and assist drivers.

The ESRA initiative has demonstrated the feasibility and the added value of joint data collection on road safety performance by partner organizations all over the world. The intention is to repeat this survey every three to four years while retaining a core set of questions in every edition. In this way, ESRA produces consistent and comparable road safety performance indicators that can serve as an input for national road safety policies and for international monitoring systems on road safety performance.

1. Introduction

In many countries the segment of the driving population age 65 and older is growing, leading to an increasing concern about potential increases in fatal motor-vehicle crashes involving this age group as many of these older individuals continue driving as they age (Cox & Cicchino, 2021). In addition to aging drivers, young drivers remain a concern as they also show an increased crash risk relative to other age demographics. Research characterizes the crash risk by age with a U-shaped curve, indicating that the youngest and oldest drivers face the most pronounced risk (Eby and Molnar 2009). This U-shape relationship persists when crashes are represented in terms of deaths per licenced drivers or per vehicle-kilometres driven. A study in Canada, for example, revealed 24.7 deaths per 100,000 drivers in the youngest demographic, seniors 65 and older had a death rate of 15.7 per 100,000 drivers, and drivers between the ages of 25 and 64, averaged 9.6 deaths per 100,000 drivers (Robertson and Vanlaar, 2008). In 2018, European Commission found that the fatality rate per million population for the population aged 65+ was 76 which was slightly lower than fatality rate for 18-24 year old (81 deaths per million population) and ranked second among all age groups (European Commission, 2020).

Due to aging populations in many countries, it is reasonable to assume that, in the next few decades, there will be more seniors driving than ever before. Worldwide, data provided by the United Nations population division (United Nations, 2019; United Nations, 2021) predicts the percentage of the population aged 65+ will increase from 9.3% in 2020 to 16% in 2050 and the percentage of the population aged 80+ from 1.9% in 2020 to 4.4% in 2050. In Europe, 21.1% of the population was aged 65+ in 2022, an increase of 3.1 percentage points from 10 years earlier, and the share of the population aged 80+ is projected to increase from 6.1% to 14.6% between 2022 and 2100 (Eurostat, 2023). As the population continues to age, with potentially more seniors retaining their driving license, challenges related to aging drivers will likely become more prevalent in high-income countries and other countries with similar demographic changes.

While young and aging drivers are both more susceptible to collisions the underlying causes differ. Research consistently shows that the lack of sufficient driving experience among young drivers hampers their ability to recognize and appropriately react to potential dangers while driving (Fisher et al., 2017; Mayhew & Simpson, 2002; Twisk & Stacey, 2007). Also, youthfulness contributes to elevated crash risk (McCartt et al., 2009; McDonald et al., 2018). Various biological, psychological, and developmental changes that occur in adolescence play a role in the high incidence of collisions among young drivers. Critical elements contributing to this phenomenon include overconfidence, sensation seeking, prevalent sleep deprivation and fatigue, peer influences to engage in risky driving behaviours, and deliberate engagement in risky behaviours like speeding, tailgating, driving while distracted, and driving when fatigued (Bates et al., 2014; Halpern-Felsher et al., 2016; Organisation for Economic Co-operation and Development, 2006; Scott-Parker, 2013; Tefft, 2013). For aging drivers, on the one hand, an older driver has many years of driving experience to draw on to supplement their driving ability and skill (Liddle and McKenna, 2003). This can make for safer, smarter driving decisions. On the other hand, advancing age can have a negative influence on driving performance due to declines in functional abilities (e.g., cognitive performance), and in some circumstances, driving cessation is the safer option (Musselwhite and Shergold, 2013; Depestele et al., 2020).

It is undeniable that advanced age can have a detrimental effect on the ability to drive safely, and that some drivers ought to cease driving, for their own safety and the safety of others. However, it must be noted that age in itself does not always mean an increased risk of crashes. For obvious reasons, the ability to see, scan, and interpret the driving environment is crucial for safe driving. However, visual skills become less refined with age. For example, older eyes are less sensitive to light, may have a restricted visual field, may have restricted length of focus, capture fewer fine details, and are less sensitive to motion (Owsley & McGwin Jr, 2010). In addition to slow declines in visual abilities, cognitive skills and mental workload and performance may also diminish with age (Eby et al., 1998; Abd Rahman et al., 2020; Gökçe et al., 2022). Even in the absence of a diagnosed cognitive impairment such as dementia, older drivers may experience challenges with attention, memory, and/or spatial cognition. For example, age-related cognitive declines may lead to decreases in secondary looks (e.g., double-checking that there is adequate space to merge) and in situational awareness (e.g., noticing other road users around the roadway, or anticipating events like a pedestrian walking out into the street; Romoser and Fisher 2009).

With age also comes the likelihood of some degree of reduced mobility. Reductions in joint flexibility, muscle strength, and/or coordination can begin well in advance of reaching the age that most consider "senior". However, the deterioration of these psychomotor skills is certainly most visible among those of older age and can have a negative effect on overall driving ability. For example, limited range in the knees, hips, hands, ankles, feet, and/or neck can make driving tasks like pressing the brake, gripping the steering wheel, executing precision movements, or turning to check blind spots difficult or impossible to do without pain (Smiley et al. 2012; Eby et al. 1998). Another study demonstrated a gradual decline in driving performance in older adults, cardiovascular fitness interacted with the aging effect on driving performance (Gökçe et al., 2022).

Finally, the driving ability of aging people may be further impaired by both prescription and over-the-counter medications, such as antidepressants, antihistamines, and benzodiazepines (Dobbs, 2005; Hill et al., 2020). This is important because the frequency and quantity of prescription drug use increases with age. Although some medications may have a positive impact on driving skills (e.g., pain reduction), others have been shown to be associated with at-fault crashes in older adults (McGwin et al., 2000). Another study found specific classes of medications have been linked to potentially unfavourable driving behaviours, such as increased speed associated with central nervous system agents and abrupt decelerations linked to hormone and gastrointestinal medications. Conversely, certain medications are correlated with potentially protective driving maneuvers, such as right-hand turning attributed to the use of antihistamines or a reduction in rapid decelerations associated with electrolyte usage (Hill et al., 2020).

While young and aging drivers face a higher risk of collisions due to different factors, they share some common risk elements, including distracted and fatigued driving (Groeger, 2006; Fofanova & Vollrath, 2011, Horrey & Divekar, 2017; Paterson & Dawson, 2017; Thompson et al., 2012). However, the nature of distracted and fatigued driving varies significantly between young and aging drivers. Studies indicate that although distractions impair driving performance across ages, aging drivers are less likely to engage in distracting activities compared to their younger and middle-aged counterparts. Furthermore, young drivers are more commonly found to be using handheld devices while driving than aging drivers. (Woods-Fry et al., 2018; Caird & Horrey, 2017; World Health Organization, 2011). It has been found that young and aging drivers are more negatively affected by multitasking than those in the middle-age category. While visual-manual distractions pose a challenge for drivers across all age groups, cognitive distractions have a larger impact on young drivers (Guo et al., 2017). Fatigue is a risk factor for all drivers (Vanlaar et al., 2008; Owens et al., 2018). Although both young and aging drivers experience fatigue while driving, studies indicate that young drivers tend to feel tired after midnight and into the early morning, whereas aging drivers are more prone to fatigue in the afternoon (Obst et al., 2011).

Understanding such similarities and differences in the risk factors affecting young and aging drivers is essential for formulating policies and programs aimed at lowering their heightened risk of collisions. Surveys from the United States show that drivers aged 65 and older show the lowest levels of mobile phone usage (including calling, texting, or using apps) while driving. Interestingly, drivers 20 years old and younger do not display the highest usage rates for these behaviours; instead, the peak rates of mobile phone use while driving are observed among those aged 21 to 54, depending on the question asked (Schroeder et al., 2018). A survey conducted in Australia by McEvoy et al. (2006) revealed that younger drivers (aged between 18–30 or 18–49 years, depending on the question posed) reported engaging in distracting activities while driving more frequently and perceived these activities as less risky compared to aging drivers. Specifically, drivers within the 18–30 years age group reported a higher incidence of crashes attributed to distraction. Additionally, a survey on fatigued driving in Europe demonstrated that drivers younger than 70 years had a significantly higher likelihood of falling asleep behind the wheel compared to those aged over 70 years (Goncalves et al., 2015). Data from the second ESRA survey conducted in 2019 (Lyon et al., 2020) found that drivers aged 18–21 years consistently reported higher rates of distracted and fatigued driving and higher rates of perceived social and personal acceptability of these behaviors than drivers aged 35–54 years. Aging drivers aged 65+ years reported even lower rates of these behaviors and acceptability.

This thematic ESRA report aims to describe the differences between aging (aged 65-74) and young drivers (aged 18-24) vs other age groups with respect to the self-declared behaviours and perceived acceptability (personal and social) related to driving while impaired, speeding, and distraction in a sample from 36 countries worldwide. within three regions including Europe, North America, and Asia-Oceania. The report comprehensively addresses these issues considering driver impairment from

alcohol, drugs, and prescription medication, driving over the speed limit, and engaging in distracted driving behaviours like listening to music or reading messages. In addition, factors that increase the likelihood of a crash involvement for an aging and young driver were also compared.

2. Methodology

ESRA (E-Survey of Road users' Attitudes) is a joint initiative of road safety institutes, research centres, public services, and private sponsors from all over the world. The aim is to collect and analyse comparable data on road safety performance, in particular road safety culture and behaviour of road users. The ESRA data are used as a basis for a large set of road safety indicators. These data provide scientific evidence for policy making at national and international levels.

ESRA data are collected through online panel surveys, using a representative sample of the national adult populations in each participating country (aiming at n=1000 per country). A few exceptions exist. In four countries (Armenia, Kyrgyzstan, Luxembourg, and Uzbekistan) the targeted sample size was reduced to 500 respondents, as sample sizes of 1000 respondents were not feasible due to limitations of the national panel or too high costs.

At the heart of this survey is a jointly developed questionnaire, which was translated into 49 national language versions in ESRA3. The themes covered include self-declared behaviour, attitudes and opinions on unsafe traffic behaviour, enforcement experiences, and support for policy measures. The survey addresses different road safety topics (e.g., driving under the influence of alcohol, drugs and medicines, speeding, distraction) and targets car occupants, moped riders and motorcyclists, cyclists, pedestrians, and riders of e-scooters. In ESRA3 the questions related to vulnerable road users (moped riders and motorcyclists, cyclists, pedestrians, and riders of e-scooters) have been expanded and questions on e-scooters and infrastructure have been added. The present report is based on the third edition of this global survey, which was conducted simultaneously in 39 countries in 2023. In total this survey collected data from more than 37000 road users in 39 countries, across five continents.

The participating countries in ESRA3 were:

- Europe: Austria, Belgium, Bosnia and Herzegovina, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Luxembourg, Netherlands, Poland, Portugal, Republic of Serbia, Slovenia, Spain, Sweden, Switzerland, United Kingdom;
- America: Brazil, Canada, Chile, Colombia, Mexico, Panama, Peru, USA;
- Asia and Oceania: Armenia, Australia, Israel, Japan, Kazakhstan, Kyrgyzstan, Thailand, Türkiye, Uzbekistan.

Vias institute in Brussels (Belgium) initiated and coordinates ESRA, in cooperation with ten steering group partners (BASt (Germany), DTU (Denmark), IATSS (Japan), ITS (Poland), KFV (Austria), NTUA (Greece), PRP (Portugal), SWOV (the Netherlands), TIRF (Canada), and University Gustave Eiffel (France)). The common results of the ESRA3 survey are published in a Main Report, a Methodology Report and 13 Thematic Reports (Table 1). Furthermore, 39 country fact sheets, including different language versions, have been produced in which national key results are compared to a regional mean (benchmark). Scientific articles, national reports and many conference presentations are currently in progress. All common ESRA3 reports have been peer-reviewed within the consortium, following a pre-defined quality control procedure. An overview of the results and news on the ESRA initiative is available on: www.esranet.eu. On this website one can also subscribe to the ESRA newsletter.

Table 1: ESRA3 Thematic Reports

Driving under influence of alcohol, drugs and medication	Support for policy measures and enforcement	Pedestrians	Young and aging road users
Speeding	Subjective safety and risk perception	Cyclists	Male and female road users
Distraction (mobile phone use) and fatigue	Infrastructure	Riders of e-scooters	
Seat belt & child restraint systems		Moped riders and motorcyclists	

The present report summarizes the ESRA3 results with respect to young and aging road users focusing on drivers and the issues of driving while impaired, speeding, and distracted driving. A more detailed overview of the data collection method and the sample per country can be found in the ESRA3 methodology report (Meesmann & Wardenier, 2024).

Most of the questions of the survey were presented on Likert scales, which were dichotomized for the analysis. A description of the scales and the correspondent dichotomization are presented in the beginning of each section.

For the descriptive analysis, all the results are presented by region (Europe22, America8, AsiaOceania6) and age group. Note that a weighting of the data was applied in the analyses. This weighting took into account small corrections with respect to national representativeness of the sample based on gender and six age groups: 18-24y, 25-34y, 35-44y, 45-54y, 55-64y, 65-74y (United Nations Statistics Division, 2023). For the regional means, the weighting also took into account the relative size of the population of each country within the total set of countries from this region. SPSS 26.0, R 4.3.1 and Stata 17.0 were used for all analyses.

Due to the nominal nature of the data, the Chi-square Test for Independence was used to assess if the observed differences are statistically significant. The strength of the association between variables was assessed through the Cramer's V coefficient.

Binary logistic regression models were also estimated to explore what factors increase or decrease the likelihood of a young or aging driver being involved in a crash while driving.

3. Results

3.1 Descriptive results

This section includes the descriptive statistics of questions related to self-declared risky driving behaviours, perceived social acceptance, and personal acceptance related to driving while impaired, speeding, and distracted driving (e.g., checking messages or listening music). Impairment may be due to alcohol, drugs, or prescription medication that carries a warning that driving ability may be negatively influenced. The focus is on the differences in responses between aging (65-74) and young drivers (18-24) vs other drivers. A p-value of 0.01 or less was used as an indicator of statistical significance.

3.1.1 Self-declared unsafe behaviours in traffic

To assess self-declared behaviours in traffic, car drivers were asked '*Over the last 30 days, how often did you as a car driver …?*'. Six items of interest were investigated:

- …drive when you may have been over the legal limit for drinking and driving.
- …drive within 1 hour after taking drugs (other than prescribed or over the counter medication).
- …drive within 2 hours after taking medication that may affect your driving ability.
- …drive faster than the speed limit outside built-up areas (except motorways/freeways).
- …talk on a hand-held mobile phone while driving.
- …read a message or check social media/news while driving.

All questions were answered on a Likert scale from 1 (never) to 5 (almost always) - The percentages of 'at least once' (answers 2 to 5) are presented in the results.

Figure 1 shows aging car drivers typically report lower or similar rates of risky behaviours compared to other age groups, with the exception of America8 and AsiaOceania6, where aging car drivers report higher or similar rates of driving faster than the speed limit outside built-up areas (except motorways/freeways) than at least some of the other age groups.

In Europe22, age appears to be a significant factor in driving when potentially over the legal alcohol limit (p-value<0.001, Cramer's V=0.128). Across age groups, the percentage of individuals reporting driving at least once when possibly over the limit decreases with increasing age, with the highest rates observed in the younger age brackets (17.6% for 18-24 and 5.5% for 65-74). Similar statistically significant trends are observed in America8 (14.3% for 18-24 and 6.3% for 65-74) and AsiaOceania6 (13.5% for 18-24 and 5.1% for 65-74).

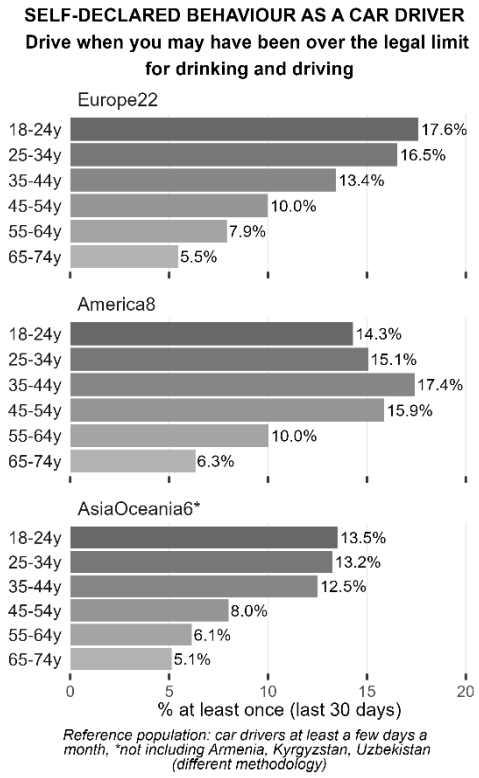
The analysis of driving within 1 hour after taking drugs (other than prescribed or over the counter medication) reveals the 65-74 age group exhibits the lowest percentage in all regions, ranging from 2% to 10.2%, while the 18-24 age group is the highest in Europe22 (12.6%) and within the top three in America8 (12.9%) and AsiaOceania6 (13.2%). The differences between age groups is statistically significant in Europe22 and AsiaOceania6 (p-value<0.001) while not considered statistically significant in America8 (p=0.066) where the range of percentages is much smaller between age groups.

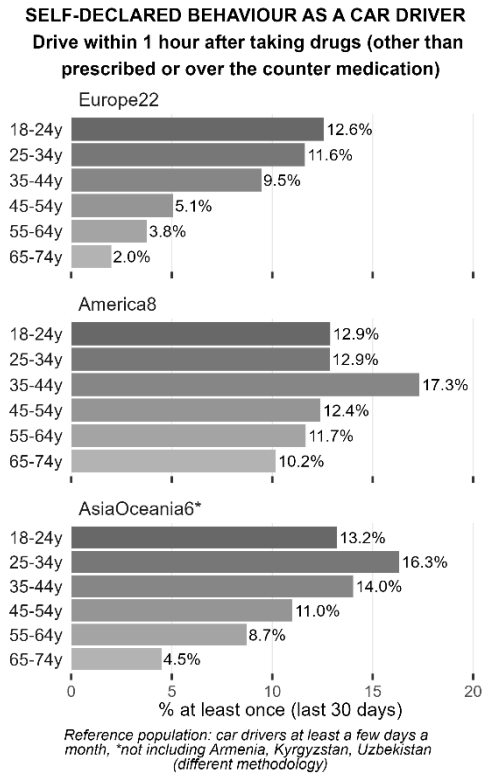
For driving within two hours after taking medication that may affect your driving ability, age is a significant factor in Europe22 and AsiaOceania6 (p-value<0.001, Cramer's V<0.11) but not in America8 (p-value=0.061, Cramer's V=0.067). Drivers aged 65-74 consistently exhibit the lowest rates of driving under medication influence (5.7% to 9.4%), while those aged 18-24, display higher rates (16.7% to 18.0%).

For driving faster than the speed limit outside built-up areas (except motorways/freeways) age is a significant factor in Europe22 (p-value<0.001, Cramer's V=0.085) and America8 (p-value<0.001, Cramer's V=0.194). In Europe22, drivers aged 65-74 display the lowest rates of speeding (45.1%), while those aged 18-24, exhibit the highest rate (59.2%). In America8 the results show a U-shaped pattern with drivers aged 18-24 having the second highest rate (50.3%) and drivers aged 65-74 having the third highest rate (49.1%).

Age is a significant predictor of both talking on a hand-held mobile phone and reading messages or checking social media/news while driving across age groups in Europe22, America8, and AsiaOceania6

(p-value<0.001, Cramer's V<0.22 for talking on phone; p-value<0.001, Cramer's V<0.25 for reading/checking messages). In all regions, drivers aged 65-74 consistently demonstrate the lowest rates, with the lowest percentage recorded in Europe22 for both behaviours (7.5% talking on the phone, and 6.1% for reading/checking messages). Conversely, younger age groups, particularly those aged 18-24, exhibit higher rates of engaging in these risky behaviours with the highest rates in America8 (38.9% talking on the phone, and 41.1% for reading/checking messages).





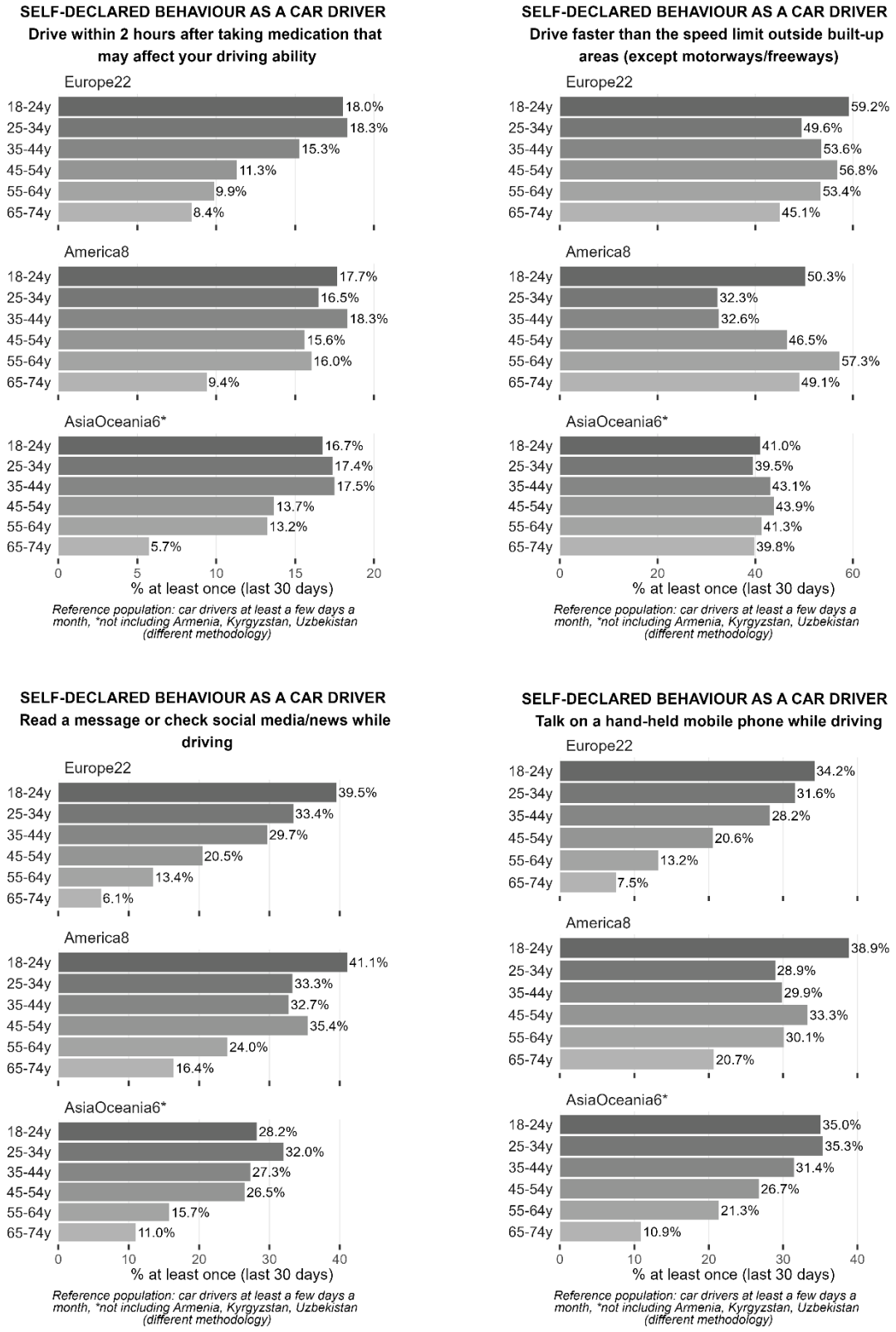


Figure 1: Self-declared behaviours as a car driver in the past 30 days, by region and age.

3.1.2 Social and personal acceptability of unsafe driving behaviours

Perceived social acceptability

To assess the level of perceived social acceptability of unsafe driving behaviours the respondents were asked to answer the question; Where you live, how acceptable would most other people say it is for a CAR DRIVER to ….? Four items of interest were investigated:

- drive when he/she may be over the legal limit for drinking and driving
- drive faster than the speed limit outside built-up areas (except motorways/freeways)
- talk on a hand-held mobile phone while driving
- read a message or check social media/news while driving

The question was answered on a Likert scale from 1 (unacceptable) to 5 (acceptable). The percentages of acceptability (answers 4 or 5) are shown in Figure 2.

The results show that levels of perceived social acceptability are very low towards driving while impaired by alcohol. In Europe22, there is a significant decreasing trend (p-value < 0.01, Cramer's V < 0.11) for acceptability of driving a vehicle while potentially over the legal alcohol limit with increasing age. Only 7.3% of Europeans aged 18-24 consider this behaviour acceptable, a figure which falls to 1.8% among those aged 65-74. In AsiaOceania6 and America8, while the pattern is less consistent, younger individuals aged 18-24 display a significant higher level of acceptability (p-value < 0.01) for such behaviour compared to those 65-74. A comparison across regions reveals that Europe shows the lowest level of perceived social acceptability for this behaviour, signifying regional differences in attitudes towards drinking and driving (p-value < 0.05).

While there is a general trend towards lower acceptability of speeding outside built-up areas (except motorways/freeways) with age, the pattern and degree of association vary by region. In Europe22, there's a clear and statistically significant trend of declining acceptability with age; 22.5% of 18-24-year-olds perceive it to be acceptable, dropping to just 6.2% among those aged 65-74 (p-value < 0.01, Cramer's V < 0.15). In America8, there is no significant difference for the acceptability of such driving behaviour across age groups, with perceived acceptability ranging from 11.3% to 8.8% (p-value > 0.05). In AsiaOceania6, perceived acceptability declines from 13.7% in the youngest to 7.4% in the 45-54 age group, before slightly increasing to 8.3% for the aging age group (p-value < 0.01, Cramer's V < 0.09).

The perceived acceptability of talking on a hand-held mobile phone while driving shows a significant decline with increasing age across Europe22, America8, and AsiaOceania6 (p-value < 0.01). In Europe22, 14.8% of the 18-24 age group perceive it to be acceptable, dropping to 3.1% in the 65-74 age group. In America8, perceived acceptance rates are highest at 10.2% for 18-24 and falls to 4.2% for the 65-74, while for AsiaOceania6, the 18-24 shows a 10.1% acceptance rate, which decreases to 2.7% in those aged 65-74.

The perceived acceptability of reading a message or checking social media/news while driving also shows a significant decline with age and varies by region (p-value < 0.01). In Europe22, the perceived acceptance rate starts at 8.2% among 18–24 and falls to 2.5% for those 65-74. America8 displays some variability yet follows a decreasing trend from 9.9% in 18-24 to 3.8% in the 65-74 age bracket. AsiaOceania6 mirrors this trend, with the rate of perceived acceptability decreasing from 8.7% in 18-24 to 3.5% in the 65-74 age group.

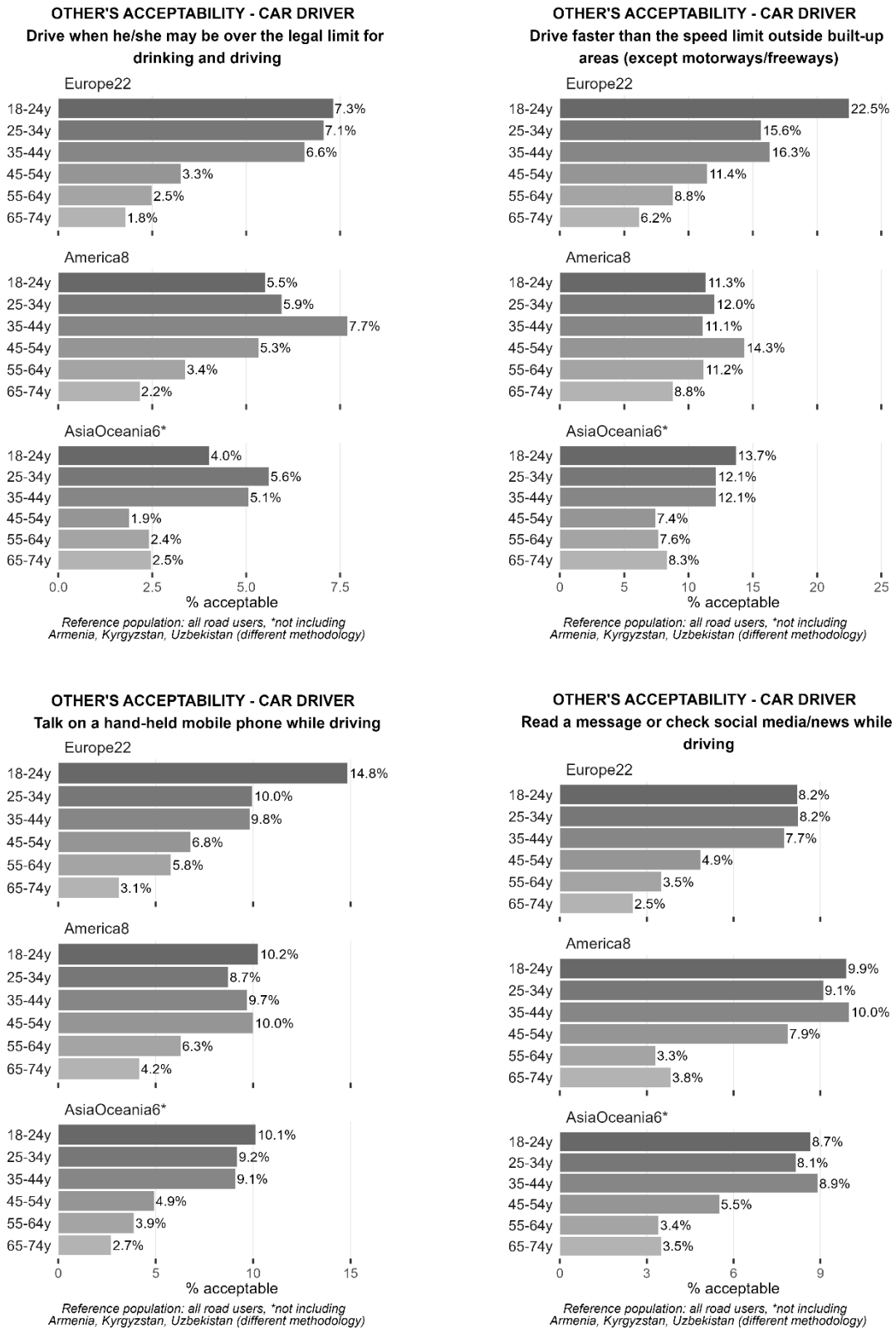


Figure 2: Other's acceptability of unsafe traffic behaviours as a car driver, by region and age.

Personal Acceptability of unsafe driving behaviours

To assess the level of personal acceptability of unsafe driving behaviours, the respondents were asked to answer the question; How acceptable do you, personally, feel it is for a car driver to…? Five items of interest were investigated:

- drive when he/she may be over the legal limit for drinking and driving
- drive within 1 hour after taking drugs (other than prescribed or over the counter medication)
- drive within 2 hours after taking a medication that may affect the driving ability
- drive faster than the speed limit outside built-up areas (except motorways/freeways)
- talk on a hand-held mobile phone while driving
- read a message or check social media/news while driving

The question was answered on a Likert scale from 1 (unacceptable) to 5 (acceptable). The percentages of acceptability (answers 4 or 5) are shown in the results.

Percentages of personal acceptability for all risky behaviours considered are lower than the percentages of the corresponding self-declared behaviours (see Figure 1), showing that a significant number of drivers engage in risky behaviours related to driving even if they consider the behaviour unacceptable.

When asked about the personal acceptability of a car driver driving when they might be over the legal limit for alcohol, age is a significant factor in Europe22 (p-value < 0.001, Cramer's V=0.103). Respondents 18-24 show the highest rates of acceptability (5.9%) with those aged 65-74 showing the second lowest rate (1.1%). The results for America8 show a different, albeit non-statistically significant pattern, with those 18-24 showing a rate of 3.6%, 35-44 showing the highest rate of 5.1% and those aged 65-74 the lowest (1.3%). In AsiaOceania the results do not appear to vary by age.

Views on the acceptability of driving within 1 hour after taking drugs (other than prescribed or over-the-counter medication) show significant differences among age groups in Europe22 and AsiaOceania6 (p-value < 0.001, Cramer's V < 0.11). In Europe22 a large difference is seen between the 18-24 group (5.5%) and the 65-74 group (0.6%), while in AsiaOceania the difference is less pronounced at 4.3% for 18-24 and 2.2% for 65-74. In America8 age is not a statistically significant factor. In all regions the reported rates of personal acceptability are roughly the same for alcohol and drugs, indicating that it is understood that impairment from either constitutes a risk factor.

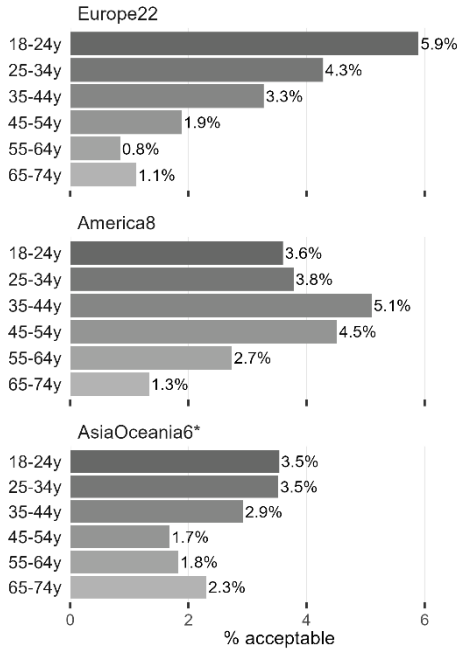
For driving within two hours after taking medication that may affect the driving ability, age is a significant factor in Europe22 and AsiaOceania6 (p-value < 0.007, Cramer's V < 0.10). In Europe22 respondents aged 18-24 have the highest rate of acceptability at 6.9% while those aged 65-74 have the second lowest rate at 1.7%. In AsiaOceania6 respondents aged 65-74 have the lowest rate at 2.5% while those aged 18-24 have the third highest rate at 4.7%.

For speeding outside of built-up areas (except motorways/freeways), age is not a significant factor in America8 or AsiaOceania6. In Europe22 age is a significant factor (p-value<0.001, Cramer's V=0.137) with respondents aged 18-24 showing the highest rate of acceptability (17.6%) and those aged 65-74 the lowest (4.5%). Although not statistically significant, in America8 the same pattern is seen with respondents aged 18-24 having the highest rate (11.1%) and 65-74 the lowest (5.3%).

The personal acceptability of talking on a hand-held mobile phone while driving varies significantly across age groups in Europe22 and AsiaOceania6 (p-value < 0.001, Cramer's V < 0.13). Respondents aged 65-74 express amongst the lowest level of personal acceptability towards this behaviour, with rates of 1.3% in Europe22 and 2.6% in AsiaOceania6. In both regions, those aged 18-24 exhibit the highest rates of personal acceptability at 9.6% in Europe22 and 7.3% in AsiaOceania6.

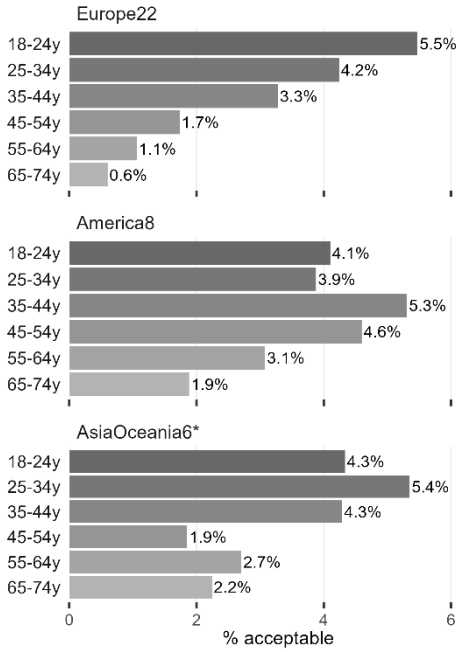
The acceptability of reading messages or checking social media/news while driving shows significant variation across age groups in all regions (p-value < 0.002, Cramer's V < 0.12). Although the trends by age group differ slightly, respondents aged 18-24 consistently show higher rates of personal acceptance than those aged 65-74. Rates of personal acceptance for 18-24 range from 4.3% to 6.1% and for 65-74 range from 0.8% to 2.3%.

PERSONAL ACCEPTABILITY - CAR DRIVER
Drive when he/she may be over the legal limit for drinking and driving



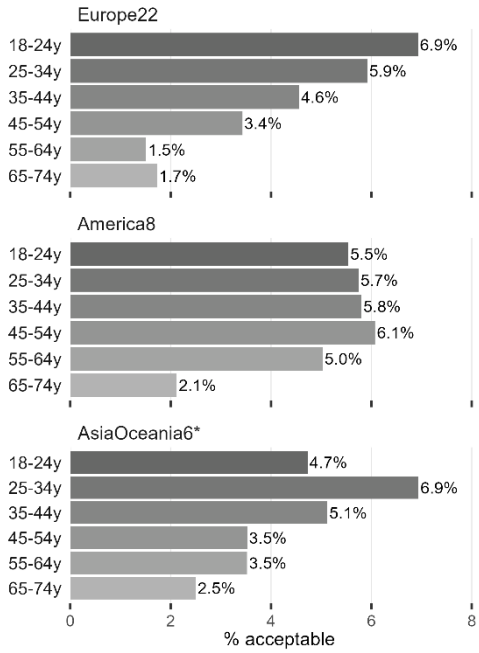
*Reference population: all road users, *not including Armenia, Kyrgyzstan, Uzbekistan (different methodology)*

PERSONAL ACCEPTABILITY - CAR DRIVER
Drive within 1 hour after taking drugs (other than prescribed or over the counter medication)



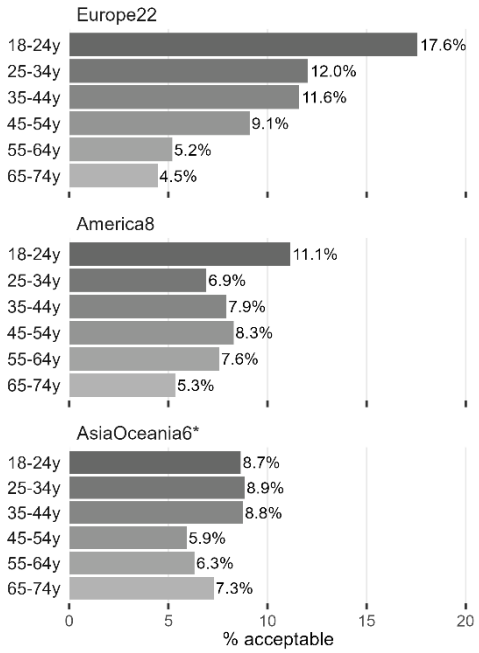
*Reference population: all road users, *not including Armenia, Kyrgyzstan, Uzbekistan (different methodology)*

PERSONAL ACCEPTABILITY - CAR DRIVER
Drive within 2 hours after taking a medication that may affect the driving ability



*Reference population: all road users, *not including Armenia, Kyrgyzstan, Uzbekistan (different methodology)*

PERSONAL ACCEPTABILITY - CAR DRIVER
Drive faster than the speed limit outside built-up areas (except motorways/freeways)



*Reference population: all road users, *not including Armenia, Kyrgyzstan, Uzbekistan (different methodology)*

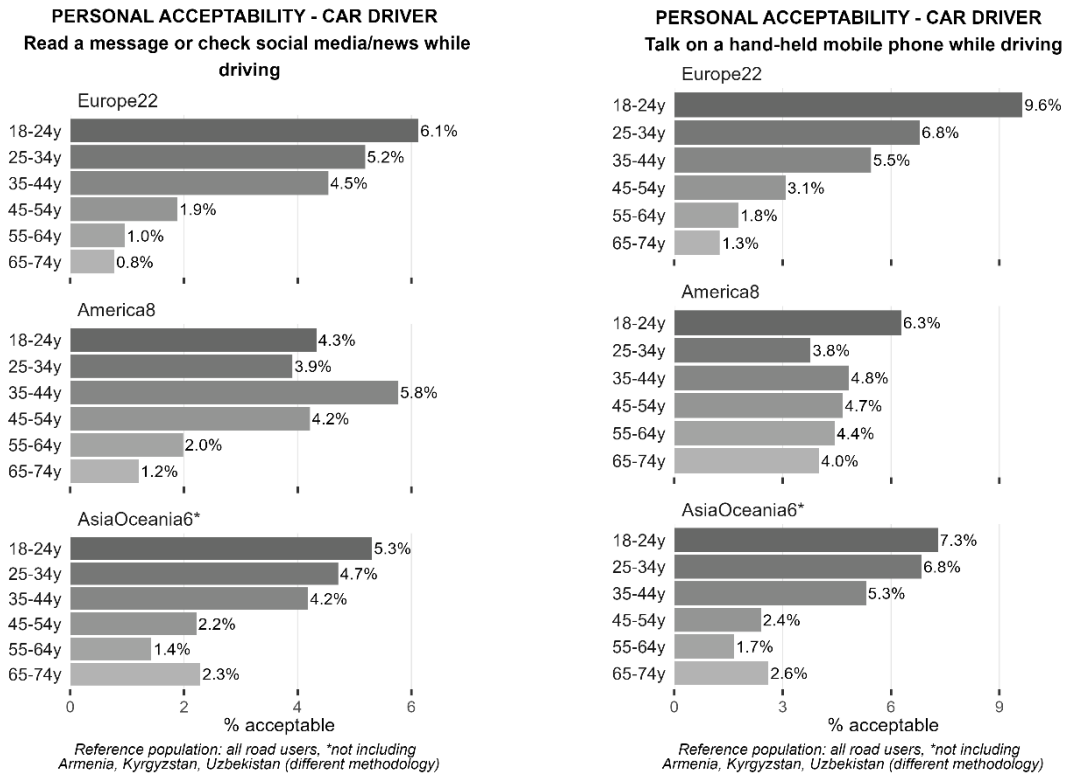


Figure 3: Personal acceptability of unsafe traffic behaviours as a car driver, by region and age.

3.2 Further analyses

To investigate the factors influencing the crash risk of young and aging drivers, a binary logistic regression model was developed. The criteria for a survey respondent to be included in the analysis included:

1. Aged 18-24 or 65-74
2. Holding a valid driving licence or learner's permit
3. Reported driving a car at least once in the last 12 months

Respondents that met these criteria were considered positive for crash involvement if they reported involvement in one or more crashes that resulted in somebody being taken to the hospital, a minor injury, or only material damage.

The model was estimated using Stata's svy: logistic commands applying the ESRA3 individual country weights. The sample included 21,958 drivers from Europe22, 8,251 from America8 and 6,884 from AsiaOceania9. Of these, 1,725 reported being involved in a crash in the previous 12 months. Due to the relatively low number of crashes in the data a significance level of 90% confidence was adopted as a guide for variable selection.

In the model, the outcome is a binary variable indicating no crash involvements (0=never) or one or more crash involvements (1=at least once) in the past 12 months. Independent variables were entered in the model in two phases. In the first phase, the direct impact of sociodemographic characteristics and driving exposure variables and their interactions with age were tested. Regarding urbanisation, an area was defined as an urban/suburban area if the distance to the nearest bus stop, light rail stops, or metro/underground station was within 1 kilometre and the frequency of transit service was at least 3 times per hour. Other areas were considered rural. In the second phase, the modelling explored the inclusion of responses to survey questions regarding the self-declared behaviour, acceptability of unsafe traffic behaviours, attitudes towards safe and unsafe behaviour in traffic, risk perception, enforcement perception, and support for policy measures as well as their interactions with age.

Odds ratios (and the respective 95% Confidence Intervals) are used to measure the strength of association between the predictor variables and crash involvement. Table 2 shows the results of the estimated model.

For the drivers included in the data, the odds of being involved in a crash increase substantially for drivers aged 18-24 (compared to drivers aged 65-74), by 294%. Female drivers have 20% lower odds of crash involvement than males. With respect to region, drivers in America8 and AsiaOceania are 62% and 42% respectively more likely to be involved in a crash than drivers in Europe22.

The variable representing exposure to driving shows interesting results. For drivers aged 65-74, those who drive less than four days a week show lower odds of being involved in a crash with an odds ratio of 0.44. This meets expectations as less driving means less exposure to the opportunity for a crash. Conversely, drivers aged 18-24 show higher odds for crash involvement when only driving four days or fewer a week. A possible explanation is that if young drivers are not driving frequently, they are not gaining the experience and skills for safe driving and thus their risk when driving remains elevated.

The results also indicated that semi-urban and urban areas are associated with lower odds of crash involvement compared to rural areas with a odds ratio of 0.76. It is important to note that these results are for a crash of any severity and the difference in odds by area could possibly be larger if the focus was on high severity crashes due to the increased speeds and crash types (e.g. run-off-road) typical in rural environments.

Concerning the other factors, only a few variables related to self-declared personal acceptability of select risky driving behaviours could be included in the model with statistical significance. The findings indicate that drivers that express some personal acceptance of driving faster than the speed limit outside built-up areas (except motorways/freeways) are associated with 30% higher odds of being involved in a crash. Drivers who express some personal acceptance of driving while talking on a hand-held phone are associated with a 64% increase in odds of crash involvement. Finally, drivers who express some personal acceptance of reading a message or checking social media/news while driving are associated with a 137% increase in odds of crash involvement.

Table 2: Factors that influence the likelihood of an aging/young driver being involved in a crash as a car driver.

Independent variables (reference categories)	Odds Ratio (CI95%)
Age group (Ref. 65-74y)	
18-24	3.94** (2.37-6.56)
Gender (Ref. male)	
Female	0.80* (0.62-1.03)
Region (Ref. Europe22)	
America8	1.62** (1.19-2.19)
AsiaOceania9	1.42** (1.06-1.92)
Frequency of driving (Ref. 4 days a week or more)	
Less than 4 days a week # young	1.28* (0.98-1.66)
Less than 4 days a week # aging	0.44** (0.22-0.89)
Urbanisation (Ref. rural)	
Urban and Semi-urban	0.76* (0.58-1.00)
Acceptability (Ref. unacceptable/neutral)	
How acceptable do you, personally, feel it is for a CAR DRIVER to …? drive faster than the speed limit outside built-up areas (except motorways/freeways)	1.30* (0.95-1.78)
How acceptable do you, personally, feel it is for a CAR DRIVER to …? talk on a hand-held phone while driving	1.64** (1.08-2.48)
How acceptable do you, personally, feel it is for a CAR DRIVER to …? read a message or check social media/news while driving	2.37** (1.52-3.68)

Notes: (1)* p-value<0.10, **p-value<0.05.

3.3 Contextual data and comparison with other findings

This section includes the analysis of external data and its association with some results of the ESRA3_2023 survey. Data on roadway fatalities were acquired from the Organization for Economic Co-operation and Development (OECD) and the European Road Safety Observatory. Population data were acquired from the United Nations Department of Economic and Social Affairs.

Figures 4 and 5 show the percentages, for the ESRA3 countries in which these data were available, of the population killed in road crashes that are 65+ and 18-24, respectively, in 2021 or latest available data and the percentage of the population that is 65+ or 18-24 in 2021. In every country with available data, drivers aged 65 and above are overrepresented among those killed in road crashes, except in Latvia, Luxembourg, and the United States. The same is true for the 18-24 age group, with the exception of Japan. It's important to note that these statistics do not differentiate between fatalities involving vehicle drivers, passengers, or killed while outside of a vehicle. Despite findings from the ESRA3 survey suggesting that aging drivers generally exhibit lower rates of risk-taking behaviours and attitudes, they remain overrepresented in traffic fatalities in these countries, likely due to their increased physical vulnerability and decreased tolerance to injury.

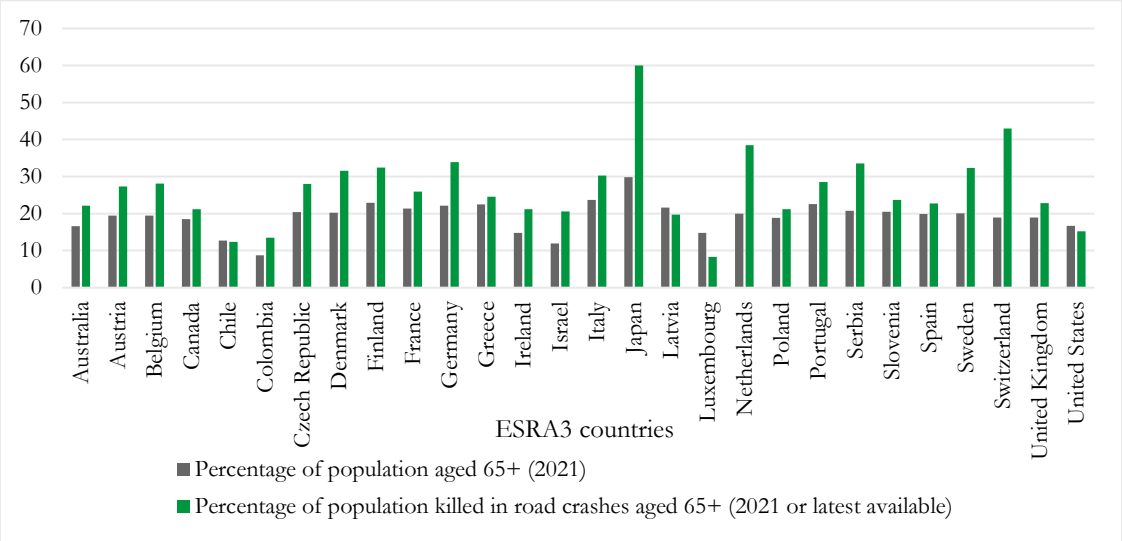


Figure 4: Percentage of population killed in road crashes aged 65+ (2021 or latest available) vs percentage of population aged 65+ (2021).

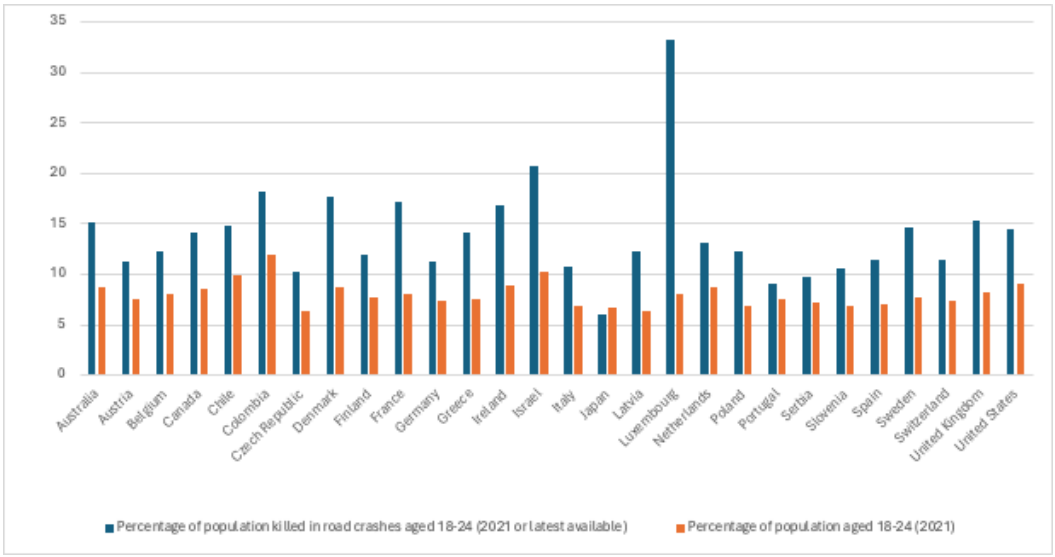


Figure 5: Percentage of population killed in road crashes aged 18-24 (2021 or latest available) vs percentage of population aged 18-24 (2021).

Figures 6 and 7 plot the percentage of the population aged 65+ and 18-24, respectively, that were killed in road crashes in 2021 or latest data versus the percentage of the population aged 65+ and 18-24, accordingly, in a given country that rated the safety of travel by car (non-electric or non-hybrid), 5 or less on a 10-point scale. Traffic fatality and population data were accessible for only 36 of the ESRA3 countries. While one might anticipate a correlation between the percentage of respondents rating car travel as unsafe and the percentage of the population killed in road crashes, the data do not exhibit significant trends or correlations (p-value > 0.05). This suggests that reported perceptions of safety for car drivers may not always align with empirical evidence of road safety risks.

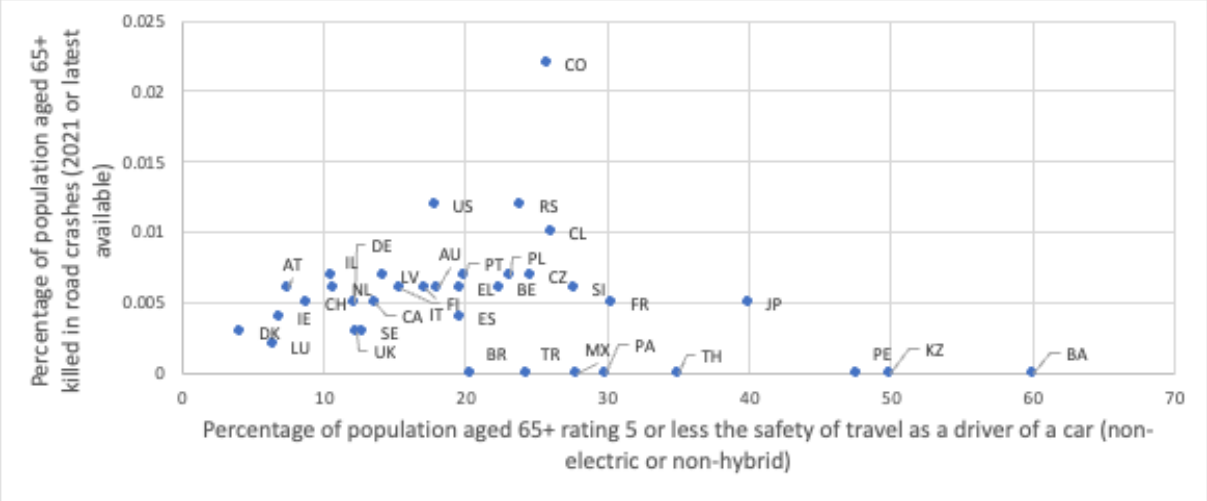


Figure 6: Percentage of population aged 65+ killed in road crashes (2021 or latest available) vs percentage of population aged 65+ rating 5 or less the safety of travel as a driver of a car (non-electric or non-hybrid).

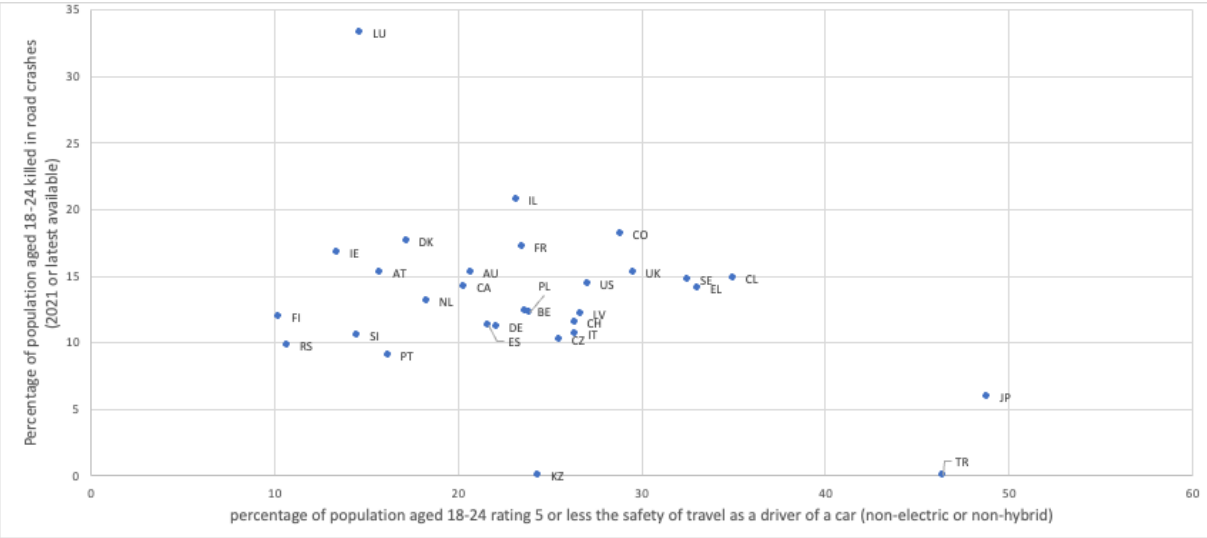


Figure 7: Percentage of population aged 18-24 killed in road crashes (2021 or latest available) vs percentage of population aged 18-24 rating 5 or less the safety of travel as a driver of a car (non-electric or non-hybrid).

3.4 Limitations of the data

Self-reported data are often susceptible to various biases, as highlighted by research (Choi & Pak, 2005; Krosnick and Presser, 2010). These include desirability bias, where respondents tend to provide answers that paint a favourable image of themselves, potentially exaggerating positive behaviours and downplaying negative ones. Another concern is bias resulting from misunderstanding questions, particularly those with complex language or lengthy formulations, which can lead to misinterpretation of the intended query. Also, recall errors may occur, leading to unintentional inaccuracies in responses due to memory lapses or mistakes.

4. Summary and discussion

This ESRA thematic report delves into the self-declared behaviours and perceived acceptability (social and personal) related to driving while impaired, speeding, and distraction, among young and aging road users. It comprehensively addresses these issues considering driver impairment from alcohol, drugs, and prescription medication, driving over the speed limit, and engaging in distracted driving behaviours like listening to music or reading messages. The analyses focus on differences between aging (aged 65-74) and young (aged 18-24) road users while also making comparisons to other age groups. In addition, factors that increase the likelihood of a crash involvement for an aging and young driver were also compared.

Aging drivers, aged 65-74, generally show lower rates of engaging in risky behaviours associated with impairment, such as driving potentially over the legal alcohol limit or under the influence of drugs, compared to younger age groups. Lower rates of risky behaviours amongst aging drivers correspond with how aging drivers view driving circumstances compared to when driving as a younger driver. A questionnaire study in Sweden (Henricksson et al., 2014) asked aging drivers (aged 70+) to express whether a driving circumstance was more difficult today and whether they took steps to avoid it compared to when they were 40 years of age. Over half of respondents indicated that driving in adverse weather, driving in an unfamiliar town, driving in darkness and driving against the light were more difficult as an aging driver and 30% or more took steps to avoid these situations. Only 10% agreed that their driving behaviour was unsafe.

Personal acceptability rates are very low concerning driving while impaired by alcohol, drugs, or prescription medication, while for speeding, the rate of acceptance is higher, but a majority of respondents still indicate speeding is unacceptable. The general trend is that aging road users report the lowest or near-lowest level of acceptance towards risky driving behaviours. With regards to speeding, the level of personal acceptability is lowest for speeding in built-up areas, with greater acceptance for speeding in non-built-up areas and on motorways/freeways. Percentages of personal acceptability are much lower than the percentages of the corresponding self-declared behaviours, suggesting that a significant number of drivers engage in risky behaviours such as driving while potentially impaired or speeding even if they consider the behaviour unacceptable. Acceptability levels for alcohol, drugs, and prescription medication impairment are relatively similar, suggesting an understanding that impairment from any of these causes poses a significant risk.

There's a notable decrease in the perception of others' acceptability of risky driving behaviours with age in all regions. Europe leads with the most stringent views against driving over the alcohol limit, especially among the aging, suggesting deeply ingrained cultural attitudes against impaired driving. In contrast, younger road users in AsiaOceania and America display a higher tolerance for such behaviour.

The variability across regions underscores the need for targeted strategies to address specific local attitudes and behaviours, pointing towards the importance of culturally and demographically nuanced approaches to improving driving safety.

To investigate factors affecting the crash risk of young and aging drivers, binary logistic regression models were developed to study reported crash involvement within the past 12 months. Using data from all regions, those aged 18-24 have a significantly higher risk of crash involvement compared to 65-74-year-olds, with the odds increasing by ranging from 294%. This substantial increase in crash risk among younger drivers could be attributed to their having less experience and tendency to take riskier actions while older drivers have more conservative driving behaviours and possibly less exposure to high-risk driving situations, such as night-time driving. Female drivers show a 20% lower crash risk than their male peers, highlighting gender differences across age groups. Regionally, drivers in America8 (62%) and AsiaOceania6 (42%) are associated with a higher crash risk than drivers in Europe22, and drivers in urban or semi-urban environments are associated with lower crash risk than those in rural areas by 24%. Interestingly, for drivers aged 65-74, those who drive less than four days a week show lower odds of being involved in a crash with an odds ratio of 0.44. This meets expectations as less driving means less exposure to the opportunity for a crash. Conversely, drivers aged 18-24 show higher odds for crash involvement when only driving four days or fewer a week. A possible explanation is that if young drivers are not driving frequently, they are not gaining the experience and skills for safe driving and thus their risk when driving remains elevated. Findings also indicated that drivers that express some personal acceptance of driving faster than the speed limit outside built-up areas (except

motorways/freeways) are associated with 30% higher odds of being involved in a crash. Drivers who express some personal acceptance of driving while talking on a hand-held phone are associated with a 64% increase in odds of crash involvement. Finally, drivers who express some personal acceptance of reading a message or checking social media/news while driving are associated with a 137% increase in odds of crash involvement. Educational campaigns that target these attitudes, alongside stricter enforcement of traffic laws, could have a significant impact on improving road safety.

Despite the findings from the ESRA3 survey that aging drivers in general report lower rates of risk-taking behaviours and less risky attitudes, an analysis of the percentage of the population killed in road crashes that are 65+ versus the percentage of the population being 65+ found they are still overrepresented in traffic fatalities in these countries. This finding is consistent with the literature as discussed in the Introduction.

A comparison of reported feelings of safety when travelling by car and rates of road crash fatalities indicated that the reported perceptions of safety are not necessarily based on factual evidence of road safety risks in general.

Recommendations

Policy recommendations

- Begin conversations with drivers early in life and focus on fitness to drive rather than focusing strictly on aging. Outreach and communication are essential, as is the provision of information about alternative transportation options and community resources, to those who are required to submit to medical review or those who decide not to pursue licence renewal.
- Emphasize to novice drivers that experience gained through driving is critical to acquiring the skills needed for safe driving. Novice driver programs such as Graduated Licensing should be structured to encourage or require frequent driving during this learning period.
- Modify the licensing process for all drivers to identify the most at-risk drivers due to physical or mental limitations with respect to the driving task and administer tests for assessing their fitness to drive.
- Ensure the existence and availability of alternative transportation options for those for whom a cessation of driving is necessary.

Specific recommendations to particular stakeholders

- *[To Non-Governmental Organizations (NGOs)]* Contribute to education and awareness raising campaigns and events against impaired driving, driving while drowsy, and speeding.
- *[To vehicle manufacturers, other companies and research organisations]* Continue to develop and promote low-cost solutions that can be incorporated in vehicles and can assist drivers.

The initial aim of ESRA was to develop a system for gathering reliable and comparable information about people's attitudes towards road safety in several European countries. This objective has been achieved and the initial expectations have even been exceeded. ESRA has become a global initiative which already conducted surveys in more than 60 countries across six continents. The outputs of the ESRA project have become building blocks of national and international road safety monitoring systems.

The ESRA project has also demonstrated the feasibility and the added value of joint data collection on road safety attitudes and performance by partner organizations in a large number of countries. The intention is to repeat this survey every three to four years, retaining a core set of questions in every wave allowing the development of time series of road safety performance indicators.

Lists of tables and figures

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Appendix 1: ESRA3 Questionnaire

Introduction

In this questionnaire, we ask you some questions about your experience with, and your attitudes towards traffic and road safety. When responding to a question, please answer in relation to the traffic and road safety situation in [COUNTRY]. There are no right or wrong answers; what matters is your own experience and perception.

Socio-demographic information

Q1) **In which country do you live? _____**

Q2) **Are you …** male – female - other

Q3) **How old are you (in years)?** [Drop down menu]

Q4_1) **Are you currently a student?** yes - no

Q4_2) **What is the highest qualification or educational certificate which you want to achieve?** primary education - secondary education - bachelor's degree or similar - master's degree or higher

Q4_3) **What is the highest qualification or educational certificate that you have obtained?** none - primary education - secondary education - bachelor's degree or similar - master's degree or higher

Q5) **Which of the descriptions comes closest to how you feel about your household's income nowadays?** living comfortably on present income - coping on present income - finding it difficult on present income - finding it very difficult on present income

Q6a) **Is the car you regularly drive equipped with seatbelts in the front seat?** yes – no
Only asked to LMIC countries.

Q6b) **Is the car you regularly drive equipped with seatbelts in the back seat?** yes - no
Only asked to LMIC countries.

Q7) **Are you using a carsharing organization (e.g., poppy or cambio[4])?** yes – no
Only asked to HIC/UMIC countries.

Q8) **Do you have to drive or ride a vehicle during your main professional activity?** yes, I transport mainly other person(s) (e.g., taxi, bus, rickshaw, …) - yes, I transport mainly goods (e.g., truck, courier, food delivery,…) - yes, I transport mainly myself (e.g., visiting patients, salesperson,…) - no, I drive or ride a vehicle only for commuting or private reasons

Q9) **Which phrase best describes the area where you live?** a farm or home in the countryside - a country village - a town or a small city - the suburbs or outskirts of a big city - a big city

Q10) **In which region do you live?** [List of regions per country]

Q11a) **How far do you live from the nearest stop of public transport?** less than 500 metres - between 500 metres and 1 kilometre - more than 1 kilometre

Q11b) **What is the frequency of your nearest public transport?** at least 3 times per hour - 1 or 2 times per hour - less than 1 time per hour

Mobility & exposure

[4] *The examples in brackets were adapted to national context.*

Q12) **During the past 12 months, how often did you use each of the following transport modes in [country]? How often did you ...?** at least 4 days a week - 1 to 3 days a week - a few days a month - a few days a year - never

Items_(random order): take the train - take the bus or minibus - take the tram/streetcar - take the subway, underground, metro - take a plane - take a ship/boat or ferry - be a passenger on non-motorized individual public transport mode (e.g., bike taxi, animal carriages,…) - be a passenger on motorized individual public transport mode (e.g., car-taxi, moto-taxi, tuk-tuk, auto rickshaw, songthaew,…) - walk or run minimum 200m down the street - cycle (non-electric) - cycle on an electric bicycle / e-bike / pedelec - drive a moped (≤ 50 cc or ≤ 4 kW) - drive a motorcycle (> 50 cc or > 4kW) - ride an e-scooter (electric-kick style scooter) - drive a car (non-electric or non-hybrid) - drive a hybrid or electric car - be a passenger in a car - be a passenger on a moped or motorcycle - use another transport mode

Q13) **Over the last 30 days, have you transported a child (<18 years of age) in a car?** yes - no

Items (random order): under 150cm - above 150cm[5]

Self-declared safe and unsafe behaviour in traffic

Q14_1a) **Over the last 30 days, how often did you as a CAR DRIVER ...?** You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.

Binary variable for most items: at least once (2-5) - never (1); only exception: items on protective systems: always wear/transport (1) – not always wear/transport (2-5)

Items (random order):

- drive when you may have been over the legal limit for drinking and driving
- drive after drinking alcohol
- drive within 1 hour after taking drugs (other than prescribed or over the counter medication)
- drive within 2 hours after taking medication that may affect your driving ability
- drive faster than the speed limit inside built-up areas
- drive faster than the speed limit outside built-up areas (except motorways/freeways)
- drive too fast for the road/traffic conditions at the time (e.g., poor visibility, dense traffic, presence of vulnerable road users)
- drive faster than the speed limit on motorways/freeways
- drive without wearing your seatbelt
- transport children under 150cm[6] without using child restraint systems (e.g., child safety seat, cushion)
- transport children above 150cm[7] without wearing their seat belt
- talk on a hand-held mobile phone while driving
- talk on a hands-free mobile phone while driving
- read a message or check social media/news while driving
- drive when you were so sleepy that you had trouble keeping your eyes open

Q14_1b_1) **You said that you have driven a car when you may have been over the legal limit for drinking and driving. Was this ...?** **You can indicate multiple answers:** in the week during daytime - in the week during night-time - in the weekend during daytime - in the weekend during night-time - on motorways - on urban roads - on rural roads

Only asked to HIC/UMIC countries.

Q14_1b_2) **You said that you have driven a car within 1 hour after taking drugs (other than prescribed or over the counter medication). Was this ...?** **You can indicate multiple answers:** cannabis - cocaine - amphetamines (e.g., speed, extasy) - illicit opiates (e.g., morphine, codeine; not prescribed as medication) - other

Q14_1b_3) **You said that you have driven a car within 2 hours after taking medication that may affect your driving ability. Was this ...?** **You can indicate multiple answers[8]:** antihistamines and/or cough medicines (such as Claritin, Allegra, Benadryl) - antidepressants (such as Prozac, Zoloft, Wellbutrin) - prescription pain medicines (such as Tylenol with codeine, OxyContin, Percocet, Vicodin/ hydrocodone) - muscle relaxants (such as Soma, Flexeril) - sleep aids, Barbiturates, or Benzodiazapines

[5] *This question was adapted to national legal regulation.*
[6] *This question was adapted to national legal regulation.*
[7] *This question was adapted to national legal regulation.*
[8] *The examples in brackets were adapted to national context.*

(such as Ambien, Lunesta, phenobarbital, Xanax, Valium, Ativan) - amphetamines (such as Adderall, Dexedrine, phentermine) - other

Q14_2) **Over the last 30 days, how often did you as a CAR PASSENGER …? You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.**

Binary variable for most items: always wear/transport (1) – not always wear/transport (2-5)
Items (random order):

- travel without wearing your seatbelt in the back seat
- travel without wearing your seatbelt in the front seat

Q14_3) **Over the last 30 days, how often did you as a MOPED RIDER or MOTORCYCLIST …?** You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.

Binary variable for most items: at least once (2-5) - never (1); only exception: items on protective systems: always wear/transport (1) – not always wear/transport (2-5)
Items (random order):

- ride when you may have been over the legal limit for drinking and driving
- ride faster than the speed limit outside built-up areas (except motorways/freeways)
- not wear a helmet on a moped or motorcycle
- read a message or check social media/news while riding
- ride within 1 hour after taking drugs (other than prescribed or over the counter medication)
- ride too fast for the road/traffic conditions at the time (e.g., poor visibility, dense traffic, presence of vulnerable road users) - Only asked to LMIC countries.
- ride a motorcycle with more than 1 passenger

Q14_4) **Over the last 30 days, how often did you as a CYCLIST …?** You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.

Binary variable for most items: at least once (2-5) - never (1); only exception: items on protective systems: always wear/transport (1) – not always wear/transport (2-5)
Items (random order):

- cycle when you think you may have had too much to drink
- cycle without a helmet
- cycle while listening to music through headphones
- read a message or check social media/news while cycling
- cycle within 1 hour after taking drugs (other than prescribed or over the counter medication)
- cross the road when a traffic light is red

Q14_5) **Over the last 30 days, how often did you as a PEDESTRIAN …?** You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.

Binary variable for most items: at least once (2-5) - never (1); only exception: items on protective systems: always wear/transport (1) – not always wear/transport (2-5)
Items (random order):

- listen to music through headphones while walking down the street
- walk down the street when you think you may have had too much to drink
- read a message or check social media/news while walking down the street
- text a message while walking down the street
- cross the road when a pedestrian light is red
- cross the road at places other than at a nearby (distance less than 30m[9]) pedestrian crossing

Q14_6) **Over the last 30 days, how often did you as RIDER OF AN E-SCOOTER (electric-kick style scooter) …?** You can indicate your answer on a scale from 1 to 5, where 1 is "never" and 5 is "(almost) always". The numbers in between can be used to refine your response.

Binary variable for most items: at least once (2-5) - never (1); only exception: items on protective systems: always wear/transport (1) – not always wear/transport (2-5)
Only asked to HIC/UMIC countries.

[9] *This question was adapted to national legal regulation.*

Items (random order):

- ride with more than 1 person on board
- ride when you think you may have had too much to drink
- cross the road when a traffic light is red
- ride on pedestrian pavement/sidewalk
- ride without a helmet

Acceptability of safe and unsafe traffic behaviour

Q15) **Where you live, how acceptable would most other people say it is for a CAR DRIVER to ….?** You can indicate your answer on a scale from 1 to 5, where 1 is "unacceptable" and 5 is "acceptable". The numbers in between can be used to refine your response.

Binary variable: acceptable (4-5) – unacceptable/neutral (1-3)
Items (random order):

- drive when he/she may be over the legal limit for drinking and driving
- drive faster than the speed limit outside built-up areas (except motorways/freeways)
- drive without wearing the seatbelt
- talk on a hand-held mobile phone while driving
- read a message or check social media/news while driving

Q16_1) **How acceptable do you, personally, feel it is for a CAR DRIVER to …?** You can indicate your answer on a scale from 1 to 5, where 1 is "unacceptable" and 5 is "acceptable". The numbers in between can be used to refine your response.

Binary variable: acceptable (4-5) – unacceptable/neutral (1-3)
Items (random order; instructed response item (trick item) as last item):

- drive when he/she may be over the legal limit for drinking and driving
- drive within 1 hour after taking drugs (other than prescribed or over the counter medication)
- drive within 2 hours after taking a medication that may affect the driving ability
- drive faster than the speed limit inside built-up areas
- drive faster than the speed limit outside built-up areas (except motorways/freeways)
- drive too fast for the road/traffic conditions at the time (e.g., poor visibility, dense traffic, presence of vulnerable road users)
- drive faster than the speed limit on motorways/freeways
- drive without wearing the seatbelt
- transport children in the car without securing them (child's car seat, seatbelt, etc.)
- talk on a hand-held mobile phone while driving
- talk on a hands-free mobile phone while driving
- read a message or check social media/news while driving
- drive when he/she is so sleepy that he/she has trouble keeping their eyes open
- Please, select the answer option number 5 "acceptable". (Instructed response item (trick item))

Q16_2) **How acceptable do you, personally, feel it is for a MOPED RIDER or MOTORCYCLIST to …?** You can indicate your answer on a scale from 1 to 5, where 1 is "unacceptable" and 5 is "acceptable". The numbers in between can be used to refine your response.

Binary variable: acceptable (4-5) – unacceptable/neutral (1-3)
Items (random order):

- ride when he/she may have been over the legal limit for drinking and driving
- ride faster than the speed limit outside built-up areas (except motorways/freeways)
- not wear a helmet on a moped or motorcycle
- read a message or check social media/news while riding
- ride a motorcycle with more than 1 passenger – Only asked to LMIC countries.

Q16_3) **How acceptable do you, personally, feel it is for a CYCLIST to …?** You can indicate your answer on a scale from 1 to 5, where 1 is "unacceptable" and 5 is "acceptable". The numbers in between can be used to refine your response.

Binary variable: acceptable (4-5) – unacceptable/neutral (1-3)
Items (random order):

- cycle when he/she may have had too much to drink
- cycle without a helmet
- read a message or check social media/news while cycling
- cross the road when a traffic light is red

Q16_4) **How acceptable do you, personally, feel it is for a PEDESTRIAN to …?** You can indicate your answer on a scale from 1 to 5, where 1 is "unacceptable" and 5 is "acceptable". The numbers in between can be used to refine your response.

Binary variable: acceptable (4-5) – unacceptable/neutral (1-3)
Items (random order):

- walk down the street when he/she may have had too much to drink
- read a message or check social media/news while walking down the street
- cross the road when a pedestrian light is red

Attitudes towards safe and unsafe behaviour in traffic

Q17) **To what extent do you agree with each of the following statements?** You can indicate your answer on a scale from 1 to 5, where 1 is "disagree" and 5 is "agree". The numbers in between can be used to refine your response.

Binary variable: agree (4-5) – disagree/neutral (1-3)
Items (random order):
Behaviour believes & attitudes

- For short trips, one can risk driving under the influence of alcohol.
- I have to drive fast; otherwise, I have the impression of losing time.
- Respecting speed limits is boring or dull.
- Motorized vehicles should always give way to pedestrians or cyclists.
- I use a mobile phone while driving, because I always want to be available.
- To save time, I often use a mobile phone while driving.

Perceived behaviour control = self-efficacy

- I trust myself to drive after drinking a small amount of alcohol (e.g., one glass of wine or one pint of beer).
- I have the ability to drive when I am a little drunk after a party.
- I am able to drive after drinking a large amount of alcohol (e.g., a bottle of wine).
- I trust myself when I drive significantly faster than the speed limit.
- I have the ability to drive significantly faster than the speed limit.
- I am able to drive fast through a sharp curve.
- I trust myself when I check messages on the mobile phone while driving.
- I have the ability to write a message on the mobile phone while driving.
- I am able to talk on a hand-held mobile phone while driving.

Habits

- I often drive after drinking alcohol.
- I often drive faster than the speed limit.
- I often use my mobile phone while driving.

Intention

- I intend not to drive after drinking alcohol in the next 30 days.
- I intend to respect speed limits in the next 30 days.
- I intend not to use my mobile phone while driving in the next 30 days.

Subjective safety & risk perception

Q18) **How safe or unsafe do you feel when using the following transport modes in [country]?** You can indicate your answer on a scale from 0 to 10, where 0 is "very unsafe" and 10 is "very safe". The numbers in between can be used to refine your response.

Items (random) = Items indicated by the respondent in Q12 are displayed.

Q19) **How often do you think each of the following factors is the cause of a road crash involving a car**? You can indicate your answer on a scale from 1 to 6, where 1 is "never" and 6 is "(almost) always". The numbers in between can be used to refine your response.

Binary variable: often/frequently (4-6) – not that often/not frequently (1-3)
Items (random order):

- driving after drinking alcohol
- driving within 1 hour after taking drugs (other than prescribed or over the counter medication)
- driving faster than the speed limit
- using a hand-held mobile phone while driving
- using a hands-free mobile phone while driving
- inattentiveness or daydreaming while driving
- driving while tired

Support for policy measures

Q20) **Do you oppose or support a legal obligation …?** You can indicate your answer on a scale from 1 to 5, where 1 is "oppose" and 5 is "support". The numbers in between can be used to refine your response.

Binary variable: support (4-5) – oppose/neutral (1-3)
Items for all countries (random order):

- forbidding all drivers of motorized vehicles to drive with a blood alcohol concentration above 0.0 ‰ (zero tolerance)
- forbidding all drivers of motorized vehicles to use a hand-held mobile phone while driving
- limiting the speed limit to 30 km/h in all built-up areas (except on main thoroughfares)
- requiring all cyclists to wear a helmet
- limiting the speed limit to a maximum of 80 km/h on all rural roads without a median strip
- forbidding all novice drivers of motorized vehicles (license obtained less than 2 years ago) to drive with a blood alcohol concentration above 0.0 ‰ (zero tolerance)

Items only for HIC/UMIC countries (random order):

- installing an alcohol 'interlock' for drivers who have been caught drunk driving on more than one occasion (technology that won't let the car start if the driver's alcohol level is over a certain limit)
- requiring cyclists under the age of 12 to wear a helmet
- forbidding all cyclists to ride with a blood alcohol concentration above 0,0‰ (zero tolerance)

Items only for LMIC countries (random order):

- forbidding all professional drivers of motorized vehicles (e.g., taxis, vans, trucks, buses, …) to drive with a blood alcohol concentration above 0.0 ‰ (zero tolerance)
- requiring all moped and motorcycle riders and passengers to wear a helmet
- requiring all car drivers and passengers (front- and back seat) to wear a seatbelt
- making liability insurance mandatory for owners of cars

Q21) **Please think of the policy measure: "…" and indicate if you agree or disagree with the following statements about it. This policy measure would …?** Disagree – agree

Random selection of one of the first 4 items in Q20 per respondent. All first 4 items in Q20 are be asked equally often in each country.
Items (random order):

- reduce the number of road crashes and injuries
- increase the safety feeling on the streets
- have negative side effects
- restrict people's individual freedom
- reduce the privacy of people
- limit people's mobility
- lead to discrimination
- be fair
- be expensive for people
- be easy to implement
- be difficult to enforce by the police
- be a burden for people
- be an unjustifiable intervention by the state
- be supported by many of my friends

Enforcement

Q22) **On a typical journey, how likely is it that you (as a car driver) will be checked by the police (including camera's or radars) for …?** You can indicate your answer on a scale from 1 to 7, where 1 is "very unlikely" and 7 is "very likely". The numbers in between can be used to refine your response.

Binary variable: likely (5-7) – unlikely/neutral (1-4)
Items (random order):

- alcohol, in other words, being subjected to a Breathalyser test
- the use of illegal drugs
- respecting the speed limits
- wearing your seatbelt
- the use of hand-held mobile phone to talk or text while driving

Q23_1) **In the past 12 months, how many times have you been checked by the police for using alcohol while driving a car (i.e., being subjected to a Breathalyser test)?** Never – 1 time – at least 2 times – Binary variable: at least once – never

Q23_2) **In the past 12 months, how many times have you been checked by the police for using drugs (other than prescribed or over the counter medication) while driving a car?** Never – 1 time – at least 2 times – Binary variable: at least once – never

Involvement in road crashes

The following questions focus on road crashes. With road crashes, we mean any collision involving at least one road vehicle (e.g., car, motorcycle, or bicycle) in motion on a public or private road to which the public has right of access. Furthermore, these crashes result in material damage, injury, or death. Collisions include those between road vehicles, road vehicles and pedestrians, road vehicles and animals or fixed obstacles, road and rail vehicles, and one road vehicle alone.

Q24a) **In the past 12 months, have you personally been involved in a road crash where at least one person was injured (light, severe or fatal crashes)?** Yes – no

Q24b) **Please indicate the transport mode(s) YOU were using at the time of these crashes.** **You can indicate multiple answers:** as a car driver – as a car passenger – as a moped or motorcycle rider – as a moped or motorcycle passenger – as a cyclist – as a pedestrian – as a rider of an e-scooter (electric-kick style scooter) – other

Infrastructure

Q25_1_a) **As a CAR DRIVER, what type of roads do you regularly use in [country]?** You can indicate multiple answers: inter-city motorways – thoroughfares and high-speed roads within cities – rural roads and roads connecting towns and villages – other streets and roads in urban areas

Q25_1_b) **As a CAR DRIVER, how would you rate the roads that you regularly use in terms of safety?** You can indicate your answer on a scale from 1 to 7, where 1 is "very unsafe" and 7 is "very safe". The numbers in between can be used to refine your response.

Binary variable: safe (5-7) – unsafe/neutral (1-4)
Items (random order):

- inter-city motorways
- thoroughfares and high-speed roads within cities
- rural roads and roads connecting towns and villages
- other streets and roads in urban areas

Q25_2_a) **As a MOPED RIDER or MOTORCYCLIST, what type of roads do you regularly use in [country]?** You can indicate multiple answers: thoroughfares and high-speed roads within cities – rural roads and roads connecting towns and villages – other streets and roads in urban areas

Q25_2_b) **As a MOPED RIDER or MOTORCYCLIST, how would you rate the roads that you regularly use in terms of safety?** You can indicate your answer on a scale from 1 to 7, where 1 is "very unsafe" and 7 is "very safe". The numbers in between can be used to refine your response.

Binary variable: safe (5-7) – unsafe/neutral (1-4)
Items (random order):

- thoroughfares and high-speed roads within cities
- rural roads and roads connecting towns and villages
- other streets and roads in urban areas

Q25_3_a) **As a CYCLIST, what type of roads/cycle lanes do you regularly use in [country]?** You can indicate multiple answers: rural roads and roads connecting towns and villages with cycle lanes – rural roads and roads connecting towns and villages without cycle lanes – streets and roads in urban areas with cycle lanes – streets and roads in urban areas without cycle lanes

Q25_3_b) **As a CYCLIST, how would you rate the roads/cycle lanes that you regularly use in terms of safety?** You can indicate your answer on a scale from 1 to 7, where 1 is "very unsafe" and 7 is "very safe". The numbers in between can be used to refine your response.

Binary variable: safe (5-7) – unsafe/neutral (1-4)
Items (random order):

- rural roads and roads connecting towns and villages with cycle lanes
- rural roads and roads connecting towns and villages without cycle lanes

- streets and roads in urban areas with cycle lanes
- streets and roads in urban areas without cycle lanes

Q25_4_a) **As a PEDESTRIAN, what type of roads/sidewalks do you regularly use in [country]?** You can indicate multiple answers: rural roads and roads connecting towns and villages with sidewalks – rural roads and roads connecting towns and villages without sidewalks – streets and roads in urban areas with sidewalks – streets and roads in urban areas without sidewalks

Q25_4_b) **As a PEDESTRIAN, how would you rate the roads/sidewalks that you regularly use in terms of safety?** You can indicate your answer on a scale from 1 to 7, where 1 is "very unsafe" and 7 is "very safe". The numbers in between can be used to refine your response.

Binary variable: safe (5-7) – unsafe/neutral (1-4)
Items (random order):

- rural roads and roads connecting towns and villages with sidewalks
- rural roads and roads connecting towns and villages without sidewalks
- streets and roads in urban areas with sidewalks
- streets and roads in urban areas without sidewalks

Social desirability scale

Introduction: The survey is almost finished. Some of the following questions[10] have nothing to do with road safety, but they are important background information. There are no good or bad answers.

Q26) **To what extent do you agree with each of the following statements?** You can indicate your answer on a scale from 1 to 5, where 1 is "disagree" and 5 is "agree". The numbers in between can be used to refine your response.

Items (random order; instructed response item (trick item) as last item):

- In an argument, I always remain objective and stick to the facts.
- Even if I am feeling stressed, I am always friendly and polite to others.
- When talking to someone, I always listen carefully to what the other person says.
- It has happened that I have taken advantage of someone in the past.
- I have occasionally thrown litter away in the countryside or on to the road.
- Sometimes I only help people if I expect to get something in return.
- Please, select the answer option number 5 "agree". (Instructed response item (trick item))

Closing comment: Thank you for your contribution!

[10] *Q26 is asked together with some last questions on sociodemographic information, which have already been listed in the beginning of the questionnaire.*

Appendix 2: ESRA3 weights

The following weights were used to calculate representative means on national and regional level. They are based on UN population statistics (United Nations Statistics Division, 2023). The weighting took into account small corrections with respect to national representativeness of the sample based on gender and six age groups (18-24y, 25-34y, 35-44y, 45-54y, 55-64y, 65-74y). For the regions, the weighting also took into account the population size of each country in the total set of countries from this region.

Individual country weight	Individual country weight is a weighting factor based on the gender*6 age groups (18-24y, 25-34y, 35-44y, 45-54y, 55-64y, 65-74y) distribution in a country as retrieved from the UN population statistics.
Europe22 weight	European weighting factor based on all 22 European countries participating in ESRA3, considering individual country weight and population size of the country as retrieved from the UN population statistics.
America8 weight	American weighting factor based on all 8 North and Latin American countries participating in ESRA3, considering individual country weight and population size of the country as retrieved from the UN population statistics.
AsiaOceania6 weight	Asian and Oceanian weighting factor based on the 6 Asian and Oceanian countries participating in ESRA3 with data collected through online panel (Australia, Israel, Japan, Kazakhstan, Thailand, Türkiye - Armenia, Kyrgyzstan, and Uzbekistan were not included due to different methodology in data collection – face-to-face CAPI), considering individual country weight and population size of the country as retrieved from the UN population statistics.

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