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E-Survey of Road users' Attitudes

Subjective safety and risk perception

ESRA2 Thematic report Nr. 15

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Subjective safety and risk perception

ESRA2 Thematic report Nr. 15

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Table of contents

List of Abbreviations

Country codes

AT	Austria
AU	Australia
BE	Belgium
CA	Canada
CH	Switzerland
CZ	Czech Republic
DE	Germany
DK	Denmark
EG	Egypt
EL	Greece
ES	Spain
FI	Finland
FR	France
HU	Hungary
IE	Ireland
IL	Israel
IN	India
IT	Italy
JP	Japan
KE	Kenya
KR	Republic of Korea
MA	Morocco
NG	Nigeria
NL	Netherlands
PL	Poland
PT	Portugal
RS	Serbia
SE	Sweden
SI	Slovenia
UK	United Kingdom
US	United States
ZA	South Africa

Other abbreviations

ESRA	E-Survey of Road Users' Attitudes
EU	European Union
ICW	Individual country weight used in ESRA2
OR	Odds Ratio
US	United States
WEF	World Economic Forum
WHO	World Health Organisation

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, 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 provide scientific evidence for policy making at national and international levels.

Vias institute in Brussels (Belgium) initiated and coordinates ESRA, in cooperation with eleven core group partners (BASt, BFU, CTL, IATSS, IFSTTAR, ITS, KFV, NTUA, PRP, SWOV, TIRF). 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, motorcycle and moped drivers, cyclists and pedestrians.

The present report is based on the second edition of this global survey, which was conducted in 2018 (ESRA2_2018). In total this survey collected data from more than 35.000 road users across 32 countries. An overview of the ESRA initiative and the project-results is available on: www.esranet.eu.

This thematic ESRA report describes the perceived levels of safety when using different transport modes, the assessment of various risk factors in traffic (e.g. alcohol, speed) regarding their contribution to accidents and the expectations regarding semi- and fully-automated passenger cars in terms of potential safety benefits amongst road users in 32 countries worldwide. The association between the perceived level of safety in different transport modes - i.e. using a car, using a motorcycle - and road fatalities is studied for European countries and described in the section "advanced analysis". For this purpose, the survey data were put into relation to national accident data as reported in "CARE", the European Union's road accident database. Moreover, linear and logistic regression models were calculated to investigate in-depth the factors contributing to the subjective level of safety of car drivers as well as to the individual level of perceiving certain road safety relevant factors such as speeding or driving impairment as a risk.

Key results

Below for each research question the major findings are presented.

How safe or unsafe do road users feel when using different transport modes?

- In all regions, respondents considered the motorcycle and the electric bicycle or pedelec as the least safe transport modes. In contrast, the aeroplane and public transport were considered the safest transport modes in North America, Asia-Oceania and Africa. In Europe driving a car was considered the safest.

- Especially in Europe and Africa (as well as in Asia-Oceania) women tend to feel less safe when using the various transport modes than men.

- In North America, Europe and Africa for some of the modes (e.g. public transport) the subjective level of safety tends to increase with age. In contrast, this age pattern was not found for Asia-Oceania or even reversed.

- Regarding the interrelation of subjective safety and road fatalities car drivers feel safer when there are less fatal road crashes in their countries. The same pattern was found for motorcyclists and pedestrians.

- The pattern for cyclists is different, the association between subjective safety and fatalities seems to be positively related. Adding exposure as further dimension to the picture it showed that cyclists in countries with higher cycling exposure tend to feel safer.

- In order to find variables that influence subjective safety and risk perception, we fit regression models with the dependent variable being subjective safety or risk perception. Although some variables seem to have an influence on subjective safety, it cannot be proved that these are causal effects.

Which factors or behaviours are perceived as frequent causes of crashes?

- In Europe, North America and Africa respondents considered driving after drinking alcohol as the riskiest factor. In Asia-Oceania speeding was considered the riskiest of all factors; in North America and Africa this is perceived as the second riskiest factor.

- In Europe, next to driving under the influence of alcohol, using a hand-held-phone while driving was considered the second riskiest. On the contrary, using a hands-free phone while driving was the behaviour least risky in all regions.

- Especially in Europe and Africa as well as in Asia-Oceania women considered dangerous driving behaviour to be riskier than men.

- In Europe and North America risk perception of different behaviours increased with increasing age, in Asia-Oceania and in Africa this age pattern was not found.

Perceived safety-related benefits of vehicle automation: how likely are safety-related benefits of semi- and fully automated passenger cars?

- For participants in Asia-Oceania and Africa safety-related benefits such as fewer crashes and reduced crash severity due to semi- and fully automated passenger cars are more likely than for participants in the US and Europe.

- Especially in Europe and North America men considered the safety benefits of semi- and fully automated passenger cars more likely to occur than women.

- In particular in Africa and Asia-Oceania the expectations of safety benefits of semi-automated passenger cars decrease with increasing age; for fully automated passenger cars this pattern can be found as well, especially in Europe and North America.

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 initiative on a triennial basis, retaining a core set of questions in every wave. 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

The prevalence of crashes, injuries and fatalities in road traffic is a measure of road safety. And it is an objective one: it is the actual, recorded numbers of road crashes, injuries and fatalities, known as objective safety. Objective risk in road safety is normally understood as the probability of road crashes, injuries or fatalities per unit of road traffic exposure. Quantifying the objective risk for different factors – especially road user related risk factors – is challenging as the presence or absence of some risk factors (e.g. fatigue) is not absolute but rather a state on a continuum which can vary over time and moreover, some risk factors (e.g. impairment due to drink-driving) are not directly observable nor absolute (either present or not). Therefore, it requires the presence and extent of such risk factors to be inferred based on indicators which are (more or less) stable over time, such as the blood alcohol concentration (unstable even in the short term) or outcomes of psychometric tests (stable, at least in the medium term) (Aigner-Breuss et al., 2017).

However, the objective level of safety (or objective risk) overall does not necessarily correspond to how safe people feel within their local traffic system or how road users subjectively experience accident risk in traffic, also known as subjective safety (Sørensen & Mosslemi, 2009). The relationship between objective and subjective traffic safety is assumed to be only minor (SWOV, 2012). At the same time, it is not agreed upon which level of subjective safety even is desirable, given that 'feeling too safe' might result in decreased caution of traffic participants and therefore in reduced traffic safety. On the other hand, not feeling safe might affect the decision to participate in traffic in the first place leading to decreased mobility. Furthermore, awareness of the contribution of specific risk factors to crashes is a precondition for behavioural changes.

The concept of subjective safety in traffic refers to feeling safe/unsafe in traffic or to the anticipation of being safe or unsafe in traffic for oneself or others, respectively (SWOV, 2012) and deals with people's fear of being involved in an accident (Hyden, 2016). This individual assessment is shaped by a big variety of internal and external factors like personal experience, observation and interpretation of traffic situations, social norms, personality traits, level of information, the built environment, infrastructure and traffic volume etc. Subjective safety has furthermore common ground with the concept of 'risk perception'. However, it is important to note that there is no agreed-upon standard definition of risk perception (Shinar, 2017). Risk perception must be differentiated from 'risk tolerance' and 'risk taking'. It is a complex construct like subjective safety and is very sensitive to perceptive biases such as heuristics by traffic participants (De Blaeij & Van Vuuren, 2003), leading to over- or underestimation of the actual risk. Furthermore, there is a difference between perceived risk in a given situation which affects the decision to take a risk and perceived risk on an abstract level or for a hypothetical situation.

Research on subjective safety is mostly carried out by surveying road users and asking them directly about their personal assessment of their safety with regard to different modes of transport.

In a study of Bjørnskau (2004) in Norway for example, 1,000 persons were asked how safe they think it is to travel by eight different modes of transport. Motorcycling was considered as the least safe transport mode followed by cycling and walking, whereas the car was considered much safer by the respondents. The subjectively safest transport modes, however, were the plane and the car.

In another study in Norway by Backer-Grøndahl, Amundsen, Fyhri & Ulleberg et al. (2007), between 568 and 833 respondents were asked how much they worry about accidents and unpleasant incidents (on a scale from one to five) for nine different means of transport. Respondents reported to worry most about accidents when travelling with the motorcycle (mean=3.85), followed by the car (mean=2.58) and the bicycle (mean=2.55), whereas respondents did not worry much about accidents when walking (mean=1.88). However, worrying about unpleasant incidents was higher for walking (2.14) than for the bicycle (mean=1.59) or the car (mean=1.29).

However, as described, the relationship between objective and subjective safety is only minor: whereas an analysis of the US-national fatal motor-vehicle crash data bank revealed that among young drivers, the highest risk group for a fatal crash were male drivers traveling with young (16-20 years old) passengers (Ouimet et al., 2010), in one American survey of 3,574 teen drivers most teen drivers consider themselves as "safe driver" (Hedlund & Compton, 2005).

In the first addition of ESRA in 2015, respondents from 17 European countries were asked about feeling (un)safe when using different transport modes, estimation of contributing factors to road accidents and perceived risky behaviours of other road users (Furian et al., 2016). The results showed, that overall respondents felt by far safest using public transport and least safe when motorcycling and cycling. In addition, overall, that generally, men tend to feel slightly safer than women and older drivers feel safer than the younger age groups when driving a car and when using public transport. Regarding the perceived contribution of certain behaviours in traffic to the occurrence of accidents, driving under the influence of alcohol clearly spearheaded the list of risk factors followed by inattentiveness and driving under the influence of drugs, whereas tiredness behind the wheel and taking psychoactive medication and driving scored lower across the respondents of all countries. Moreover, in all age groups respondents agreed on driving under the influence of alcohol and driving too fast as being the main causes for road accidents, whereas technical defects in vehicles and traffic jams are perceived a comparatively minor cause for road accidents. In addition, women generally tended to estimate the contribution of the various risk factors to accidents to be higher than men.

Building on these aspects this thematic ESRA2 report aims at describing subjective safety and risk perception of all kind of road users – and also the role of gender and age – not only for countries in Europe, but for road users of 32 countries from four regions of the world (Europe, North America, Asia-Oceania and Africa). For this purpose, road users were asked about how safe or unsafe they feel when using various transport modes and about their assessment of how many accidents can be accounted for by a specific factor or risky behaviour like driving too fast. In addition, the perceived and anticipated safety-related benefits of semi- and fully automated vehicles are investigated. Further analyses, moreover, investigate the association between (un)safe feeling in different transport modes, i.e. using a car, and road fatalities as well as the influence of various factors on subjective safety and risk perception of car drivers by means of regression models.

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 provide scientific evidence for policy making at national and international levels.

ESRA data is collected through online panel surveys, using a representative sample of the national adult populations in each participating country (at least N = 1000 per country). At the heart of this survey is a jointly developed questionnaire, 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, motorcycle and moped drivers, cyclists and pedestrians. The present report is based on the second edition of this global survey, which was conducted in 2018 (ESRA2_2018). In total this survey collected data from more than 35 000 road users across 32 countries.

The participating countries in ESRA2_2018 were:

- **Europe**: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Poland, Portugal, Serbia, Slovenia, Spain, Sweden, Switzerland, United Kingdom;
- **America**: Canada, USA;
- **Asia and Oceania**: Australia, India, Israel, Japan, Republic of Korea;
- **Africa**: Egypt, Kenya, Morocco, Nigeria, South Afrika.

Vias institute in Brussels (Belgium) initiated and coordinates ESRA, in cooperation with eleven core group partners (BASt (Germany), BFU (Switzerland), CTL (Italy), IATSS (Japan), IFSTTAR (France), ITS (Poland), KFV (Austria), NTUA (Greece), PRP (Portugal), SWOV (the Netherlands), TIRF (Canada)). The common results of the ESRA2_2018 survey will be published in a Main Report, a Methodology Report and at least fifteen Thematic Reports. Furthermore, 32 country fact sheets were produced, in which national key results are compared to a regional mean (benchmark) and scientific articles, national reports and many conference presentations are currently in progress. An overview of the results and news on the ESRA initiative is available on: www.esranet.eu

Table 1: ESRA2 Thematic Reports

Driving under influence	Child restraint systems	Cyclists
Speeding	Unsafety feeling & risk perception	Moped drivers & motorcyclists
Distraction (mobile phone use)	Enforcement	Young road users
Fatigue	Vehicle automation	Elderly road users
Seat belt	Pedestrians	Gender aspects

The present report summarizes the ESRA2_2018-results with respect to subjective safety and risk perception. An overview of the data collection method and the sample per country can be found in (Meesmann & Torfs, 2019. ESRA2 methodology).

Note that a weighting of the data was applied to the descriptive 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, 65y+; based on population statistics from United Nations data (United Nations Statistics Division, 2019). For the regions, the weighting also took into account the relative size of the population of each country within the total set of countries from this region. IBM SPSS Statistics 19.0.0 and R 3.5.1 were used for the analyses.

3 Results

3.1 Descriptive analysis

This section presents the descriptive statistics on questions about subjective safety and risk perception. The ESRA2 essential questions on subjective safety and risk perception are the following:

- How safe or unsafe do you feel when using the following transport modes in your country? (For list of queried modes see section 3.1.1) – Q16
- How often do you think each of the following factors is the cause of a road crash involving a car? (For list of queried risk factors see section 3.1.2) – Q17

In addition, the results of the following questions relating to the (perceived) road safety benefits of semi- and fully automated passenger cars are described (For list of queried benefits see section 3.1.3):

- How likely do you think it is that the following benefits will occur if everyone would use a semi-automated passenger car? (Items "fewer crashes" and "reduced severity of crash") – Q25_1
- How likely do you think it is that the following benefits will occur if everyone would use a fully automated passenger car? (Items "fewer crashes" and "reduced severity of crash") – Q25_2

For each thematic topic, the results are presented in a similar way: first the basic results per region in a table, then the results are further split out in various graphs first by region and country, then by age, and by gender.

Statistical tests of differences between regions, gender and age groups have been performed: a Chi^2 Test for Independence was used to assess if the answers depend significantly on the region, on the gender and on the age group, respectively. Pairwise comparisons were performed to identify the pairs of groups (region, gender, age groups) that differ significantly. The strength of the association between variables was assessed through the Eta-squared coefficient and the Cramer's V coefficient. The classification of strength of associations expressed by the coefficients are found in Table 2 (Cohen, 1988).

Table 2: Tresholds used to indicate the strength of coefficients

	Small strength	Medium strength	Large strength
Eta-squared	0.01	0.06	0.14
Cramer's V (association with region: 3 deg. of freedom)	0.06	0.17	0.29
Cramer's V (association with gender: 1 deg. of freedom)	0.10	0.30	0.50
Cramer's V (association with age: 5 deg. of freedom)	0.05	0.13	0.22

3.1.1 Subjective Safety: How safe or unsafe do you feel when using the following transport modes in your country?

For assessing subjective safety, in total 22 different transport modes were rated by the respondents regarding their perceived level of safety. The scale of answers ranged from 0 (very unsafe) to 10 (very safe) – the mean score of the answers are presented in the results. For the sake of brevity, results are not presented for all 22 different transport modes, but highlight the most relevant transport modes with regard to their frequency of use and their importance for road safety, including:

- Drive a car (non-electric or non-hybrid)
- Be a passenger in a car
- Use public transport (including train, bus, tram or streetcar, subway, airplane, ship, boat or ferry)
- Cycle (non-electric)
- Drive a motorcycle (> 50 cc and > 4 kW non electric)

The transport modes "cycle on an electric bicycle, e-bike or pedelec" and "take the airplane" were analysed as the former is used more often in road transport lately and the latter is a good comparative value, as taking the airplane is often perceived more unsafe than other modes with higher associated risk.

Comparisons of regions and countries

Figure 1 shows that road users consider the motorcycle and the electric bicycle or pedelec as the least safe transport modes in all regions. This is especially the case in Africa5 and NorthAmerica2 where – compared to the other regions – the lowest mean scores (<6) are observable. Road users in AsiaOceania5 consider the motorcycle and the electric bicycle or pedelec a bit safer (mean score of 6.6 and 6.8, respectively).

In contrast, the aeroplane and public transport are considered as the safest transport modes among the four regions. Overall, in AsiaOceania5 road users considered the aeroplane and public transport as most safe (mean score of 7.8 and 7.7, respectively). Although in Europe20 road users also considered the aeroplane and public transport as rather safe (mean score of 7.6 each), here, the car was considered as the safest transport mode (mean score of 7.7).

The association with the regions was highest for driving a motorcycle and cycling on an electric bicycle or pedelec (Eta-squared of 0.04) and lowest for taking the airplane (Eta-squared of 0.00).

Overall, the perceived level of safety of road users regarding different transport modes is highest in AsiaOceania5 (highest mean scores), whereas it is lowest in Africa5 – except of car use, which is perceived the safest in Europe.

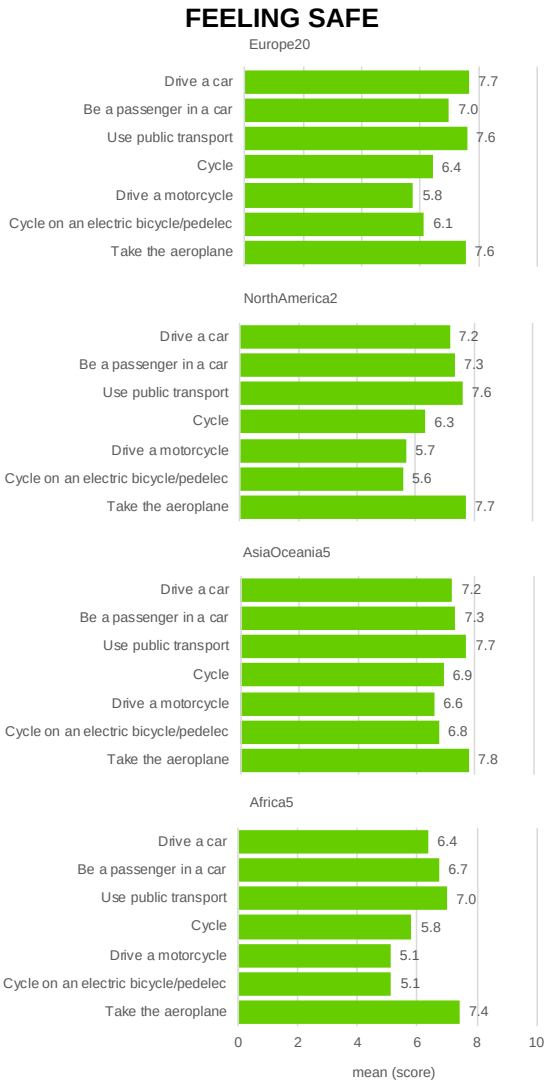
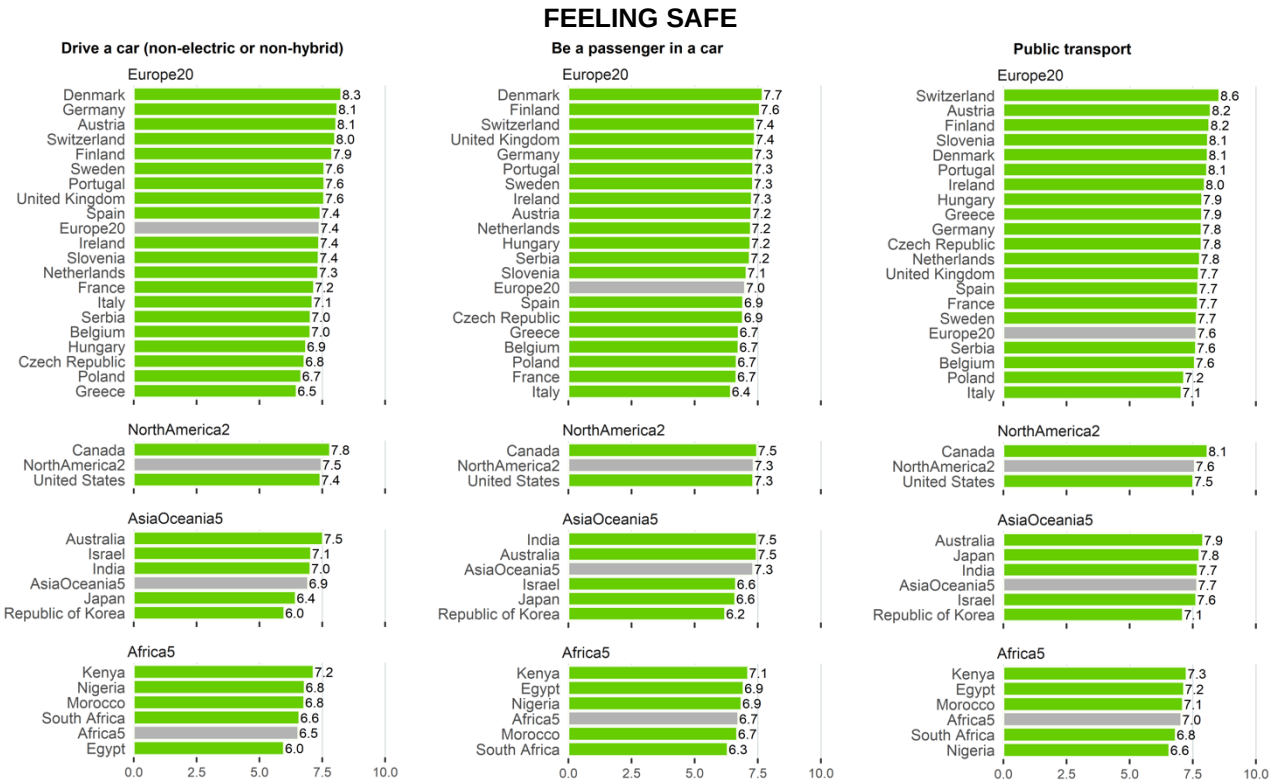


Figure 1: Level of subjective safety using different transport modes by region.

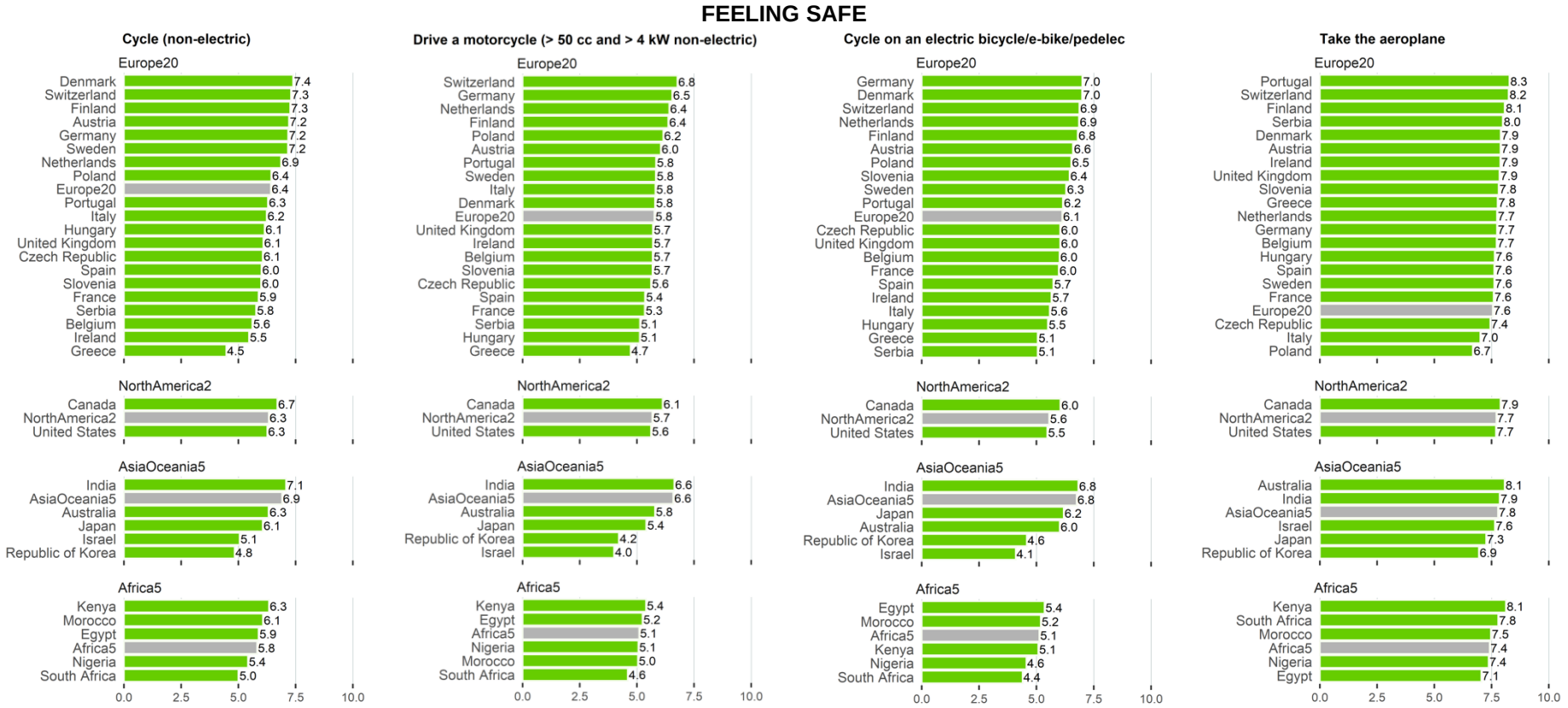
Looking at the single countries of the regions in detail (Figure 2 and 3), the motorcycle was considered least safe especially in Greece, Hungary and Serbia (Europe20), in Israel and the Republic of Korea (AsiaOceania5) and in Morocco and South Africa (Africa5), whereas it was considered safest in Switzerland, Germany (Europe20) and India (AsiaOceania5). For the electric bicycle or a similar pattern is observable: this transport mode was considered least safe especially in Serbia, Greece and Hungary (Europe20), in Israel and the Republic of Korea (AsiaOceania5) as well as in Nigeria and South Africa (Africa5), whereas it was considered safer in Germany, Denmark and Switzerland (Europe20) as well as in India (AsiaOcenia5). The same pattern, but to a lesser extent, was found for cycling.

Among all of the countries, the car was considered least safe in Greece, Poland and the Czech Republic (Europe20), in Japan and the Republic of Korea as well as in Egypt (Africa5). Rather high mean scores for the car (>7.5) are only observable in some of the European countries (e.g. Denmark, Germany, Austria, Switzerland) as well as in Canada (NorthAmerica2) and Australia (AsiaOceania5). How the subjective level of safety corresponds with the actual accident numbers is explored in section 3.2.1.



Reference population: all road users who used the respective transport type in the past 12 months

Figure 2: : Level of subjective safety using different transport modes by region and country (1)

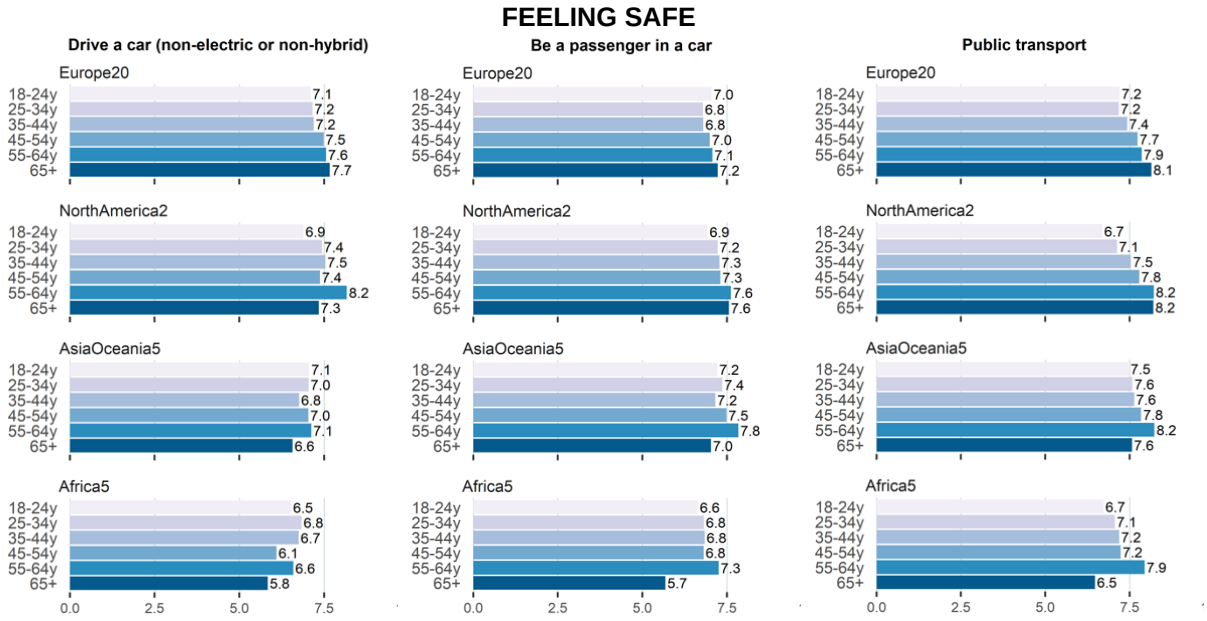


Reference population: all road users who use the respective transport type in the past 12 months

Figure 3: Level of subjective safety using different transport modes by region and country (2)

Comparisons of age groups

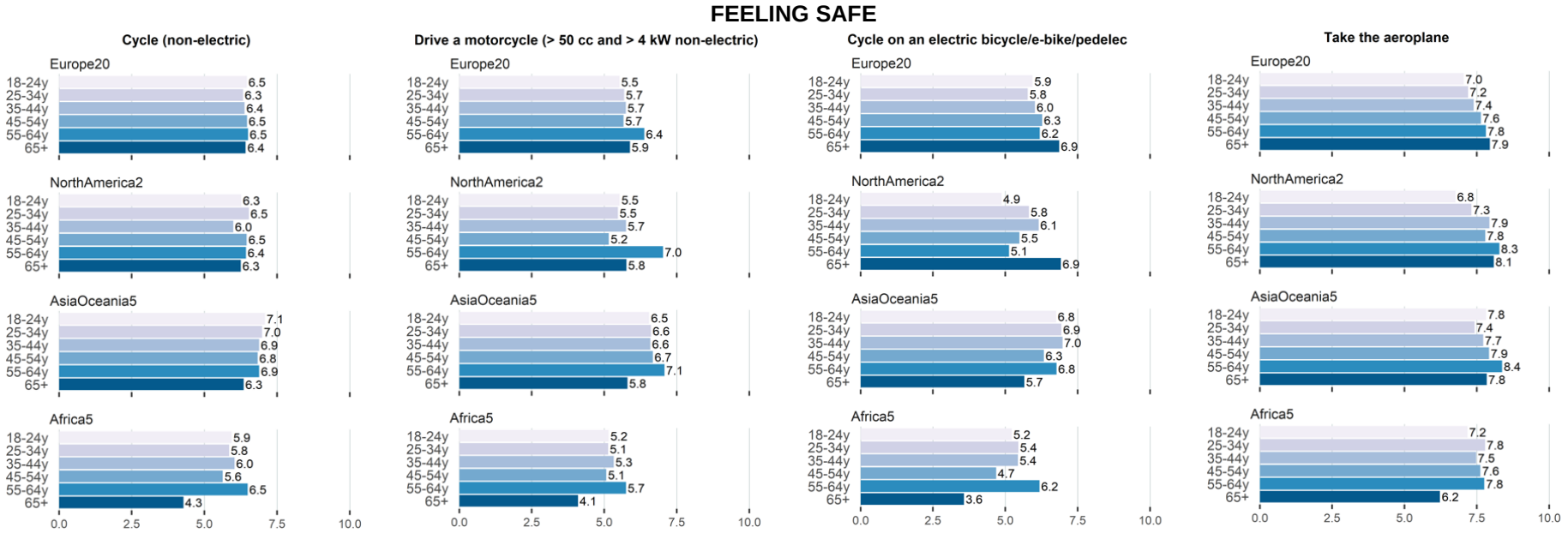
Regarding the association of subjective safety with age, figure 4 and 5 show that for some transport modes the level of safety increases with age (e.g. for public transport especially in Europe20 and NorthAmerica2), whereas for other transport modes no such trend is observable, or even an opposite trend (e.g. for cycling in AsiaOcenia5). For the increase of subjective safety with age associations of low to medium strength (Eta-squared ranging from 0.02-0.06) and of statistical significance ($p<0.01$) are particularly observable for NorthAmerica2 (e.g. public transport, take the aeroplane and drive a car), for Africa5 (e.g. cycle an electric bike or pedelec, take the aeroplane and cycle) and for Europe20 (e.g. public transport). However, this trend is mostly not present in AsiaOceania5 for most of the modes - with associations of very low strength (Eta-squared<0.01) - except for public transport, electric bicycle or pedelec and the aeroplane, where at least associations of low strength (Eta-squared≈0.01[1]) were found.



Reference population: all road users who use the respective transport type in the past 12 months

Figure 4: Level of subjective safety using different transport modes by region and age group (1)

[1] Approximately equal 0.01

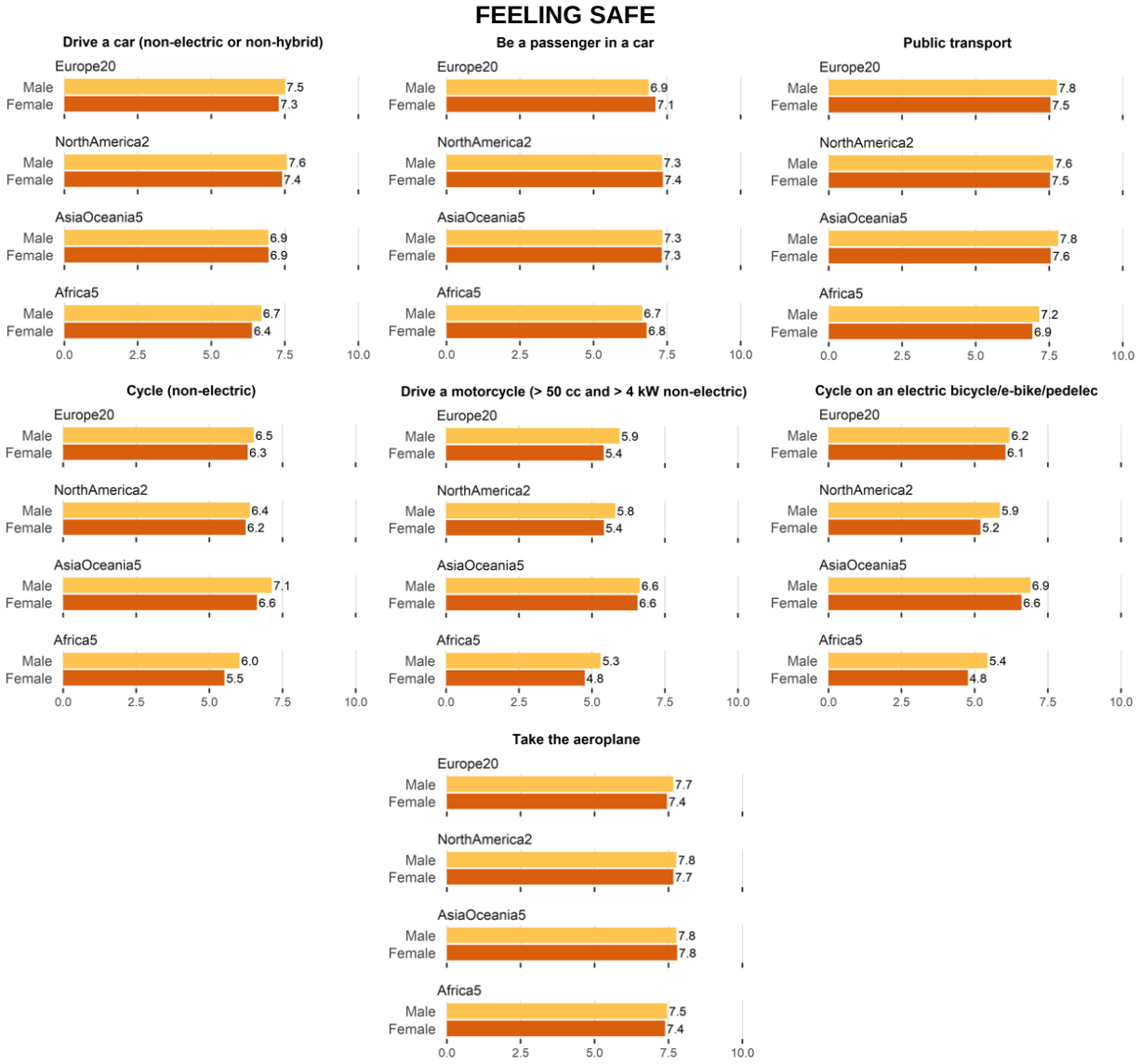


Reference population: all road users who used the respective transport type in the past 12 months

Figure 5: Level of subjective safety using different transport modes by region and age group (2)

Gender comparisons

The association of subjective safety and gender was predominantly small across the regions (Eta-squared≤0.01). Compared to men, women overall consider all presented transport modes less safe, except for being a passenger in a car (Figure 6). This is observable for nearly all regions, but especially for Europe20 and Africa5 where mean scores of females were often statistically significantly lower ($p<0.01$), e.g. for driving a motorcycle or a car. For cycling and the use of public transport this was also true for AsiaOceania5. However, for NorthAmerica2 no statistically significant difference in mean scores between females and males were found ($p>0.01$) for all of the seven presented transport modes.



Reference population: all road users who use the respective transport type in the past 12 months

Figure 6: Level of subjective safety using different transport modes by region and gender

3.1.2 Risk perception: How often do you think each of the following factors is the cause of a road crash involving a car?

To assess the risk perception of factors potentially contributing to accidents, participants were asked *'How often do you think each of the following factors is the cause of a road crash involving a car?'.* Seven items related to risky behaviours while driving a car were included:

- Driving after taking drugs (other than medication)
- Inattentiveness or day-dreaming while driving
- Using a hands-held mobile phone while driving
- Using a hands-free mobile phone while driving
- Driving after drinking alcohol
- Driving while tired
- Driving faster than the speed limit

The scale to answer this question ranged from never (1) to (almost) always (6). The percentages presented in the figures 7-12 represent the answers scaled 4 to 6. This assessment of risk does not refer to concrete situations that a person might have experienced but to a more global level and to the general driving population.

Comparisons of regions and countries

Figure 7 shows that road users consider driving after drinking alcohol as the riskiest of all the presented risk factors in nearly all of the four regions. In Europe20 the percentage of respondents who consider that driving after drinking alcohol is often to frequently the cause of a road crash involving a car was highest (80.6%). In contrast, in AsiaOceania5 road users consider driving faster than the speed limit as the riskiest of all factors. Moreover, driving faster than the speed limit was considered as the second riskiest factor in NorthAmerica2 and Africa5.

Besides that, a factor that was also considered as risky by the participants is using a hand-held phone while driving, especially in Europe20 and NorthAmerica2: 75.8% of the respondents in Europe 20 and 70.8% of the respondents in NorthAmerica2 considered that talking on a hand-held mobile phone while driving is often/frequently the cause of a road crash involving a car.

Using a hands-free mobile phone while driving however, was the behaviour considered least risky among all the seven factors in all regions. However, the proportion was significantly higher in Europe20 (50.9%) than in the other regions ($p<0.01$).

The association with the regions was highest for driving after drinking alcohol and using a hand-held mobile phone while driving (Cramer's V of 0.22 and 0.19) and lowest for using a hands-free mobile phone while driving (Cramer's V of 0.04).

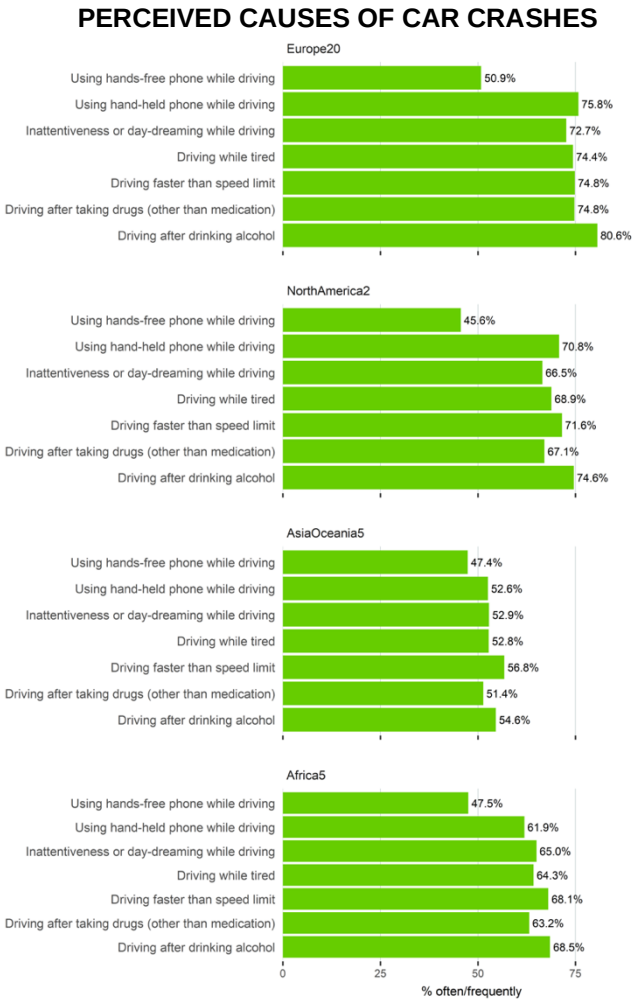


Figure 7: Perceived frequency of behaviours contributing to crashes by region.

Overall it is observable that in Europe20 the percentages of respondents who consider that the different factors are often or frequently the cause of a road crash involving a car are highest, whereas especially in AsiaOcenia5 these percentages were rather low.

Looking at the individual countries of each of the regions in detail (Figures 8 and 9), driving after drinking alcohol was considered risky especially in Finland and the Czech Republic (Europe20), Israel and Australia (AsiaOceania5) as well as Kenya (Africa5). By comparison, for the US and Canada the percentage of respondents who consider driving after drinking alcohol often or frequently to be the cause of a road crash involving a car was not as high (≤80%). Similarly, this pattern is observable for driving after taking drugs (other than medication) as well as driving while tired.

Regarding driving faster than the speed limit, on the country level, it was especially high in Hungary, Portugal and Poland (Europe20) as well as in Kenya and Nigeria (Africa5), whereas countries in NorthAmerica2 and AsiaOceania5 (except for Australia) show lower percentages.

Using a hand-held mobile phone while driving was considered risky in countries in Europe20 like Portugal, Spain and the Netherlands as well as in Israel and Australia (AsiaOcenia5) and Kenya and Nigeria (Africa5). For all other countries the percentage of participants who consider that using a hand-held mobile phone while driving is often/frequently the cause of a road crash involving a car was overall higher in countries in Europe than in countries of the other regions. In contrast, the assessment for using a hands-free mobile phone while driving as a risk factor was overall rather low. Only participants in Spain and Germany considered this behaviour as rather risky.

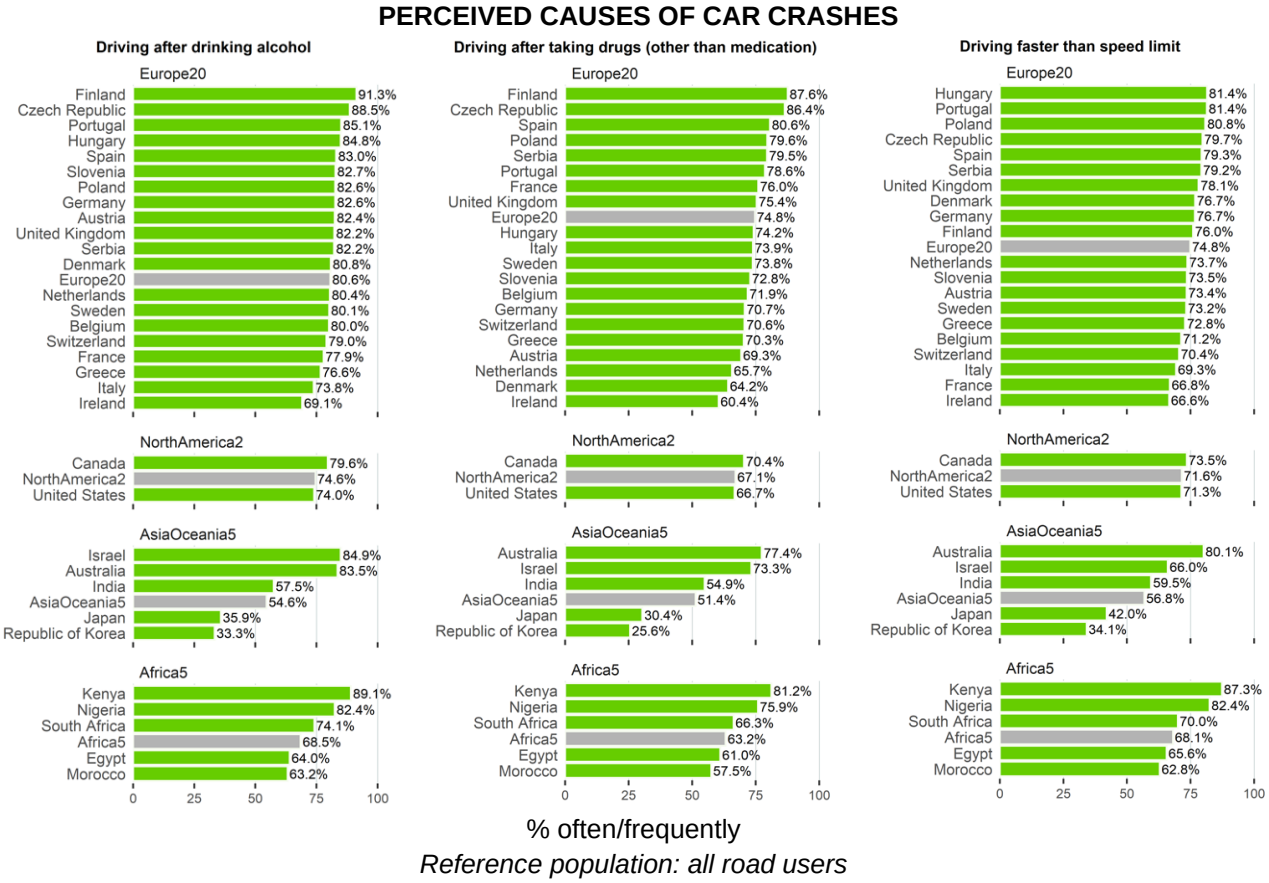
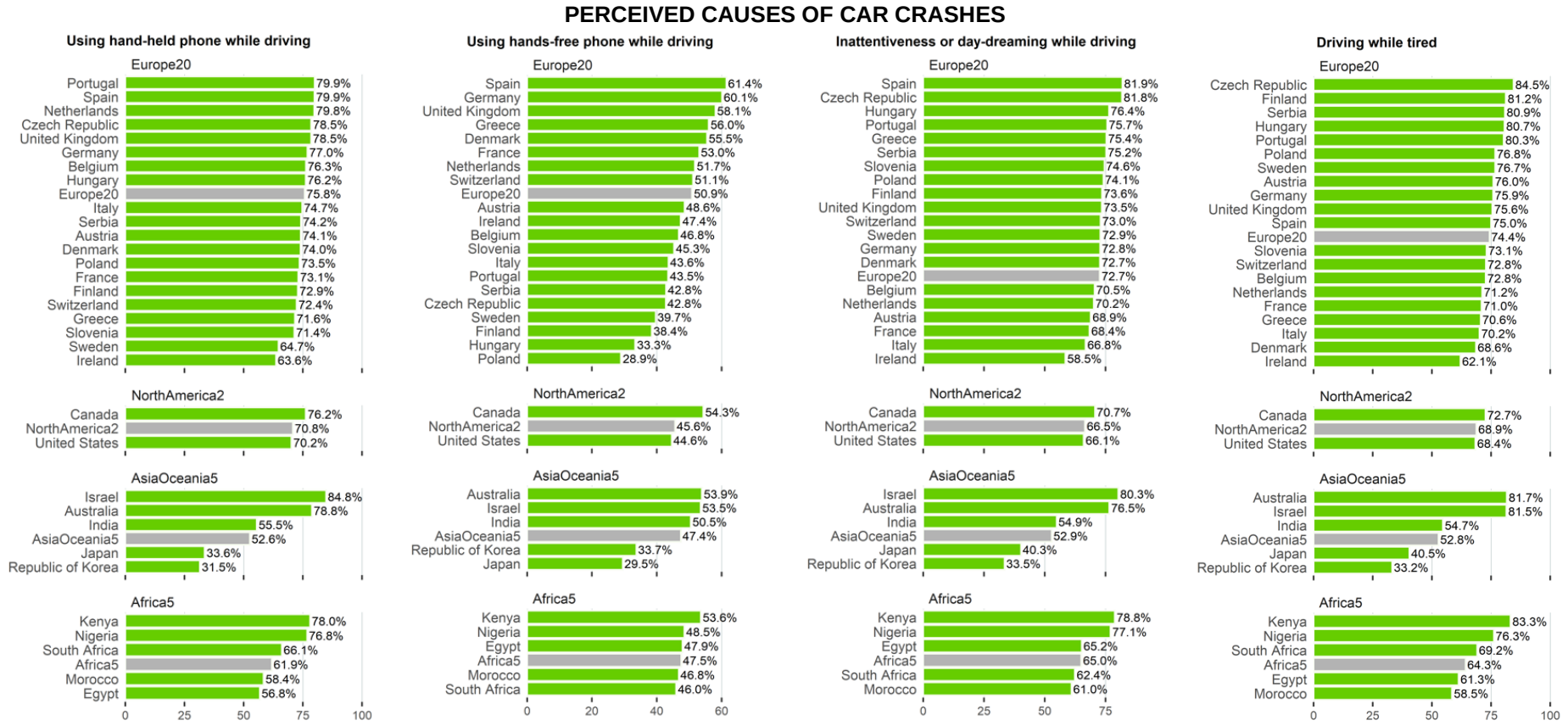


Figure 8: Perceived frequency of behaviours contributing to crashes by region and country (1)

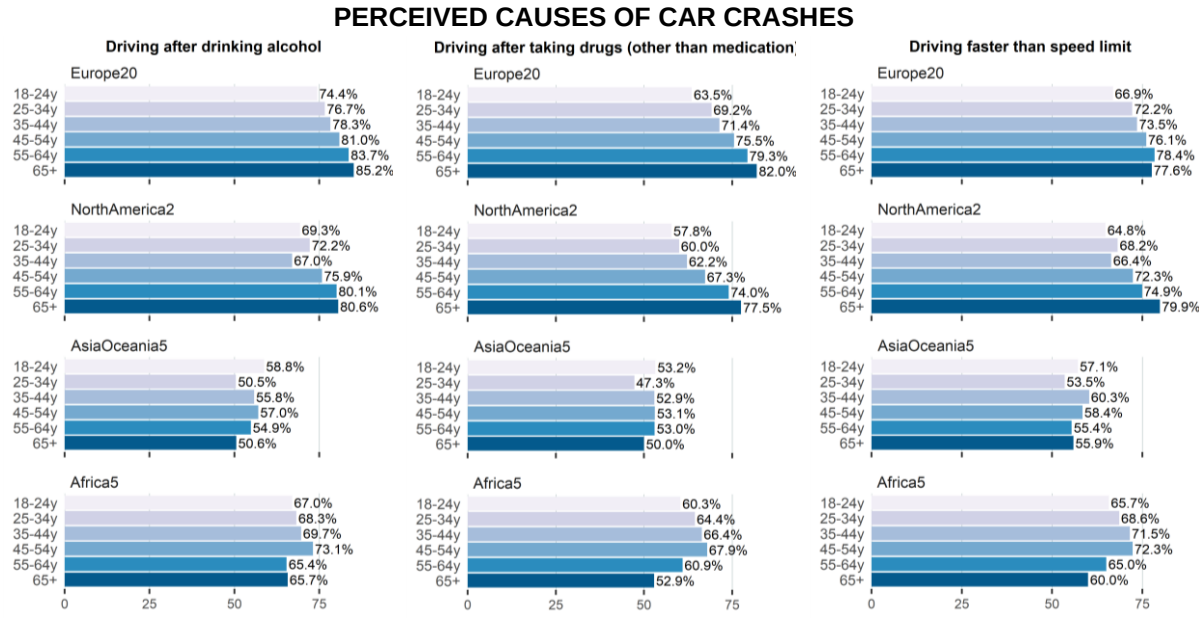


Reference population: all road users

Figure 9: Perceived frequency of behaviours contributing to crashes by region and country (2)

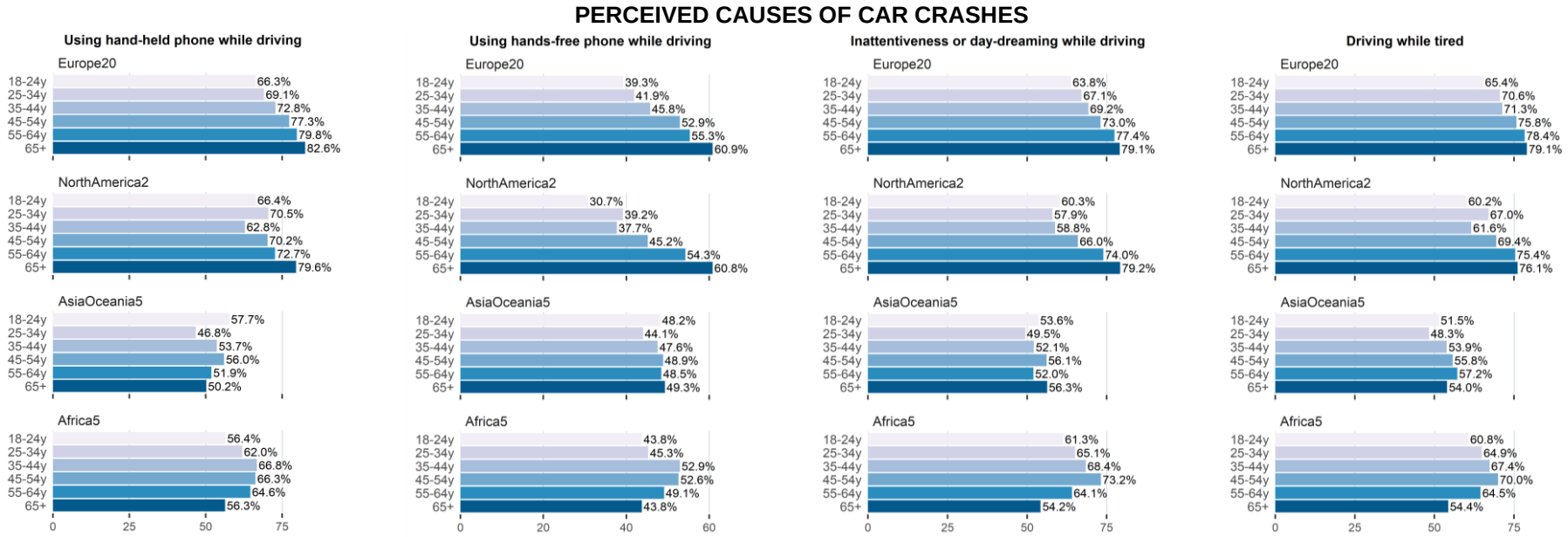
Comparisons of age groups

Figures 10 and 11 show that the risk perception increases with increased age in Europe and North America. The associations are of low (e.g. driving faster than the speed limit) to almost high strength (e.g. using hands free phone while driving) with Cramer's V ranging from 0.08 to 0.20 and statistically significant ($p<0.01$). However, the data do not show this trend for AsiaOceania5 nor for Africa5.



Reference population: all road users

Figure 10: Perceived frequency of behaviours contributing to crashes by region and age group (1)



Reference population: all road users

Figure 11: Perceived frequency of behaviours contributing to crashes by region and age group (2)

Gender comparisons

The association of risk factor assessment and gender was predominantly small in all regions (Cramer's V <= 0.10). Compared to men, women overall consider all the seven presented factors as riskier (Figure 12). This was found for nearly all regions, but especially for Europe20 and NorthAmerica2, where percentages of females were often statistically significantly higher (p-value < 0.01), e.g. for driving after drinking alcohol, driving after taking drugs (other than medication) or using a hand-held phone while driving. For using a hands-free phone and driving while tired this was also observable for AsiaOceania5. However, for Africa5 no statistically significant differences were observable (p-value > 0.01) for none of the seven presented risk factors.

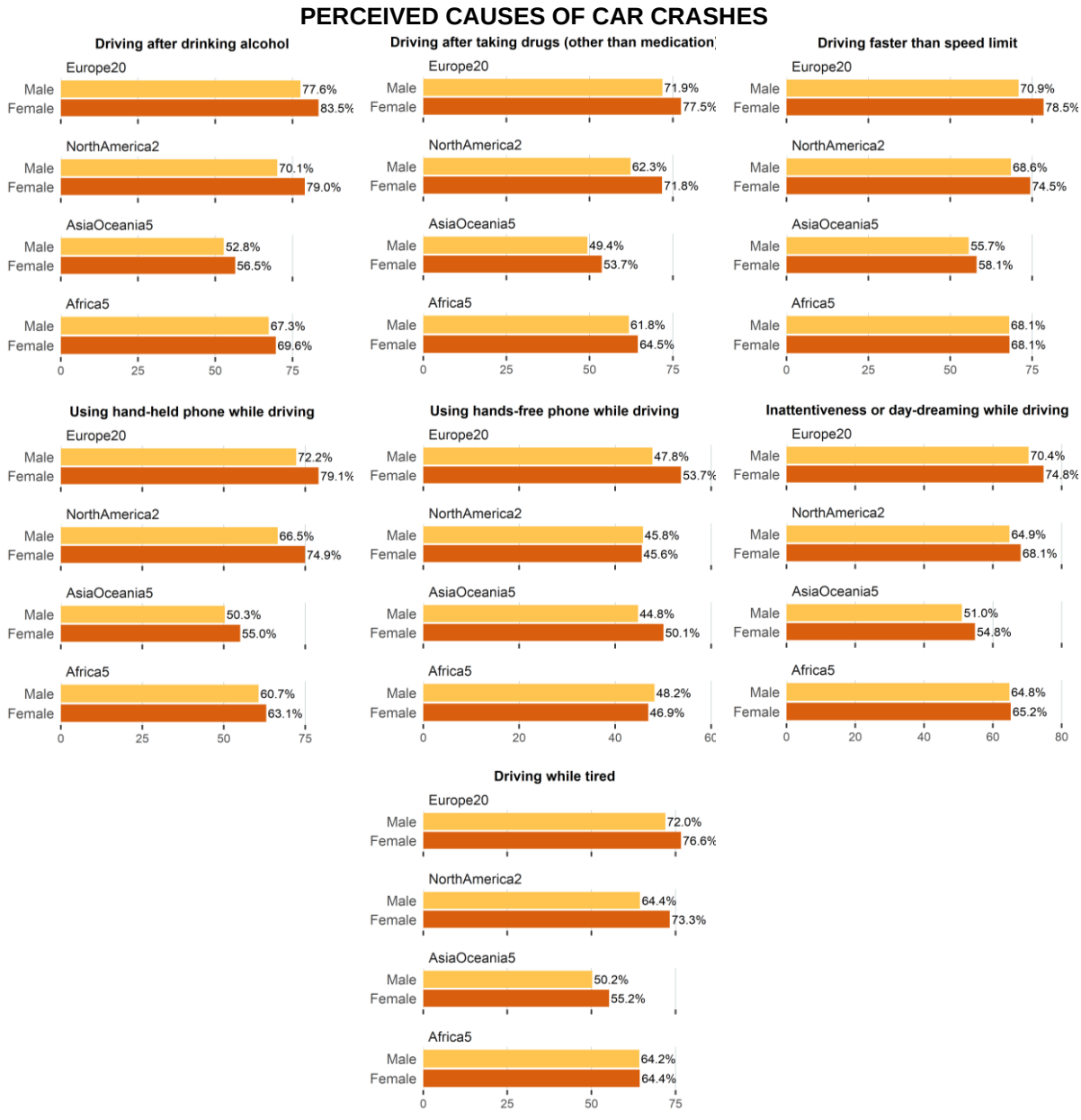


Figure 12: Perceived frequency of behaviours contributing to crashes by region and gender

3.1.3 Benefits of vehicle automation: How likely do you think that fewer crashes and a reduced severity of crashes will occur if everyone would use a semi-/ fully-automated passenger car?

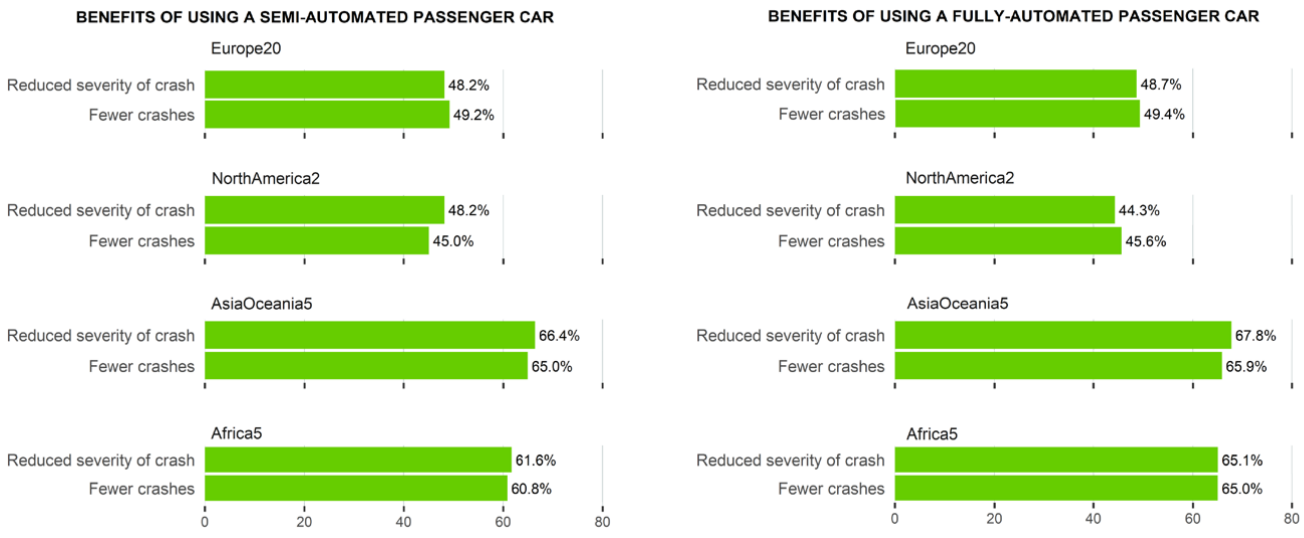
To assess the expectations of potential benefits of semi-automated and fully automated passenger cars, respondents were asked "How likely do you think it is that the following benefits will occur if everyone would use a semi-automated passenger car?" and "How likely do you think it is that the following benefits will occur if everyone would use a fully-automated passenger car?". Eight items related to possible benefits of semi-/ fully automated passenger cars were included. Besides benefits related to travel time, comfort or emissions, also two safety-related items were included:

- Fewer crashes
- Reduced severity of crash

The scale to answer these questions ranged from very unlikely (1) to very likely (7). Answers scaled 5 to 7 are presented aggregately as percentages in the following description and figures.

Comparisons of regions and countries

Regarding the expected benefits of vehicle automation from participants of the different regions (Figure 13), participants in AsiaOcenania5 and Africa5 indicate a significantly higher perceived likelihood of fewer crashes or a reduced severity of crashes than participants in Europe 20 and especially in the US and Canada (p-value < 0,01). The association with the regions is slightly stronger for reduced severity of crash (Cramer's V = 0.156 and 0.171) than for fewer crashes (Cramer's V = 0.134 and 0.154). Moreover, these benefits are stronger associated with fully automated passenger cars than with semi-automated passenger cars in AsiaOceania5 and Africa5, whereas this pattern does did not result for Europe20 and North America2.



Reference population: all road users

Figure 13: Safety-related benefits of using a semi-automated passenger car (left) and a fully automated passenger car (right) by region.

Participants of countries who are expecting fewer crashes using semi- or fully automated passenger cars, respectively, are also more likely to expect a reduced severity of crashes. The rankings of the single countries are similar (Figures 14 and 15).

Countries in which participants are expecting safety-related benefits (fewer crashes, reduced severity of crashes) when using semi-automated cars are India, Kenya and Nigeria, but also Egypt and Morocco. In Europe, such high percentages only result for Greece, Portugal and Hungary. In contrast, participants in most European countries – but especially in Finland, the United Kingdom and Sweden as well as in NorthAmerica2 – are rather sceptical regarding safety-related benefits of semi-automated passenger cars.

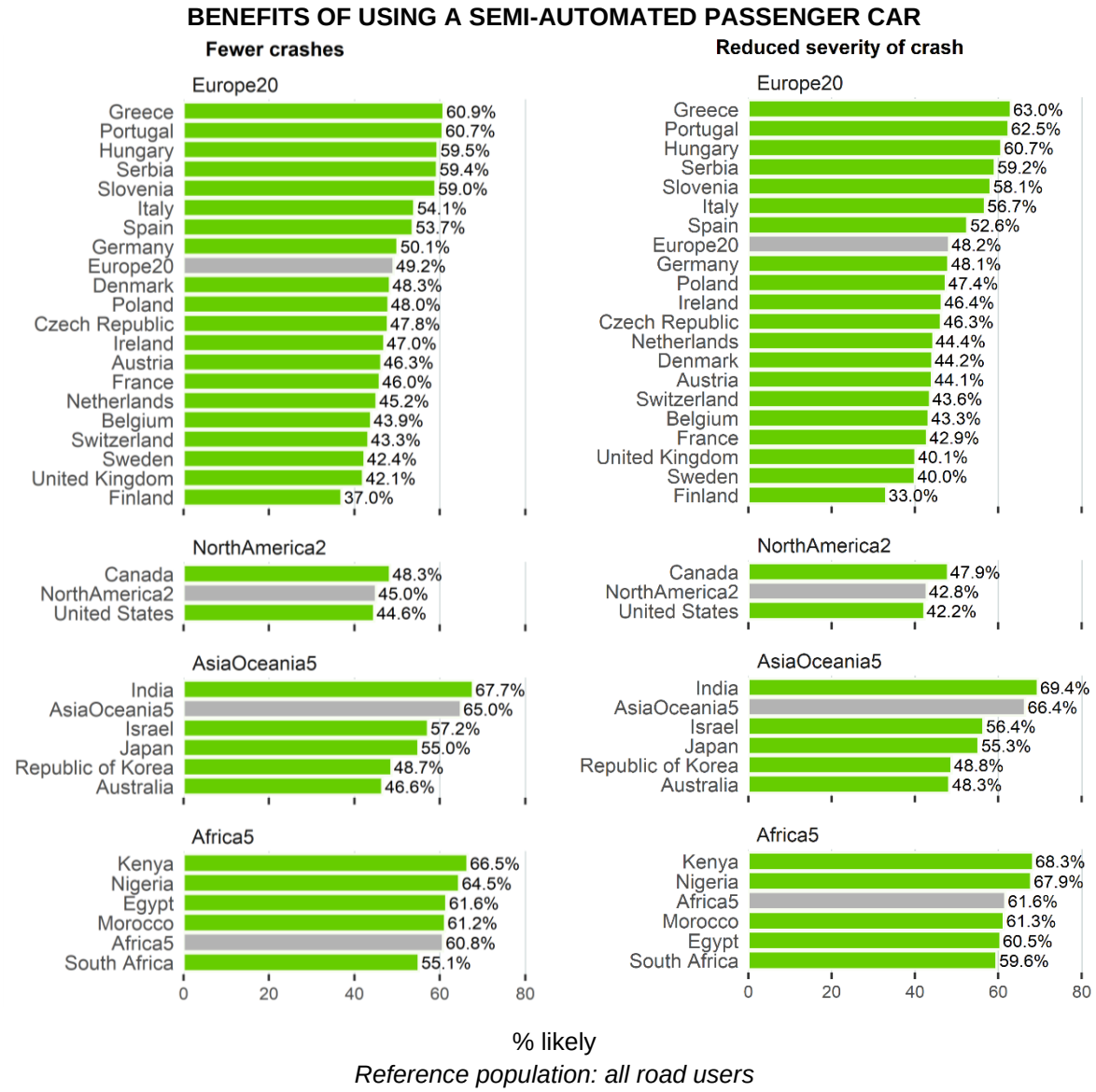


Figure 14: Safety-related benefits of using a semi-automated passenger car by region and country.

Almost the same pattern is observable for expectations regarding fully automated passenger cars. Countries expecting safety-related benefits more likely than others are again India in AsiaOceania5, Kenya and Nigeria but especially also Egypt in Africa5 and Hungary, Portugal, Serbia and Greece

(although compared to semi-automated passenger cars to a lesser extent) in Europe20. Similarly, most countries in Europe – again especially Finland and Sweden – are less likely to expect safety-related benefits of fully automated passenger cars. This applies also to the US and Canada, where respondents are also rather sceptical regarding the potential of fewer crashes and a reduced severity of crashes.

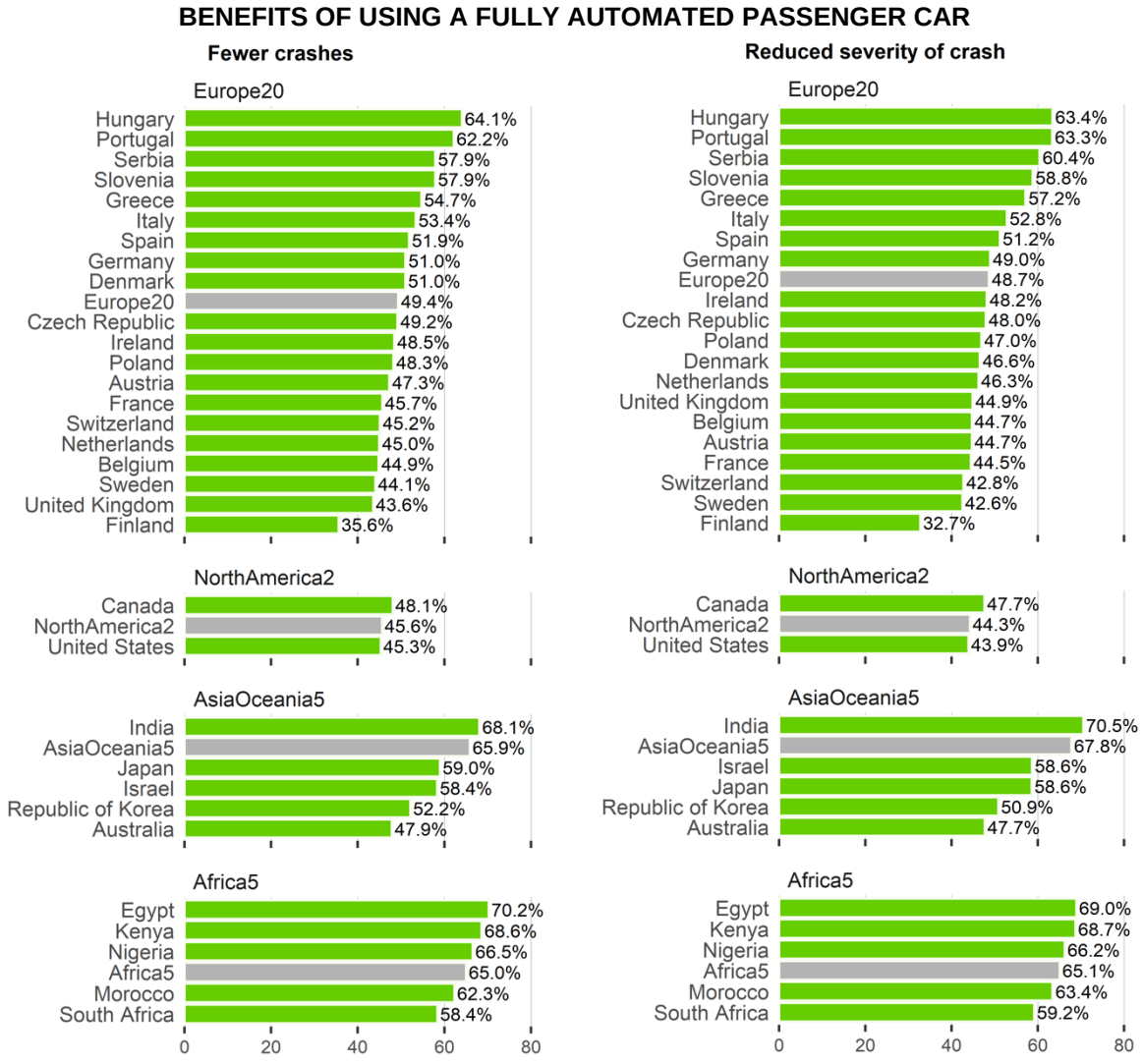


Figure 15: Safety-related benefits of using a fully automated passenger car by region and countries.

Comparisons of age groups

Regarding the association of expected safety-related benefits of automated passenger cars and age (Figure 16), there is a trend in all the regions the likelihood of the expected benefits decreasing with the increase of age. The association of age and the benefits in terms of fewer crashes due to semi-automated cars is almost of medium strength (Cramer's V ranges from 0.10 to 0.12) for the Africa5, AsiaOceania5 countries as well as for North America. As for benefits of fully automated cars, this is only the case for the European and North American countries (Cramer's V=0.10; $p \leq 0.01$).

Whereas regarding semi-automated passenger cars associations of (almost) medium strength (Cramer's V from 0.10 to 0.12) and statistically significant ($p<0.01$) are observable especially in regions Africa5 and AsiaOceania5 as well as in NorthAmerica2 (for fewer crashes), regarding fully-automated passenger cars associations of (almost) medium strength (Cramer's V of 0.10) and statistically significant ($p<0.01$) are apparent only in regions Europe20 and NorthAmerica2.

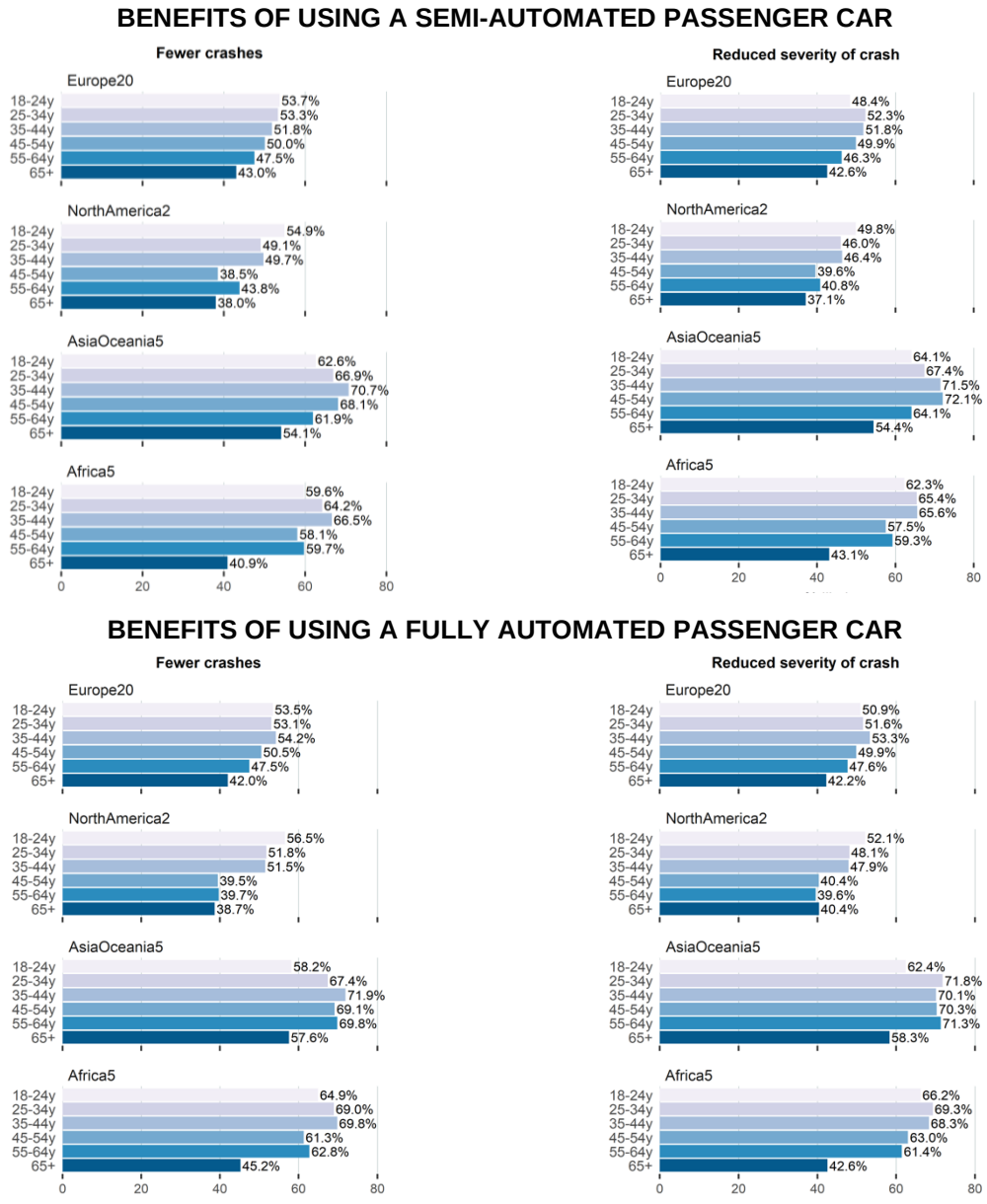
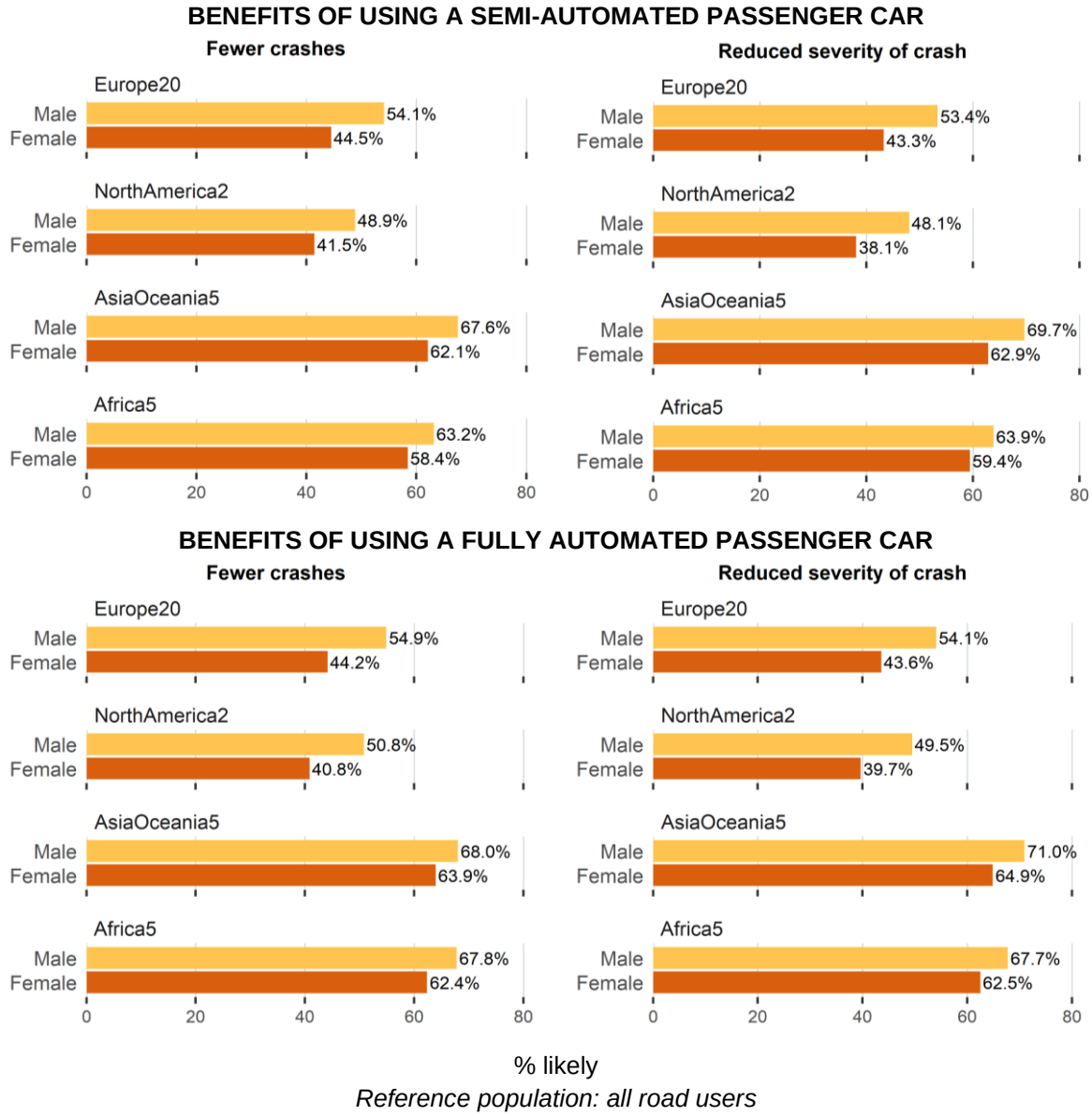


Figure 16: Safety-related benefits of using a semi-automated passenger car (top) and a fully automated passenger car (bottom) by region and age group.

Gender comparisons

Regarding the association of expected safety-related benefits of semi- and fully automated passenger cars and gender (Figure 17), for all regions, men consider the safety-related benefits (fewer crashes, reduced severity of crashes) as more likely to occur than women. Percentages are significantly higher for all regions ($p<0.01$). However, associations of at least small strength result only for Europe and North America (Cramer's V=0.10), with the exception of "fewer crashes" with semi-automated cars.



Reference population: all road users

Figure 17: Safety-related benefits of using a semi-automated passenger car (top) and a fully automated passenger car (bottom) by region and gender.

3.2 Advanced analyses

In this section, we combined ESRA2 survey data concerning subjective safety with accident data from the CARE database provided by the European Commission. We tackled this task by plotting the mean scores of subjective safety, separately for each country, together with a measure for the accidents rate in the corresponding country for different modes (see Figure 18 until Figure 21). Additionally, we tried to explain subjective safety and risk perception by other variables in the survey by fitting linear and logistic regression models.

3.2.1 Interrelation of subjective safety and road fatalities

The weighted mean scores of subjective safety for different transport modes, separately for the European countries, are already plotted in Figure 3 up to Figure 6. Here, we relate the mean scores to mode specific road fatalities in 2017 per million inhabitants. Because Serbia and Ireland do not provide accident data for 2017 in the CARE database, we had to exclude them from this analysis. The analysis was done separately for car drivers, motorcyclists, cyclists and pedestrians. The line in the plots indicates a regression line when regressing the mean of subjective safety onto road fatalities for the 18 country dots in the plot.

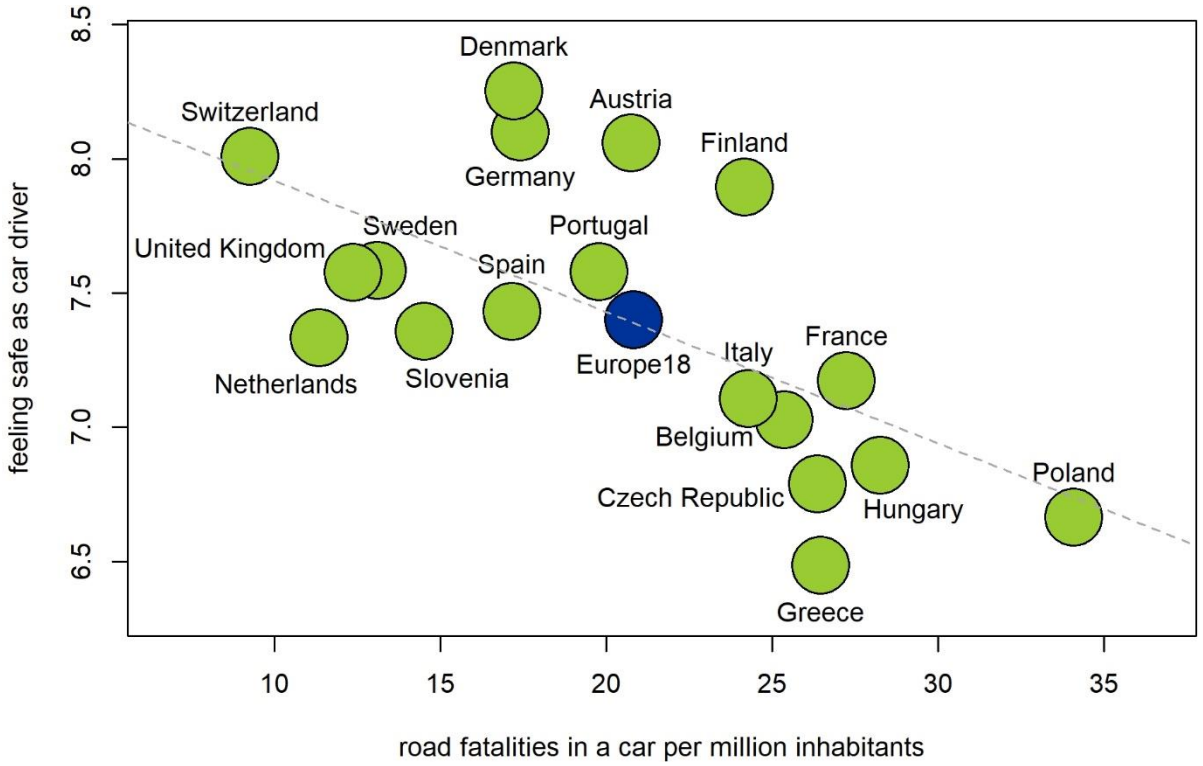


Figure 18: Subjective safety of car drivers and road fatalities

The pattern in Figure 18 is as expected, people feel safer when there are less fatal road crashes. It should be noted that "subjective safety" cannot be regarded as a predictor of fatal road crashes in different countries, the figure should be more a descriptive statement. Switzerland has only 9.3 road fatalities per million inhabitants and with a mean score of 8 people feel very safe as a car driver. In contrast, road fatalities in Poland and Greece are very high with 34.1 and 26.5, respectively, while the safety feeling is low (mean of 6.7 and 6.5, respectively). The countries where car drivers feel the safest are Switzerland, Denmark, Germany, Austria and Finland.

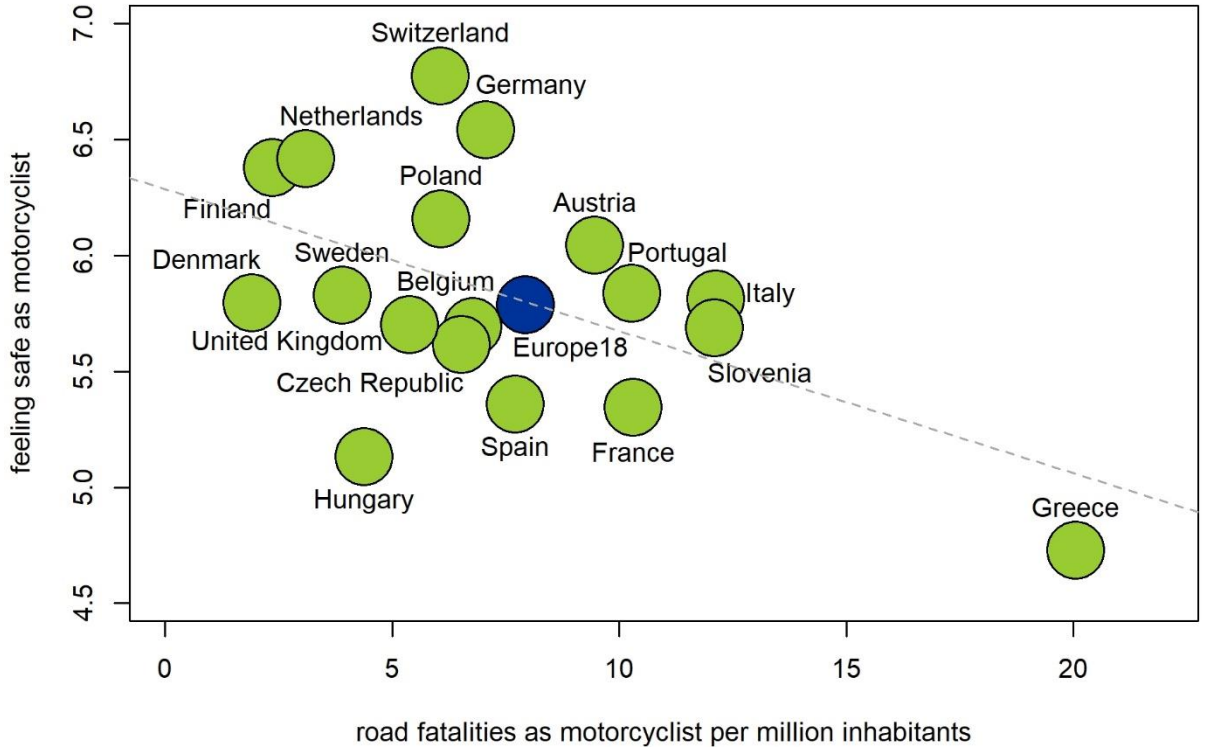


Figure 19: Subjective safety of motorcyclists and road fatalities

For the motorcyclists (Figure 19) we found the same pattern as for the car drivers. Countries with a high safety feeling like Switzerland, Germany, Netherlands and Finland have a small number of road fatalities between 2.4 and 7 whereas countries with a lower safety feeling like Italy or Slovenia have higher number of road fatalities per million inhabitants. Greek people feel very unsafe as motorcyclists with a mean score of only 4.7 and they have 20 people killed as motorcyclists per million inhabitants. The high number of fatal road crashes might be connected to the motorcycle tourism and low helmet wearing rates in Greece.

The pattern for cyclists (see Figure 20) is different, the association between subjective safety and fatalities seems to be positively related. To add a further dimension to the picture we integrated exposure as bubble diameter. The bubble diameter is proportional to the fraction of frequent cyclists among all the cyclists in a country, indicated by the ESRA2 survey. The bubble diameter is largest for the Netherlands and smallest for Portugal. Countries with larger diameters tend to feel safer as cyclists, i.e. Netherlands, Denmark and Germany; on the other side of the spectrum (with low exposure) are for example France, Greece, Slovenia or Czech Republic.

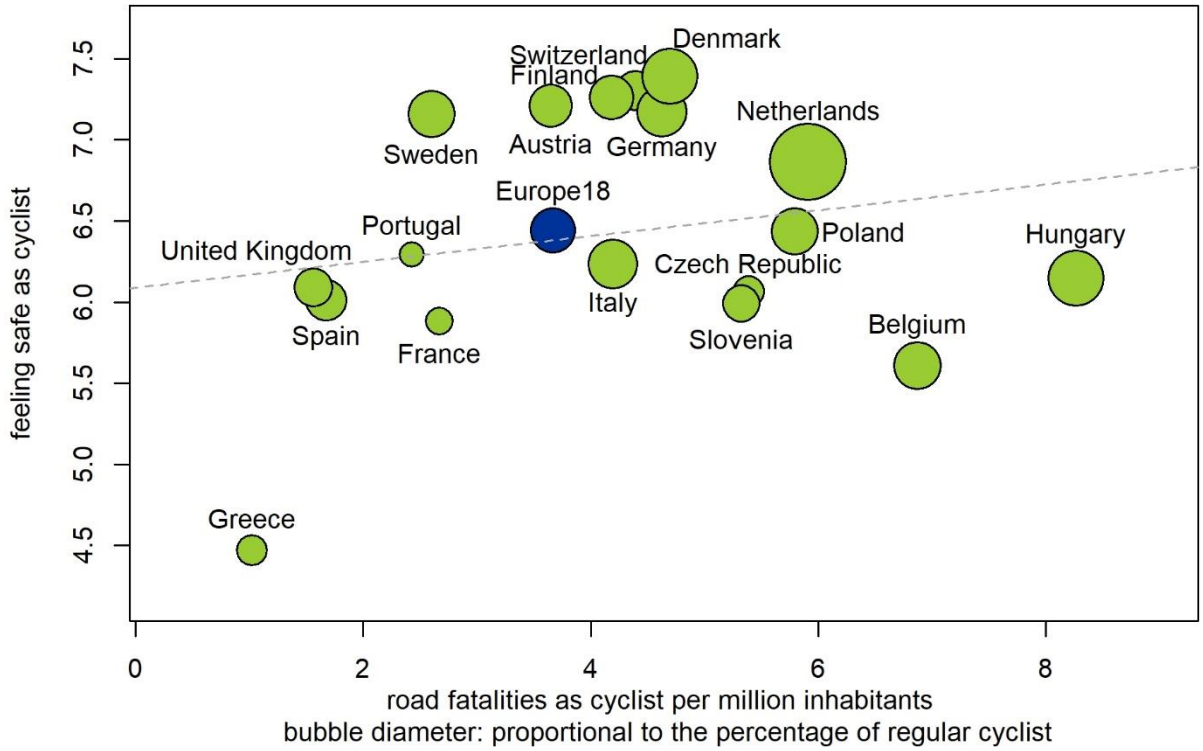


Figure 20: Subjective safety of cyclists and road fatalities

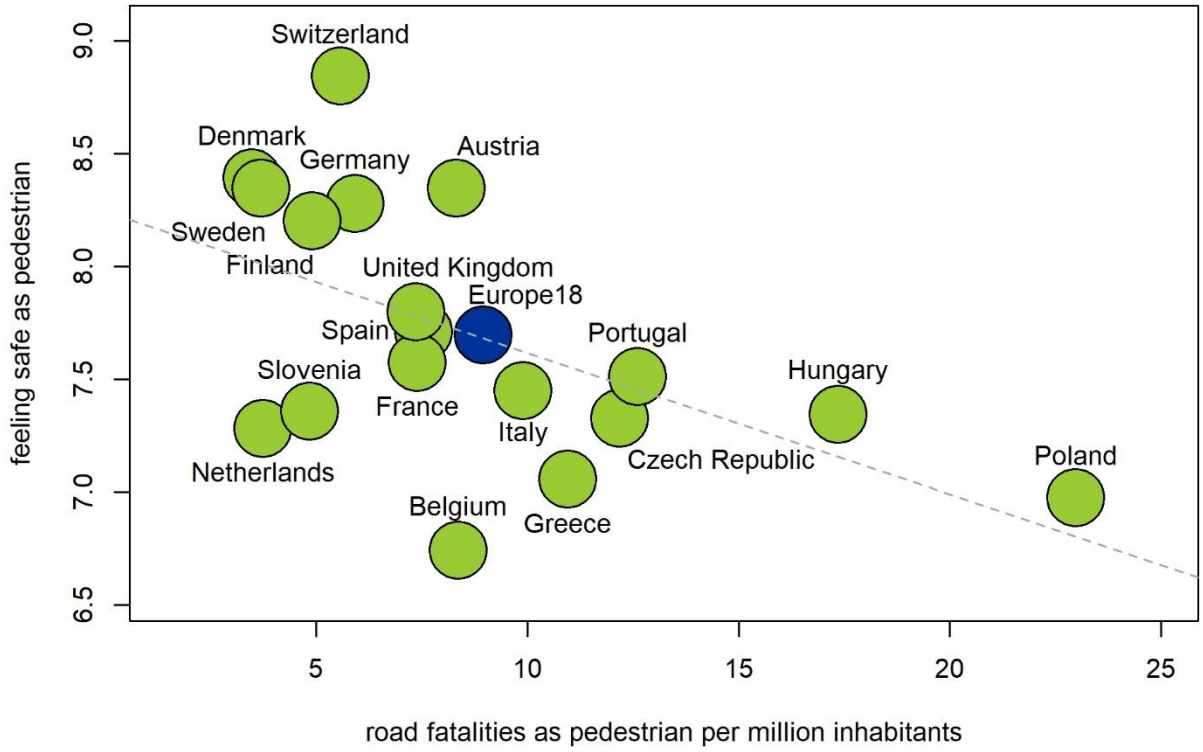


Figure 21: Subjective safety of pedestrians and road fatalities

A negative relation persists also for pedestrians, i.e., the more pedestrians per million inhabitants are killed, the less safe people feel when walking. Poland and Hungary have the highest number of road fatalities as pedestrians with 23 and 17.3; there is a relatively low mean score for subjective safety of 7 and 7.3, respectively. People in Switzerland, Denmark, Sweden, Finland, Germany and Austria feel safe as a pedestrian and have a road fatality rate per million inhabitants below 10 (see Figure 21).

3.2.2 Influential variables to subjective safety and risk perception

In order to find variables that influence subjective safety and risk perception we fit regression models. Restricting ourselves to European car drivers, survey design limits the analysis further to car drivers that drive a non-electric and non-hybrid car at least a few days per month.
To explain subjective safety, we used the following variables:

- Age
- Gender
- Education
- Involvement in a road crash involving personal injuries
- Personal acceptability of driving after drinking/driving faster than the speed limit.
- Current traffic rules and penalties for driving under the influence of alcohol/driving faster than the speed limit.
- Self-declared safe and unsafe behaviour in traffic (driving after drinking/ driving faster than the speed limit)
- Perceived behavioural control, habits and attitudes[2] about driving after drinking/driving faster than the speed limit.

To investigate the influence of these variables on subject safety, we fit a linear regression model treating the variables as numeric. Although, strictly speaking, some assumptions for using a linear model are not met, it is sufficient to draw a picture how the variables interact. Furthermore, survey questions were posed in a way to mimic a numerical scale for the Likert items, e.g. the dependent variable of subjective safety is measured on 11 values. But limitations have to be kept in mind.

In Table 3, we see that Country has an effect on subjective safety, e.g., the reference category being Austria, there is a decrease of 0.8 safety points for being from Belgium and a 1.22 decrease for being from Greece. This means that people from Belgium rate on average subjective safety with 0.8 points less than people from Austria whereas people from Greece even have 1.22 decrease on the average subjective safety. The level of education does not influence subjective safety in our data. A one unit increase in personal acceptability of driving after drug use or driving after taking medication results in a 0.15 and 0.14 decrease in subjective safety. Self-reported behaviour only has minor negative effects. Attitudes concerning alcohol do have negative effects whereas attitude variables concerning driving faster than the speed limit seem to have positive effects.

Although some variables seem to have influence on subjective safety, we do not believe that this are causal effects. We should also be careful when interpreting the p-values because model assumptions are not met. Only 9% of the variation in the dependent variable is explained by the independent variables, i.e. R^2 is approximately 0.09. Interpreting the results, we think that subjective safety is a very complex construct that is difficult to predict and depends on a lot of factors like e.g. media exposure of car crashes, traffic volume, personal exposure and personal factors.

[2] Perceived behavioural control refers to the perception of one owns ability to actually perform a certain behaviour and attitudes can be defined as positive or negative feeling towards an object or behaviour (Otto et al., 2019)

Table 3: overview of linear regression results when explaining subjective safety

Dependent variable: How safe or unsafe do you feel when driving a car? (0 = very unsafe – 10 = very safe)	**Estimate**	**Std. error**	**t-value**	**p-value**
(Intercept)	7.35	0.2	36.97	0.00
Country (ref. Austria)				
Belgium	-0.80	0.19	-4.25	2.18e-05
Switzerland	0.10	0.2	0.49	0.625
Czech Republic	-0.97	0.2	-4.90	9.46e-07
Germany	0.12	0.16	0.77	0.442
Denmark	0.27	0.22	1.23	0.218
Greece	-1.22	0.19	-6.45	1.17e-10
Spain	-0.23	0.16	-1.38	0.167
Finland	-0.05	0.22	-0.24	0.814
France	-0.68	0.16	-4.25	2.18e-05
Hungary	-0.92	0.2	-4.71	2.56e-06
Ireland	-0.40	0.23	-1.71	0.087
Italy	-0.61	0.16	-3.82	1.32e-04
Netherlands	-0.64	0.18	-3.58	3.40e-04
Poland	-1.06	0.17	-6.41	1.50e-10
Portugal	-0.30	0.19	-1.59	0.112
Serbia	-0.67	0.20	-3.21	0.001
Sweden	-0.35	0.20	-1.79	0.074
Slovenia	-0.57	0.29	-1.99	0.047
United Kingdom	-0.27	0.16	-1.69	0.091
Gender (ref. male)				
female	-0.09	0.04	-2.45	0.014
Age				
	0.01	0.001	10.92	1.10e-27
Education (ref. none/primary education)				
secondary education	0.03	0.08	0.41	0.680
bachelor's degree or similar	0.07	0.08	0.88	0.378
master's degree or higher	-0.08	0.08	-0.97	0.335
In the past 12 months, how often have you been involved in a car crash? (ref. never)				
at least once	-0.1	0.07	-1.41	0.158
Personal acceptability for car driver (1 = unacceptable – 5 = acceptable)				
drive when he/she may be over the legal limit for drinking and driving	0.01	0.04	0.37	0.710
drive 1 hour after using drugs (other than medication)	-0.15	0.04	-3.53	4.25e-04
drive after taking a medication that may influence the ability to drive	-0.14	0.03	-4.84	1.30e-06
drive faster than the speed limit inside built-up areas	-0.07	0.02	-2.55	0.011
drive faster than the speed limit outside built-up areas (but not on motorways/freeways)	0.11	0.03	3.85	1.19e-04
drive faster than the speed limit on motorways/freeways	0.06	0.03	2.40	0.017
Current traffic rules and penalties for driving under the influence of alcohol. (disagree – agree) (ref. disagree)				
The traffic rules should be stricter.	0.03	0.05	0.58	0.563
The traffic rules are not being checked sufficiently.	-0.02	0.05	-0.37	0.713
The penalties are too severe.	-0.16	0.05	-3.21	0.001
Current traffic rules and penalties for driving faster than the speed limit. (disagree – agree) (ref. disagree)				
The traffic rules should be stricter.	-0.19	0.04	-4.31	1.68e-05
The traffic rules are not being checked sufficiently.	-0.08	0.05	-1.79	0.074
The penalties are too severe.	-0.01	0.04	-0.15	0.882
Over the last 12 months, how often did you as a car driver				
drive after drinking alcohol	-0.06	0.03	-1.98	0.048
drive faster than the speed limit outside built-up areas	-0.01	0.02	-0.57	0.568
Attitudes (1 = disagree – 5 = agree)				
I trust myself to drive after having a glass of alcohol.	0.12	0.02	6.73	1.74e-11
I have the ability to drive when I am a little drunk after a party	-0.02	0.03	-0.53	0.595
I am able to drive after drinking a large amount of alcohol (e.g. half a litre of wine).	-0.11	0.03	-3.36	0.001
Even when I am a little drunk after a party, I drive.	-0.09	0.03	-3.01	0.003
It sometimes happens that I drive after consuming a large amount of alcohol (e.g. a litre of beer or half a litre of wine).	-0.03	0.04	-0.85	0.398
I have to drive fast; otherwise, I have the impression of losing time.	-0.10	0.02	-4.62	3.94e-06
Respecting speed limits is boring or dull.	0.04	0.02	2.51	0.012
I trust myself when I drive significantly faster than the speed limit.	0.12	0.02	7.05	1.82e-12
I am able to drive fast through a sharp curve.	0.09	0.02	4.52	6.26e-06
I like to drive in a sporty manner through a sharp curve.	0.06	0.02	2.78	0.005

To analyse risk perception as dependent variable, we use the dichotomized version of the variables "How often do you think that driving after drinking (or driving after taking drugs or driving faster than the speed limit) is the cause of a road crash involving a car?" resulting in the categories "not that often/not frequently" and "often/frequently". We fit logistic regression models and include only those independent variables that are associated with the dependent variable, i.e., alcohol and drug related items for explaining risk perception of alcohol and drug use. The same applies to the counterpart concerning speed. The odds ratio including their 95% confidence intervals of the logistic regression model concerning risk perception of alcohol are listed in the third column in Table 4. The results for risk perception of taking drugs and speed can also be found in Table 4 in columns 4 to 5 and 6 to 7, respectively.

Table 4: overview over logistic regression results explaining risk perception

How often do you think each of the following factors is the cause of a road crash involving a car? (0 = not that often/not frequently, 1 = often/frequently)	**Driving after drinking alcohol**		**Driving after taking drugs**		**Driving faster than the speed limit**	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
(Intercept)	2.28	(1.46,3.55)	0.84	(0.57,1.25)	3.26	(2.18,4.88)
Country (ref. Austria)						
Belgium	1.22	(0.78,1.91)	1.33	(0.90,1.94)	0.89	(0.60,1.32)
Switzerland	1.08	(0.68,1.71)	1.28	(0.86,1.92)	0.94	(0.62,1.41)
Czech Republic	2.11	(1.26,3.53)	3.11	(1.98,4.89)	1.07	(0.70,1.63)
Germany	1.22	(0.84,1.76)	1.14	(0.83,1.56)	1.15	(0.83,1.60)
Denmark	1.00	(0.60,1.68)	0.82	(0.53,1.26)	1.03	(0.64,1.64)
Greece	0.76	(0.49,1.17)	1.05	(0.72,1.54)	0.71	(0.48,1.04)
Spain	1.34	(0.91,1.97)	2.18	(1.56,3.04)	1.27	(0.90,1.79)
Finland	2.32	(1.22,4.38)	3.40	(1.94,5.94)	1.00	(0.62,1.59)
France	1.14	(0.79,1.67)	1.86	(1.34,2.57)	0.84	(0.60,1.18)
Hungary	1.42	(0.88,2.27)	1.44	(0.97,2.15)	1.49	(0.97,2.28)
Ireland	0.60	(0.36,0.99)	0.81	(0.52,1.29)	0.64	(0.40,1.03)
Italy	0.69	(0.48,1.01)	1.33	(0.96,1.83)	0.69	(0.05,0.96)
Netherlands	0.97	(0.64,1.48)	0.89	(0.62,1.27)	1.00	(0.68,1.45)
Poland	1.28	(0.87,1.89)	2.06	(1.47,2.89)	1.36	(0.96,1.93)
Portugal	1.49	(0.95,2.34)	1.87	(1.27,2.76)	1.46	(0.97,2.18)
Serbia	1.39	(0.83,2.30)	2.18	(1.39,3.43)	1.31	(0.82,2.07)
Sweden	1.03	(0.64,1.64)	1.37	(0.91,2.06)	0.84	(0.56,1.27)
Slovenia	1.42	(0.70,2.87)	1.43	(0.79,2.58)	1.00	(0.55,1.82)
United Kingdom	1.08	(0.74,1.58)	1.43	(1.03,1.97)	1.04	(0.74,1.45)
Gender (ref. male)						
female	1.32	(1.22,1.44)	1.26	(1.17,1.36)	1.35	(1.26,1.46)
Age						
	1.01	(1.01,1.01)	1.02	(1.01,1.02)	1	(1.00,1.01)
Education (ref. none/primary education)						
secondary education	1.32	(1.1,1.58)	1.22	(1.04,1.43)	1.09	(0.93,1.28)
bachelor's degree or similar	1.32	(1.10,1.56)	1.12	(0.95,1.32)	1.21	(1.02,1.43)
master's degree or higher	1.23	(1.10,1.48)	1.09	(0.92,1.30)	1.23	(1.03,1.46)
In the past 12 months, how often have you been involved in a car crash? (ref. never)						
at least once	0.86	(0.74,1.00)	0.76	(0.66,0.88)	0.85	(0.74,0.98)
Personal acceptability for car driver (1 = unacceptable – 5 = acceptable)						
drive when he/she may be over the legal limit for drinking and driving	0.85	(0.78,0.92)	1.00	(0.93,1.08)	-	-
drive 1 hour after using drugs (other than medication)	0.93	(0.85,1.01)"	0.81	(0.75,0.88)	-	-
drive after taking a medication that may influence the ability to drive	1.11	(1.04,1.18)	1.10	(1.04,1.17)	-	-
drive faster than the speed limit inside built-up areas	-	-	-	-	0.97	(0.92,1.02)
drive faster than the speed limit outside built-up areas (but not on motorways/freeways)	-	-	-	-	0.91	(0.86,0.96)
drive faster than the speed limit on motorways/freeways	-	-	-	-	0.99	(0.94,1.05)
Current traffic rules and penalties for driving under the influence of alcohol. (disagree – agree) (ref. disagree)						

The traffic rules should be stricter.	1.22	(1.11,1.35)	1.19	(1.09,1.30)	-	-
The traffic rules are not being checked sufficiently.	0.87	(0.78,0.96)	0.97	(0.89,1.07)	-	-
The penalties are too severe.	0.47	(0.42,0.52)	0.59	(0.53,0.64)	-	-
Current traffic rules and penalties for driving faster than the speed limit. (disagree – agree) (ref. disagree)						
The traffic rules should be stricter.	-	-	-	-	0.99	(0.91,1.09)
The traffic rules are not being checked sufficiently.	-	-	-	-	1.27	(1.17,1.38)
The penalties are too severe.	-	-	-	-	0.61	(0.57,0.67)
Over the last 12 months, how often did you as a car driver						
drive after drinking alcohol	1.01	(0.94,1.09)	1.02	(0.95,1.09)	-	-
drive faster than the speed limit outside built-up areas	-	-	-	-	1.08	(1.04,1.13)
Attitudes (1 = disagree – 5 = agree)						
I trust myself to drive after having a glass of alcohol.	1.07	(1.03,1.12)	1.05	(1.01,1.09)	-	-
I have the ability to drive when I am a little drunk after a party	1.01	(0.95,1.07)	0.97	(0.92,1.03)"	-	-
I am able to drive after drinking a large amount of alcohol (e.g. half a litre of wine).	1.00	(0.93,1.07)	1.08	(1.01,1.16)	-	-
Even when I am a little drunk after a party, I drive.	1.05	(0.98,1.12)	1.02	(0.96,1.09)	-	-
It sometimes happens that I drive after consuming a large amount of alcohol (e.g. a litre of beer or half a litre of wine).	0.86	(0.8,0.93)	0.9	(0.84,0.97)	-	-
I have to drive fast; otherwise, I have the impression of losing time.	-	-	-	-	0.97	(0.92,1.01)
Respecting speed limits is boring or dull.	-	-	-	-	0.94	(0.9,0.97)
I trust myself when I drive significantly faster than the speed limit.	-	-	-	-	0.95	(0.91,0.98)
I am able to drive fast through a sharp curve.	-	-	-	-	1	(0.96,1.04)
I like to drive in a sporty manner through a sharp curve.	-	-	-	-	0.93	(0.89,0.97)

The odds ratio of the Czech Republic is 2.11 compared to the reference category Austria, this means that the odds of perceiving alcohol as being very often the cause of a road crash increases by 111% for people who live in the Czech Republic compared to Austrians. The odds of drug use being very often the cause of a road crash is with a value of 3.11 even higher for the Czech Republic compared to Austria. The odds of Finland are also quite large compared to the reference category being Austria, i.e., 2.32 for driving after drinking alcohol and even 3.4 for driving after taking drugs. Looking at the data, the odds for the speeding variants are rather low. The coefficients are considered significant at the 5% level if the confidence interval does not enclose 1. Model fits indicated by Cox & Snells Pseudo-R^2 are only around 0.04 for all three models. Hence, the model results should be considered with caution. They should not be interpreted as causal effects.

3.3 Comparison with other findings

Having no point of reference, interpreting the results of the ESRA2 survey on subjective safety and risk perception is difficult. For this reason, some results of the current report are exemplarily compared with data of the ESRA1 survey.

In Figure 18 the mean score of the answers of the participants on the feeling of (un)safety for different transport modes in different countries are juxtaposed with the data from the first edition of the ESRA survey (ESRA1) in 2015 using the transport modes of driving a car and cycling as examples.

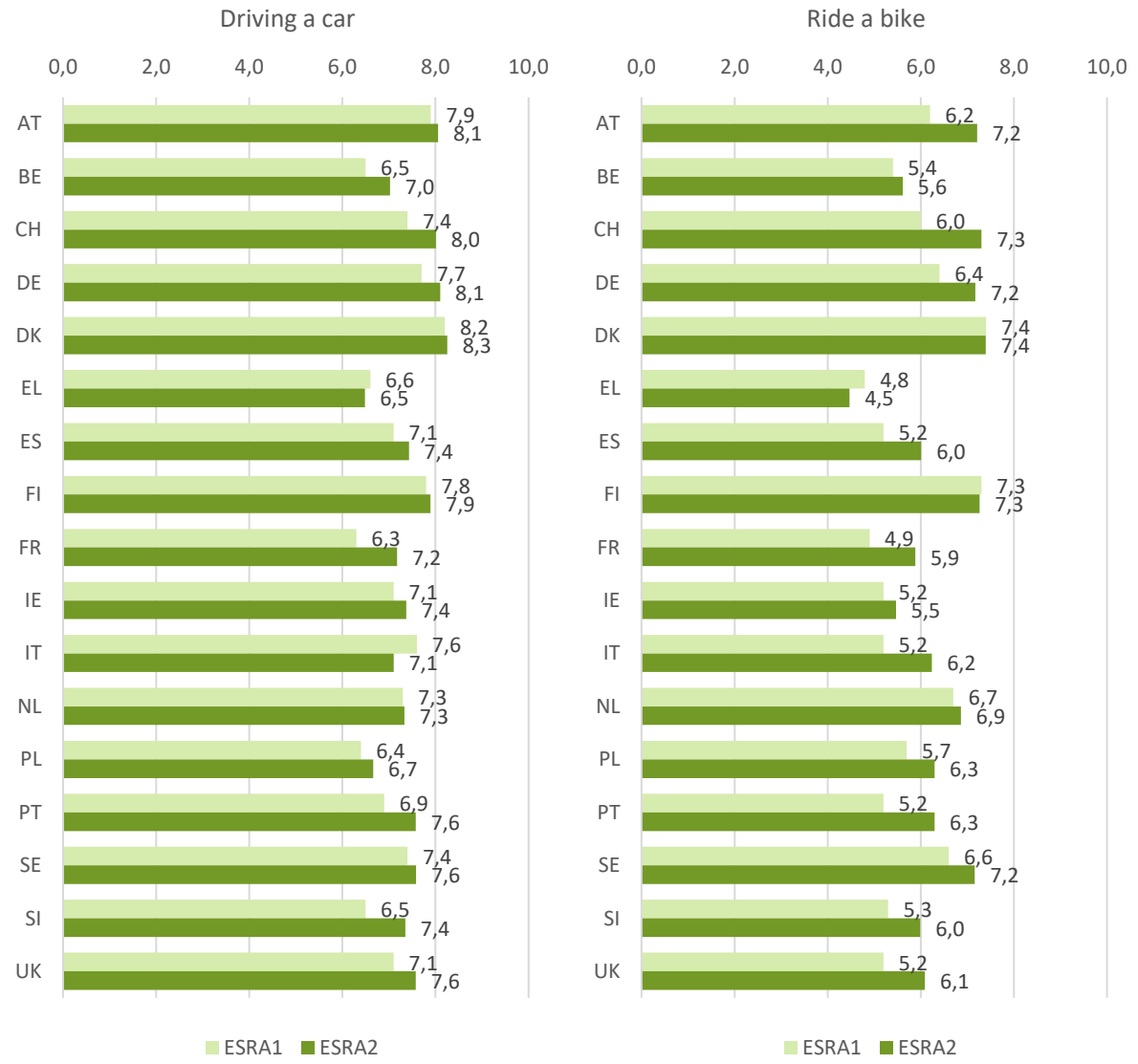


Figure 22: Subjective safety for driving a car (left) and riding a bike (right) by country

As shown in Figure 22 the subjective safety for driving a car is slightly lower in ESRA1 for most countries. It should be noted that in 2015 these questions were answered by slightly different samples of respondents in 2015 and 2018. A considerable higher level of safety for driving a car in ESRA2 compared to ESRA1 is only observable for France, Slovenia and Portugal. In contrast, the safety level for driving a car is lower in ESRA2 compared to ESRA1 especially in Italy and Greece. Regarding the subjective safety for cycling, larger differences in the assessment of participants between ESRA1 and ESRA2 are observable: in most countries the level of safety for cycling is considerable higher in ESRA2 compared to ESRA1 – this is especially the case for Switzerland, Portugal, France and Austria. In contrast, only for a few countries there is no change in the safety level for cycling (e.g. Denmark and Finland) or a lower safety level for cycling in ESRA2 compared to ESRA1 (e.g. Greece).

3.4 Limitations of the data

Some limitations have to be acknowledged, both for the surveying method and the data analysis. First of all, despite the advantages of online surveys, the representativeness of the surveyed populations may be a problem, mainly for countries with low rates of internet use. That is the case for some of the countries of the ESRA2 survey where the percentage of population using the internet is low, e.g. Kenya

and Nigeria (lower than 30%) or India and Egypt (lower than 50%). Moreover, the number of African respondents aged 65 or older was quite low, so that the answers of this particular age group in African countries should be interpreted with caution. Furthermore, when analyzing group differences, one should have in mind that p-values rather than adjusted p-values are reported. Model fit of linear and logistic regression models are rather poor. Hence, the importance of significant factors in these models should be interpreted as tendency rather than causality. Besides, we do not have the intention of finding the true model. Actually, we might be far away from the true model because we think that subjective safety and risk perception depend also on media exposure of car crashes, traffic volume or personal factors. There might be a lot of other factors that directly or indirectly influence subjective safety or risk perception that are not addressed by the survey.

4 Summary and discussion

4.1 Major findings

Subjective safety

How safe or unsafe do road users feel when using different transport modes?

- In all regions, respondents considered the motorcycle and the electric bicycle or pedelec as the least safe transport modes. In contrast, the aeroplane and public transport were considered the safest transport modes in North America, Asia-Oceania and Africa. In Europe driving a car was considered the safest.

- Especially in Europe and Africa (as well as in Asia-Oceania) women tend to feel less safe when using the various transport modes than men.

- In North America, Europe and Africa for some of the modes (e.g. public transport) the subjective level of safety tends to increase with age. In contrast, this age pattern was not found for Asia-Oceania or even reversed.

- Regarding the interrelation of subjective safety and road fatalities car drivers feel safer when there are less fatal road crashes in their countries. The same pattern was found for motorcyclists and pedestrians.

- The pattern for cyclists is different, the association between subjective safety and fatalities seems to be positively related. Adding exposure as further dimension to the picture it showed that cyclists in countries with higher cycling exposure tend to feel safer.

- In order to find variables that influence subjective safety and risk perception, regression models were fit. Although some variables seem to have an influence on subjective safety, it cannot be proved that this are causal effects.

Which factors or behaviours are perceived as frequent causes of crashes?

- In Europe, North America and Africa respondents considered driving after drinking alcohol as the riskiest factor. In Asia-Oceania speeding was considered the riskiest of all factors; in North America and Africa this is perceived as the second riskiest factor.

- In Europe, next to driving under the influence of alcohol, using a hand-held-phone while driving was considered the second riskiest. On the contrary, using a hands-free phone while driving was the behaviour least risky in all regions.

- Especially in Europe and Africa as well as in Asia-Oceania women considered dangerous driving behaviour to be riskier than men.

- In Europe and North America risk perception of different behaviours increased with increasing age, in Asia-Oceania and in Africa this age pattern was not found.

Benefits of vehicle automation

Perceived safety-related benefits of vehicle automation: how likely are safety-related benefits of semi- and fully automated passenger cars?

- For participants in Asia-Oceania and Africa safety-related benefits such as fewer crashes and reduced crash severity due to semi- and fully automated passenger cars are more likely than for participants in the US and Europe.

- Especially in Europe and North America men considered the safety benefits of semi- and fully automated passenger cars more likely to occur than women.

- In particular in Africa and Asia-Oceania the expectations of safety benefits of semi-automated passenger cars decrease with increasing age; for fully automated passenger cars this pattern as well, especially in Europe and North America.

4.2 Discussion

Earlier surveys on subjective safety of road users mostly were carried out only for a specific country (e.g. Bjørnskau, 2004; Backer-Grøndahl et al., 2007) or focussed only on countries in Europe (e.g. Furian, Brandstätter, Kaiser & Witzik et al., 2016). The present ESRA2 survey focused on subjective safety and risk perception of all kind of road users – and also the role of gender and age – not only for countries in Europe, but for road users of 32 countries from four regions of the world (Europe, North America, Asia-Oceania and Africa).

In line with previous research, the ESRA2 data reflect that road users consider motorcycling as the least safe transport mode, followed by cycling, i.e. in particular the electric bicycle or pedelec but also bicycles without pedal drive. This is not only the case in Europe (like also found in Furian et al. 2016) but also in all the other regions. In contrast, besides the aeroplane, especially public transport but also the car (especially in Europe) were considered as rather safe across all regions. These results overall correspond well with the accidents statistics (WHO, 2018a) as well as with the results of the first addition of ESRA (Furian et al. 2016). In Europe, subjective safety of car drivers, motorcyclists and pedestrians is negatively associated with the number of road fatalities per million inhabitants for the relevant mode. Only for cyclists the association seems to be positive but this can be explained by the missing factor of exposure (see Figure 18 up to Figure 21). Explaining subjective safety by appropriate factors, we see that most of the factors have minor impact but there is not a single one that stands out (see Table 3).

On the country-level, especially the results regarding cycling show that in countries with low cycling rates like Greece or US, it is considered less safe than in countries with a high number of cyclists (e.g. Denmark). This is in line with the hypothesis of 'safety in numbers' which states that a motorist is less likely to collide with a pedestrian or cyclist as the numbers of pedestrians or bicyclists increase (Brüde & Larsson, 1993; Elvik & Goel, 2019), but also could be traced back to the lack of cycling infrastructure in countries like Greece or US compared to the existence of more advanced cycling infrastructure in countries like Denmark, the Netherlands or Germany. Similar results were found by Furian et al. (2016) focusing on countries in Europe. Moreover, comparing the results regarding the subjective safety for cycling with the results from ESRA1 shows that in most countries (in Europe) the level of subjective safety for cycling is considerable higher in ESRA2 (2018) compared to ESRA1 (2015), whereas for car driving only minor changes are observable. Again, safety in numbers might play a role considering the rise of bike shares of all trips especially in European cities lately and similarly also the investment of cities in expanded and improved cycling infrastructure (Pucher & Buehler, 2017).

Regarding risk perception, results show that women generally tend to estimate risk factors to be higher than men. In line with Furian et al. (2016) this is especially true for Europe (see also Table 4), but also for Africa (as well as for Asia-Oceania). However, both groups overall agree on the factors being a frequent cause of crashes (driving after drinking alcohol and driving faster than the speed limit) and the factor being the least frequent cause (using a hands-free phone while driving) in nearly all regions. However, there is an equal number of men and women producing road accidents, but when it comes to road fatalities men are clearly in the lead (WHO, 2018b). An explanation might be that women who feel less safe are more cautious and risk conscious in road traffic and thus avoid the risk taking behaviours that lead to road fatalities to a higher extent.

Safety-related benefits (fewer crashes, less severe crashes) of semi- and fully automated passenger cars are perceived as more likely to occur for respondents in Asia-Oceania (especially India) and Africa compared to Europe and North America. This corresponds very much with the results of earlier surveys on automated vehicles which indicate that respondents from China and India are in general more positive about automated vehicles than respondents from the US or UK and that in general respondents of lower-income countries are more positive about automated vehicles than respondents from high-

income countries (Schottle & Sivak, 2014; World Economic Forum, 2015; Nordhoff, de Winter, Kyriakidis, van Arem & Happee et al., 2018). This positive attitude on automated vehicles of the respondents seems also to affect the expected safety benefits of automated vehicles, although results of Shoettle & Sivak (2014) indicate that both low- and high-income countries are equally concerned about safety issues related to automated vehicles (e.g. system failure).

4.3 Closing remarks

The initial aim of ESRA was to develop a system for gathering reliable and comparable information about people's attitudes towards road safety in a number of 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 46 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 initiative on a triennial basis, retaining a core set of questions in every wave allowing the development of time series of road safety performance indicators.

List of tables

List of figures

Overview appendix

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Appendix 1: ESRA2_2018 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.

Thank you for your contribution!

Socio-demographic information

Q1) In which country do you live? _____

Q2) Are you ... male – female – other (only in country who officially recognizes another gender)

Q3a) In which year were you born? Dropdown menu

Q3b) In which month were you born? Dropdown menu

Q4_1) 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

Q4_2) What is the highest qualification or educational certificate that your mother has obtained? none - primary education - secondary education - bachelor's degree or similar - master's degree or higher - I don't know

Q5a) Which of the following terms best describes your current professional occupation? white collar or office worker (excluding executive)/ employee (public or private sector) →Q5b - blue collar or manual worker/worker →Q5b - executive →Q5b - self-employed/independent professional →Q5b - currently no professional occupation →Q5c

Q5b) Do you have to drive or ride a vehicle for work? (Please indicate the job category that is most appropriate for you) yes, I work as a taxi, bus, truck driver, … - yes, I work as a courier, mailman, visiting patients, food delivery, salesperson, … - no

Q5c) You stated that you currently have no professional occupation. Which of the following terms best describes your current situation? I am … a student - unemployed, looking for a job – retired - not fit to work - a stay-at-home spouse or parent - other

Q6) What is the postal code of the municipality in which you live? _____

Q7) In which region do you live? Drop down menu

Q8a) How far do you live from the nearest bus stop, light rail stop, or metro/underground station? less than 500 metres → Q8b - between 500 metres and 1 kilometre → Q8b - more than 1 kilometre → skip Q8b

Q8b) What is the frequency of your nearest bus stop, light rail stop, or metro/underground station? at least 3 times per hour - 1 or 2 times per hour - less than 1 time per hour

Mobility & exposure

Q9) Do you have a car driving licence or permit (including learner's permit)? yes - no

Q10) 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): walk minimum 100m (pedestrian; including jogging, inline skate, skateboard, …) - cycle (non-electric) - cycle on an electric bicycle/e-bike/pedelec - drive a moped (≤ 50 cc or ≤ 4 kW; non-electric - drive a motorcycle (> 50 cc and > 4 kW non-electric) - drive an electric moped (≤ 4 kW) - drive an electric motorcycle (> 4 kW) - drive a powered personal transport device such as an electric step, hoverboard, solowheel,… - drive a car (non-electric or non-hybrid) - drive a taxi - drive a bus as a driver - drive a truck/lorry - drive a hybrid or electric car - take a taxi or use a ride-hail service (e.g. Uber, Lyft) - take the train - take the bus - take the tram/streetcar - take the subway - take the aeroplane - take a ship/boat or ferry - be a passenger in a car - use another transport mode

Q11) Over the last 30 days, have you transported a child (<18 years of age) in a car? yes - no
Items: below 150cm - above 150cm

Self-declared safe and unsafe behaviour in traffic

Q12_1a) Over the last 12 months, 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 all items: at least once (2-5) - never (1)
Items (random):

- drive after drinking alcohol
- drive faster than the speed limit outside built-up areas (but not on motorways/freeways)
- read a text message or email while driving

Q12_1b) 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 all items: at least once (2-5) - never (1)
Items (random):

- drive when you may have been over the legal limit for drinking and driving
- drive after drinking alcohol
- drive 1 hour after using drugs (other than medication)
- drive after taking medication that carries a warning that it may influence your driving ability
- drive faster than the speed limit inside built-up areas
- drive faster than the speed limit outside built-up areas (but not on motorways/freeways)
- drive faster than the speed limit on motorways/freeways
- drive without wearing your seatbelt
- transport children under 150cm without using child restraint systems (e.g. child safety seat, cushion)
- transport children over 150cm without wearing their seatbelts
- talk on a hand-held mobile phone while driving
- talk on a hands-free mobile phone while driving
- read a text message/email or check social media (e.g. Facebook, twitter, etc.) while driving
- drive when you were so sleepy that you had trouble keeping your eyes open

Q12_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 all items: at least once (2-5) - never (1)
Item:

- travel without wearing your seatbelt in the back seat

Q12_3) Over the last 30 days, how often did you as a MOPED DRIVER 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 all items: at least once (2-5) - never (1)
Items (random):

- ride when you may have been over the legal limit for drinking and driving
- ride faster than the speed limit outside built-up areas (but not on motorways/freeways)
- ride a moped or motorcycle without a helmet
- read a text message/email or check social media (e.g. Facebook, twitter, etc.) while riding a moped or motorcycle

Q12_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 all items: at least once (2-5) - never (1)
Items (random):

- 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 text message/email or check social media (e.g. Facebook, twitter, etc.) while cycling
- cycle on the road next to the cycle lane

Q12_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 all items: at least once (2-5) - never (1)
Items (random):

- listen to music through headphones as a pedestrian while walking in the streets
- read a text message/email or check social media (e.g. Facebook, twitter, etc.) while walking in the streets
- cross the road when a pedestrian light is red
- cross the road at places other than at a nearby (distance less than 30m) pedestrian crossing

Acceptability of safe and unsafe traffic behaviour

Q13_1) 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):

- drive when he/she may be over the legal limit for drinking and driving
- drive 1 hour after using drugs (other than medication)
- drive faster than the speed limit outside built-up areas (but not on motorways/freeways)
- not wear a seatbelt while driving
- transport children in the car without securing them (child's car seat, seatbelt, etc.)
- talk on a hand-held mobile phone while driving
- read a text message/email or check social media (e.g. Facebook, twitter, etc.) while driving

Q14_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)

- drive when he/she may be over the legal limit for drinking and driving
- drive 1 hour after using drugs (other than medication)
- drive after taking a medication that may influence the ability to drive
- drive faster than the speed limit inside built-up areas
- drive faster than the speed limit outside built-up areas (but not on motorways/freeways)
- drive faster than the speed limit on motorways/freeways
- not wear a seatbelt while driving
- 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 hand-free mobile phone while driving
- read a text message/email or check social media (e.g. Facebook, twitter, etc.) while driving
- drive when they're so sleepy that they have trouble keeping their eyes open

Attitudes towards safe and unsafe behaviour in traffic

Q15) 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):
Normative believes & subjective norms (including injunctive norms from Q13)

- Most of my friends would drive after having drunk alcohol.
- Most of my friends would drive 20 km/h over the speed limit in a residential area.

Behaviour believe & 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.
- For short trips, it is not really necessary to use the appropriate child restraint.
- 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 (here: self-efficacy)

- I trust myself to drive after having a glass of alcohol.
- 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. half a liter of wine).
- I trust myself when I drive significantly faster than the speed limit.
- I am able to drive fast through a sharp curve.
- I trust myself when I check my 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.
- Even when I am a little drunk after a party, I drive.
- It sometimes happens that I drive after consuming a large amount of alcohol (e.g. a liter of beer or half a liter of wine).
- I often drive faster than the speed limit.
- I like to drive in a sporty fast manner through a sharp curve.
- It happens sometimes that I write a message on the mobile phone while driving.
- I often talk on a hand-held mobile phone while driving.
- I often check my messages on the mobile phone while driving.

Intentions

- I will do my best not to drive after drinking alcohol in the next 30 days.

- I will do my best to respect speed limits in the next 30 days.
- I will do my best not to use my mobile phone while driving in the next 30 days.

Quality control items

- Indicate number 1 on the answering scale.
- Indicate number 4 on the answering scale.

Subjective safety & risk perception

Q16) 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 Q10 are displayed.

Q17) 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)

- driving after drinking alcohol
- driving after taking drugs (other than 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 day-dreaming while driving
- driving while tired

Support for policy measures

Q18) Do you oppose or support a legal obligation to …? 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 (random)

- install 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 the legal limit)
- have zero tolerance for alcohol (0,0 ‰) for novice drivers (licence obtained less than 2 years)
- have zero tolerance for alcohol (0,0 ‰) for all drivers
- install Intelligent Speed Assistance (ISA) in new cars (which automatically limits the maximum speed of the vehicle and can be turned off manually)
- install Dynamic Speed Warning signs (traffic control devices that are programmed to provide a message to drivers exceeding a certain speed threshold)
- have a seatbelt reminder system for the front and back seats in new cars
- require all cyclists to wear a helmet
- require cyclists under the age of 12 to wear a helmet
- require all moped drivers and motorcyclists to wear a helmet
- require pedestrians to wear reflective material when walking in the streets in the dark
- require cyclists to wear reflective material when cycling in the dark
- require moped drivers and motorcyclists to wear reflective material when driving in the dark
- have zero tolerance for using any type of mobile phone while driving (hand-held or hands-free) for all drivers
- not using headphones (or earbuds) while walking in the streets
- not using headphones (or earbuds) while riding a bicycle

Q19_1) What do you think about the current traffic rules and penalties in your country for driving or riding under the influence of alcohol? agree – disagree
Items:

- The traffic rules should be stricter.
- The traffic rules are not being checked sufficiently.
- The penalties are too severe.

Q19_2) What do you think about the current traffic rules and penalties in your country for driving or riding faster than the speed limit? agree – disagree
Items: Q19_1

Q19_3) What do you think about the current traffic rules and penalties in your country for using a mobile phone while driving or riding? agree – disagree
Items: Q19_1

Enforcement

Q20_1) On a typical journey, how likely is it that you (as a CAR DRIVER) will be checked by the police 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)

- … alcohol, in other words, being subjected to a Breathalyser test
- … the use of illegal drugs
- … respecting the speed limits (including checks by a police car with a camera, fixed cameras, mobile cameras, and section control systems)
- … wearing your seatbelt
- … the use of hand-held mobile phone to talk or text while driving

Q21_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 - I prefer not to respond to this question
Binary variable: at least once - never (removing "I prefer not to respond to this Q)

Q22_1) In the past 12 months, how many times have you been checked by the police for the use of drugs (other than medication) while DRIVING A CAR? never – 1 time – at least 2 times - I prefer not to respond to this question
Binary variable: at least once - never (removing "I prefer not to respond to this Q)

Involvement in road crashes

Introduction: 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.

Q23_1a) In the past 12 months, how many times have you personally been involved in road crashes in which you or somebody else had to be taken to the hospital? ___ times (number; max. 10) if 0 → Q23_2a; if >0 → Q23_1b → Q23_2a
Binary variable: at least once - never

Q23_1b) Please indicate the transport modes you were using at the time of these crashes.
Items indicated by the respondent in Q10 are displayed; Threshold = 'at least a few days a year'.
Number to be indicated after each transport mode; note the sum should be equal to the number indicated in Q23_1a

Q23_2a) In the past 12 months, how many times have you personally been involved in road crashes with only minor injuries (no need for hospitalisation) for you or other people? ___ times (number; max. 10) if 0 → Q23_3a; if >0 → Q23_2b → Q23_3a
Binary variable: at least once - never

Q23_2b) = Q23_1b

Q23_3a) In the past 12 months, how many times have you personally been involved in road crashes with only material damage?
___ times (number; max. number 10) if 0 → skip Q23_3b; if >0 → Q23_3b → next Q
Binary variable: at least once - never

Q23_3b) = Q23_1b

Vehicle automation

I2) Introduction: The following questions focus on your opinion about automated passenger cars. We talk about two different levels of vehicle automation:
Semi-automated passenger cars: Drivers can choose to have the vehicle control all critical driving functions, including monitoring the road, steering, and accelerating or braking in certain traffic and environmental conditions. These vehicles will monitor roadways and prompt drivers when they need to resume control of the vehicle.
Fully-automated passenger cars: The vehicle controls all critical driving functions and monitoring all traffic situations. Drivers do not take control of the vehicle at any time.

Q24) How interested would you be in using the following types of automated passenger car? You can indicate your answer on a scale from 1 to 7, where 1 is "not at all interested" and 7 is "very interested". The numbers in between can be used to refine your response.
Binary variable: interested (5-7) - not interested/neutral (1-4)
Items:

- semi-automated passenger car
- fully-automated passenger car

Q25_1) How likely do you think it is that the following benefits will occur if everyone would use a semi-automated passenger car? 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):

- fewer crashes
- reduced severity of crash
- less traffic congestion
- shorter travel time
- lower vehicle emissions
- better fuel economy
- time for functional activities, not related to driving (e.g. working)
- time for recreative activities, not related to driving (e.g. reading, sleeping, eating)

Q25_2) How likely do you think it is that the following benefits will occur if everyone would use a fully-automated passenger car? 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.
Items (random) = Q25_1

Bonus question to be filled in by national partner

Q26) .....? You can indicate your answer on a scale from 1 to 5, where 1 is "…." and 5 is "….". The numbers in between can be used to refine your response.
Items (random; 4 items)

Q27) .....? You can indicate your answer on a scale from 1 to 5, where 1 is "…." and 5 is "….". The numbers in between can be used to refine your response.
Items (random; 4 items)

Social desirability scale

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

Q28) To what extent are the following statements true? You can indicate your answer on a scale from 1 to 5, where 1 is "very untrue" and 5 is "very true". The numbers in between can be used to refine your response.
Items (random):

- I always respect the highway code, even if the risk of getting caught is very low.
- I would still respect speed limits at all times, even if there were no police checks.
- I have never driven through a traffic light that had just turned red.
- I do not care what other drivers think about me.
- I always remain calm and rational in traffic. (if needed pop-up: rational = non-emotional)
- I am always confident of how to react in traffic situations.

Appendix 2: ESRA2 weights

The following weights are used to calculate representative means on national and regional level. They are based on UN population statistics (United Nations Statistics Division, 2019). 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, 65y+). 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, 65y) distribution in a country as retrieved from the UN population statistics.
Europe20 weight	European weighting factor based on all 20 European countries participating in ESRA2_2018, considering individual country weight and population size of the country as retrieved from the UN population statistics.
NorthAmerica2 weight	North American weighting factor based on all 2 North American countries participating in ESRA2_2018, considering individual country weight and population size of the country as retrieved from the UN population statistics.
AsiaOceania5 weight	Asian and Oceanian weighting factor based on all 5 Asian and Oceanian countries participating in ESRA2_2018, considering individual country weight and population size of the country as retrieved from the UN population statistics.
Africa5 weight	African weighting factor based on all 5 African countries participating in ESRA2_2018, considering individual country weight and population size of the country as retrieved from the UN population statistics.
ESRA32 weight	ESRA32 weighting factor based on all 32 countries participating in ESRA2_2018, considered individual country weight and population size of the country as retrieved from the UN population statistics.
ESRA32_sample weight	ESRA32-sample weighting factor based on all 32 countries participating in ESRA2_2018, considered individual country weight with N=1000 in all countries.

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