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Road Safety Habits and Related Factors of the Adult Population

Summary of the Doctoral Thesis
for obtaining a doctoral degree (*Ph.D.*)

Sector – Health and Sports Sciences
Sub-sector – Public Health

Riga, 2021

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Content

Abbreviations

BAC	Blood Alcohol Concentration
CI	Confidence Interval
EC	European Commission
EU	European Union
KSI	Killed or Seriously Injured
OR	Odds Ratio
RTC	Road Traffic Collision
WHO	World Health Organisations

Introduction

Road safety is on the agenda of public health at both global and national levels. Although significant investments and improvements have been made in the design and development of legislation, in the definition and implementation of vehicle standards and in the provision of access and operational assistance following a collision, the World Health Organisation suggests that this progress has not been made quickly enough to compensate for the increasing population and the rapid transport motorisation worldwide. Consequently, the number of deaths continues to rise. When analysing the number of deaths in road traffic collisions in 2018, European roads are recognized as the safest in the world (on average 49 deaths per million inhabitants), while Latvia has one of the highest road traffic fatality rates among the 28 European Union Member States (78 deaths per million inhabitants) ("Interim Impact Assessment of the Road Safety Plan 2017–2020", 2020).

The urgency of the problem and the planning of timely, targeted, and long-term interventions are highlighted in both international policy planning documents – the United Nations Agenda for Sustainable Development (United Nations, 2015), the Global Plan for the Decade of Action for Road Safety 2011–2020 (WHO, 2011), Roadmap to a Single European Transport Area – Towards a competitive and resource-efficient transport system (European Commission, 2011) and the adoption of the EU's strategic road safety action plan (European Commission, 2018b), and in national policy planning documents – Road Safety Plan for 2007–2013 (2007), for 2014–2016 (2013), for 2017–2020 (2017), as well as in the Latvian Public Health Guidelines for 2014–2020 (2014).

Road safety has been analysed for several decades, using the experience of various sciences – mathematics, physics, traffic engineering, urban planning, education, psychology, sociology, medicine and law. The analysis of the causes of RTCs distinguishes the importance of the environment (road surface, weather

conditions, etc.), the means of transport (technical condition of the vehicle, etc.), the behaviour of road users, and the interaction of all these factors. The current overall road safety paradigm focuses on the knowledge that road injuries are predictable and therefore avoidable (WHO, 2011; WHO, 2018). Besides, if previously the European Commission had set the prevention of fatalities in traffic collisions as the main goal, over time, more and more attention is paid to efforts to reduce the number of severe crashes (LR MK, 2017).

Discussions between specialists and experts on the strengths and weaknesses of various theories, frameworks, and models, as well as the mutual interaction in assessing the possibilities of improving road safety, remain. Not only are theories related to road safety, they are also used to explain and analyse general health-related behaviours, such as distinguishing between health behaviours with positive consequences (regular health checks, seat belt use, etc.) and health behaviours with negative consequences (smoking, alcohol abuse, etc.) (Ogden, 2004).

Thus, based on road safety prevention policies and current research discussions, the doctoral thesis analyses the road safety behaviour of the Latvian adult population and the related factors – demographic and socio-economic factors characterizing the individual, individual health behaviour factors, as well as attitudes towards road safety – and the mutual independent effect of these factors.

Aim of the Thesis

The aim of the thesis is to describe KSI in RTCs and their risk factors from 2010 to 2018, to study the road safety habits of the adult population of Latvia during the same period, as well as to clarify the relationship between the habits and individual factors, health behaviour, and attitude towards road safety factors.

Objectives of the Thesis

The following objectives have been identified to achieve the aim of the thesis.

1. To analyse the proportion of KSI in RTCs and the relationship between individual factors (gender, age), health behaviour (exceeded blood alcohol concentration), conditions of the collision (location, visibility, lighting, seasonality), to assess trends and dynamics.
2. To find out the incidence rate and its changes in the analysed period of KSI in RTCs.
3. To study the road safety habits of the adult population of Latvia (use of reflectors, use of seat belts in the front and rear seat of the vehicle) in relation to demographic and socio-economic factors characterising the individual, to evaluate trends and dynamics.
4. To assess the association between road safety habits and health behaviour of the Latvian adult population (excessive alcohol consumption, smoking, not using the preventive health care services provided by the state).
5. To determine the association between the road safety habits of the adult population of Latvia and the factors that influence the attitude towards road safety.
6. To evaluate the independent effect of the associated factors on the road safety habits of the adult population when adjusted for demographic and socio-economic parameters.

Hypothesis of the Thesis

- ✓ The number of KSI in RTC in Latvia has decreased over a nine-year period, and safe habits have improved.
- ✓ There is an association between road safety habits and individual health

- ✓ an annual health check at the family doctor.
- ✓ Attitudes towards the use of seat belts, intoxicated driving, and speeding vary between respondents with good and bad traffic safety habits.

Novelty of the Thesis

This doctoral thesis discusses in detail road safety habits of the adult population of Latvia in a unique multi-dimensional and complex approach, and it includes analysis of habits not only in relation to demographic and socio-economic factors, but also including health behaviours and the individual's attitude towards road safety. The association between these factors, using the relevant statistical methods, has so far not been studied in Latvia, as well as in general aspects of road safety from the point of view of public health have been little studied and explored in other epidemiological studies. Only separate scientific publications are available in international databases in the research on habits-related road safety factors in Latvia.

One of the advantages of this study is the methods used. The analysis of KSI in RTC was performed using a national database, which includes information on almost 100% of all reported RTCs and persons involved. Data from a monitoring type of study were used in the analysis of the safety habits, using a representative sample of the Latvian adult population which was selected each particular year by multistage random stratified sampling, and it ensured representation of all most important socio-demographic groups. The large number of persons involved in RTC (N = 57 471) and respondents of the safety habits study (N = 10 731) provided sufficient statistical capacity for complex data analysis and testing the statistical interaction. As a result, it is possible to assess the road safety habits and differences of persons involved in RTC in the different analysed groups.

The coverage of the data on RTCs, the cross-sectional design of the study used in the analysis of safety habits and the data of five consecutive studies used, allowed to analyse not only the number of KSI in RTC and the prevalence of road safety habits, but also to assess differences over time. The possibility to analyse data both in general and by selecting years separately and comparing the trends between them allowed to verify and partially reject one of the original hypotheses, which predicted that the number of KSI in RTC has decreased during the nine-year period in Latvia.

Also, within the framework of the thesis, several questionnaires of the study "Health Behaviour among Latvian Adult Population" on the behaviours influencing the health of the Latvian adult population were supplemented with questions about the individual's attitude towards road safety. Based on scientific publications and research conducted in other countries, and in cooperation with researchers of the Centre for Disease Prevention and Control, and researchers at Rīga Stradiņš University, validated questions in Latvian, English and Russian were prepared and included in the study, which allowed the results of the analysis to be compared and interpreted in relation to studies carried out in other countries.

The multivariate regression analysis used to assess the impact of factors associated with road safety habits made it possible to assess the association between each individual demographic factor, health behavioural factor and factors associated with the conditions of RTCs with KSI in RTC as well as to determine the association between each demographic and socio-economic factor, health behavioural factor and attitude factor with road safety habits regardless of demographic and socio-economic factors. As a result, it can be reasonably concluded that road safety habits are closely related to risky health behaviours and attitudes towards road safety, thus expanding the traditionally studied

parameters of RTC conditions and road safety and highlighting the need to also include psychological aspects and individual behaviour.

The novelty of the thesis is the obtained results and conclusions about the important role of attitudes and health behaviours in identifying road safety habits. The proven association highlights the need to implement reduction of road traffic injuries in integrated programs, with sectoral policies and research being carried out in a coordinated approach in the long term. The research carried out within the framework of the thesis highlights a potential for improving cross-sectoral cooperation in the future.

1 Material and Methods

The research within the framework of the doctoral thesis has been carried out in parallel in two stages.

In the first stage of the study, KSI in RTCs aged 18 years and over from year 2010 to 2018 were studied and the associated demographic factors of the individual were defined, as well as the factors characterizing the individual's health behaviour and RTC conditions were determined.

In the second stage of the study, using the data of a representative questionnaire of the study "Health Behaviour among Latvian Adult Population", the road safety habits of respondents aged 18 and older from year 2010 to 2018 were analysed – the use of reflectors, the use of seat belts in the front and rear seats, as well as their association with individual demographic and socio-economic factors, health behaviour and attitudes towards road safety was clarified.

1.1 Analysis of KSI in RTCs in Latvia (2010–2018)

1.1.1 Data Sources and Extraction

The Statistical Database of RTCs and Consequences for the period from year 2010 to 2018 was used for the analysis, where the existing information covers almost 100% of all reported RTCs and the persons involved. The database is maintained by the Road Traffic Safety Directorate in accordance with Article 4 of the Road Traffic Law (1997), and it provides statistics on RTC and the persons involved based on information provided by the Information Centre of the Ministry of the Interior to the extent and in accordance with procedures specified by the Cabinet.

For the calculation of the incidence rate for KSI in RTCs, population data from the Official Statistical Portal (www.stat.gov.lv) have been used for the

relevant period, which were obtained in accordance with the requirements of the study, research factors and their grouping.

1.1.2 Characteristics of the Population, Research Factors and Grouping

The target population of the study is the adult population of Latvia, thus data on persons involved in RTC who were 18 years and older at the time of the RTC were selected and included in the analysis. In total, the analysis for the period included 57,471 persons involved in RTC aged 18 and over.

Data on the outcomes of the crash have been used for the analysis of **severity of the injury** of the persons involved in the RTC – there are/are not killed persons in the RTC, there are/are not injured persons in the RTC. According to the "Regulations for the Registration of Road Traffic Collisions, Victims and Deaths" (2010): (1) a person shall be considered a victim of a collision if they have died from sustained injuries or received medical assistance, (2) a person shall be considered a fatally injured if they have died at the scene of the collision from sustained injuries or within 30 days, (3) a person shall be considered a person injured in a collision if they have sustained injuries and received medical assistance. Severely injured persons are persons who have been treated in a hospital for more than 24 hours. Slightly injured persons are persons who have received medical assistance. This approach has been used in the relevant database since 2004. Based on these definitions, the analysis is based on two categories: (1) persons killed or seriously injured, compared to (2) persons who were not injured or were injured slightly.

Data on the gender and age of the individual have been used for the general **demographic characterisation** of the persons involved in the RTC. Gender distribution: 67.9% (N = 39 035) male and 32.1% (N = 18 435) female. Age was calculated from the information on the time of the collision and the

persons involved – by mathematically subtracting the data of the RTC (date, month, year) from the person's birth data and rounding to the nearest whole number (without decimal values). The average age of respondents was 42.2 years (standard deviation ± 16.2 years). Age distribution: 13.9% (N = 7998) aged 18–24, 25.3% (N = 14 544) aged 25–34, 19.8% (N = 11 399) aged 35–44, 17.7% (N = 10 187) aged 45–54 years and 23.2% (N = 13 343) aged 55 years and older.

Data on **blood alcohol concentration** (BAC) were analysed in two categories: (1) BAC was exceeded or (2) not exceeded. The permitted BAC for road users is determined by Article 28 of the Road Traffic Law (1997) and sections of Article 149 of the Administrative Liability Law (2018), as well as regulated by "Procedures for Determining the Blood/Breath Alcohol Concentration and Determining the Effects of Narcotic Drugs or Other Intoxicating Substances" (2018). The permitted BAC specified in Latvian legislation is 0.2 per mil for drivers with less than two years of driving experience, and 0.5 per mil for all other drivers.

The **location** of the RTCs was analysed in four groups: (1) Riga; (2) cities (administrative territory); (3) state motor roads (According to the Law on Motor Roads (1992) which connect with the primary motor road network of other countries and connect the capital city with other republic cities); (4) state regional roads (which interconnect the administrative centres of municipalities or connect them with republic cities or the capital city, or with the major or regional motor roads or interconnect republic cities) and local roads (which connect the administrative centres of municipalities with municipality towns, populated areas of municipalities where parish administrations are located, with villages, or with other State motor roads, or interconnect administrative centres of individual municipalities).

Data on the **conditions of the collision** were based on the weather conditions at the time of the collision. The categories available in the database were combined and analysed in two categories: (1) good visibility (combined "clear" and "sunny") and (2) poor visibility (combined categories "cloudy", "mist", "rain", and "snow").

Data on the **light conditions** at the time of the collision were combined into two categories: (1) daylight and (2) other, including twilight, night, and night with light sources.

From the information regarding the time of the collision, various factor groups were created in relation to **seasonality**. For the analysis of the relationship with the season, 12 calendar months were divided into four seasons – spring (March, April, May), summer (June, July, August), autumn (September, October, November), and winter (December, January, February). For the assessment of associations, analysis was carried out both in four groups of seasons and by combining in two groups: (1) spring and summer, (2) autumn and winter.

The day of the week of the collision was defined by the date of the collision. All days of the week were included in the analysis, and they were combined into two groups: (1) working days and (2) the weekend.

The time of the day of the collision was combined into six groups – (1) from 00:00 to 03:59, (2) from 04:00 to 07:59, (3) from 08:00 to 11:59, (4) from 12:00 to 15:59, (5) from 16:00 to 19:59, (6) from 20:00 to 23:59. For the assessment of associations, the time of the day of the collision was analysed both in six groups and by combining in three groups: (1) time from midnight to 7:59, (2) time from 8:00 to 15:59 and (3) time from 16:00 to 23:59.

1.2 Analysis of Road Safety Habits in Latvia (2010–2018)

1.2.1 Data Sources and Extraction

The data of the questionnaires from the "Health Behaviour among Latvian Adult Population" study of the Centre for Disease Control and Prevention of Latvia for the years 2010, 2012, 2014, 2016 and 2018 were used in the doctoral thesis. The "Health Behaviour among Latvian Adult Population" study is a monitoring-type of study that has been carried out in Latvia since 1998, with questionnaires being organized every two years. Questionnaires from monitoring member states have also been adapted to assess the performance of the WHO CINDI project (Country Wide Integrated Non-Communicable Disease Intervention) (SPKC, 2010).

The questionnaire was prepared in Latvian and translated into Russian taking into consideration the ethnic composition of the Latvian population. The data were obtained from interviews conducted in a language in which communication was easier for the respondents, thus ensuring full understanding of the questions and adequate formulation of the answers. Due to the unified sampling and data acquisition methodology, it is possible to analyse and directly compare the results and dynamics obtained in the conducted questionnaires.

1.2.2 Selection of the Target Group and Characteristics of the Population

A representative sample of the Latvian population was used to conduct questionnaires in the "Health Behaviour among Latvian Adult Population" study. In each survey year, the sampling was based on multi-stage random stratified selection with quota elements, ensuring representation of all major socio-demographic groups. Until 2014, the sample of the study consisted of residents of Latvia aged 15 to 64 years. Beginning with the 2016 survey, the target

population was expanded to include an additional age group from 65 to 74 years. The sample was stratified by gender, age, region, and level of urbanisation (population type). Stratified random sampling provides representation of socio-demographic groups. The random route procedure was used in the sample calculation and geographical distribution.

The sample of the questionnaire is calculated and stratified on the basis of the current published information on the population of Latvia in Latvian cities and parishes, obtained from the Official Statistics Portal (www.stat.gov.lv) in accordance with the requirements of the research work, research factors and their grouping. Data were additionally weighted before processing according to several parameters characterizing the respondents: gender, age, type of population, region of residence, and nationality, according to official data available. By applying data weighting procedures, the distribution of the research sample was corrected, bringing it closer to the corresponding age structure of the Latvian population.

Of the 10 731 respondents, 42.5% (N = 4562; 95% CI 41.5 – 43.5) were male and 57.5% (N = 6169; 95% CI 56.5 – 58.4) were female.

The analysis includes respondents aged 18 to 64 (in the 2010, 2012 and 2014 questionnaires), and 18 to 74 (in the 2016 and 2018 questionnaires), who were divided into five age groups according to the proportion of respondents in groups and a unified approach to the methodology. The average age of respondents was 40.9 years (standard deviation ± 14.7 years). The overall percent distribution of age groups is proportional: 16.8% (N = 1807; 95% CI 16.3 – 17.5) of respondents were 18 – 24 years old, 22.2% (N = 2381; 95% CI 21.4 – 23.0) respondents were 25 – 34 years old, 19.9% (N = 2138; 95% CI 19.2 – 20.7) respondents were 35 – 44 years old, 19.2% (N = 2060; 95% CI 18.5 – 19.9) respondents were 45 – 54 years old, the remaining 21.9% (N = 2345; 95% CI 21.1 – 22.6) were 55 years and older.

Slightly more than half of respondents – 53.9% – had incomplete or completed higher education (N = 5789; 95% CI 53.0 – 54.9), 39.3% of respondents (N = 4215; 95% CI 38.4 – 40.2) had acquired secondary education, the other 6.8% (N = 727; 95% CI 6.5 – 7.3) had received primary education.

Slightly more than a third of respondents – 33.6% – live in Riga (N = 3609; 95% CI 32.7 – 34.5). A little more than a third of respondents live in large and small cities – 18.5% of respondents (N = 1986; 95% CI 17.7 – 19.4) live in large cities and 17.8% of respondents (N = 1911; 95% CI 17.1 – 18.5) live in small towns. The remaining 30.1% of respondents (N = 3225; 95% CI 29.2 – 30.1) live in rural areas.

1.2.3 Variable Characteristics and Grouping

Dependent Characteristics

In the doctoral thesis, such road safety habits of the respondents as the use of reflectors, the use of seat belts in the front and rear seats of the vehicle, were selected as dependent variables. The use of reflectors applies to vulnerable road users, i.e., pedestrians, while the use of seat belts applies to both drivers and passengers.

A question to clarify the habits for using **reflectors** was included in the questionnaire: “Do you use light reflectors when you walk along the street in the dark?” with answers “almost always”, “sometimes”, “never” and “I do not walk in the dark”. Respondents who answered “I do not walk in the dark” were excluded from further analysis. The responses were dichotomised into two groups: (1) reflectors are used (including answer “almost always”) or (2) reflectors are not used according to the safety recommendations (including answers “sometimes” and “never”).

To find out the behaviour for using a **seat belt in the front seat** of the car, the respondents were asked: “Do you use seat belts when driving in the front

seat?" with answers "almost always", "sometimes", "never" and "I do not travel by car". Respondents who answered "I do not travel by car" were excluded from further analysis. The answers were dichotomized in two categories: (1) seat belts are used in the front seat (answer "almost always" is included) or (2) seat belts are not used according to road safety rules (answers "sometimes" and "never").

To determine the behaviour for using a **seat belt in the rear seat** of the car, the respondents had to answer: "Do you use seat belts in the rear seat?" with answers "almost always", "sometimes", "never", "there is no seat belt in the rear seat" and "I never travel in the rear seat of the car". Respondents who answered "I never travel in the rear seat of the car" and "there is no seat belt in the rear seat" were excluded from further analysis. Similarly, the answers were dichotomized into two groups: (1) the seat belt in the front seat is used (includes the answer "almost always") or (2) is not used (answers "sometimes" and "never").

Independent Characteristics

The **demographic and socio-economic factors** of individuals, such as gender, age, education level and place of residence, are analysed as independent characteristics in the doctoral thesis.

The study included respondents aged 18 and older, who, based on similar studies, were divided into five age groups: (1) 18–24 years, (2) 25–34 years, (3) 35–44 years, (4) 45–54 years, (5) 55 years and older.

The place of residence of the respondents was analysed in four groups: (1) Riga; (2) large cities, including the other eight republican cities – Daugavpils, Jēkabpils, Jelgava, Jūrmala, Liepāja, Rēzekne, Valmiera and Ventspils; (3) small towns, including parish towns; and (4) rural areas, including another place of residence indicated by the respondent.

The level of education of the respondents was analysed in three groups: (1) finished primary education, (2) secondary education, (3) incomplete or completed higher education.

The association between road safety habits and **health behaviour** was identified. Excessive alcohol use, smoking and not using state-provided preventive health services were considered risky health behaviours.

According to the WHO definition, heavy episodic drinking is the consumption of at least 60 grams and more of pure alcohol at least once in the last month (30 days) (WHO, 2018). This indicator is used for acute consequences of alcohol consumption, such as injuries, including injuries resulting from road collisions. In the thesis the respondents were asked the question: "How often do you drink six or more units of alcohol at once (1 serving/unit: 40 ml of spirits or 100 ml of wine or 1 bottle (500 ml) of beer, or 1 bottle/can (~300 ml) of an alcoholic cocktail)?". Risky alcohol use was defined for respondents who had consumed at least six units of alcohol in a single setting last month. For analysis, the answers were divided in: (1) "no" (including answers "never" and "less than once a month"), and (2) "yes" (including "once a month", "once a week" and "almost every day").

The smoking index was also used for health behaviour analysis, which was calculated by asking respondents several questions: "Have you ever smoked?", "Have you smoked at least 100 cigarettes?", "Have you smoked every day?", "When did you last smoke?". Within the analysis of the thesis, the smoking index was grouped into three categories: (1) non-smokers, (2) other smokers, combining the smoking index categories "smokes occasionally", "quit 1–12 months ago", "quit a year and more ago", and (3) daily smokers.

Smoking habits were also analysed in question: "Does your family restrict smoking in your car?" with answers (1) "no smokers in our family", (2) "smoking is not allowed in the car" and (3) "smoking is allowed in the car", where the two

initial answers “can smoke, if other people are not in the car” and “can smoke in the car in other people's presence”. Respondents who answered “never travel by car” were excluded from further analysis. Everyday smoking and smoking in the car, including in the presence of other people, are considered risky health behaviours.

To analyse the use of state-guaranteed and recommended preventive health care services, the question “How many times have you visited your family doctor in the last year (12 months)?”, where the number of visits reported by respondents was combined into two groups: (1) “yes” (family doctor visited one or more times) and (2) “no” (family doctor was not visited last year). The analysis also included the question: “Have you ever visited your family doctor to perform a free preventive health check?” (the question is included in the 2014, 2016 and 2018 questionnaires). Two groups were defined to assess whether a free preventive examination had been carried out by the family doctor in the last three years: (1) “yes”, which combines the two initial answers “during the last year” and “in the last 3 years”, and (2) “no”, combining the other two initial answers “longer than the last 3 years ago” and “never”. Respondents were considered to have risky health behaviours if they have not visited their family doctor in the past year and if they have not performed a free preventive health check with their family doctor over the past three years.

Attitude towards road safety was analysed in several aspects – an individual's attitude towards the use of seat belts, driving under the influence, speeding, as well as penalties for violating traffic rules (questions included in the 2016 questionnaire). Risky attitudes towards road safety were defined for category (2) “no” for respondents:

- ✓ who agreed or rather agreed with the statements – it is not necessary to wear a seat belt on short journeys; when driving at speeds up to 40 km/h, it is not necessary to use the seat belt;

- ✓ who disagreed or rather disagreed, or who had difficulty answering the statements – the seat belt must always be worn when driving; driving at the speed limit reduces the chance of being involved in a collision; driving under the influence of alcohol increases the risk of being involved in a collision; penalties for traffic violations must be stricter.

The opposite answers were accepted as category (1) "yes", i.e., non-risky attitude. Given that the research questions included sentence constructions with statements and double negative, they were reformulated in the description of the thesis to ensure better transparency, mutual comparison and interpretation of results.

1.3 Statistical Analysis

The data analysis uses descriptive statistical methods: frequency distribution, calculation of mean values, and cross-tabulation analysis. The Chi-square test was used to compare subgroups of respondents in 2 × 2 tables. The Wilson score interval method was used to determine the percentage difference in statistical confidence intervals to compare more than two independent groups (Erdoğan and Gülhan, 2016).

To determine the association between the dependent and independent characteristic, an odds ratio calculation was used, which indicates the change in the odds ratio of dependent characteristic as the independent characteristic changes by one unit. The independent characteristic of the study increases the odds of the dependent characteristic in cases where OR > 1 and decreases in cases where OR < 1 (Sklzo and Nieto, 2014).

Linear trends of RTCs and road safety habits in the period from 2010 to 2018 were evaluated using a linear regression model: log (SP) = b0 + b1ti + ei (i = 1...n), where SP denotes the number of RTCs or

road safety behaviours, t – year of the questionnaire, b0 is the intercept of the regression line, b1 is the slope of the regression line, e is the margin of error. The research year in the model can be considered as an independent categorical variable with several response categories according to years.

The incidence rate of KSI in RTCs (number of cases per 100,000 person-years) was calculated by IB = number of RTCs during the year / (average population in a particular year).

An analysis of multifactor regression models was performed to identify the associations between different factors and road safety habits. The independent variables included in the model have been selected on the basis of the aim and tasks of the thesis, as well as based on the results of previous studies on the factors influencing the characterizing parameters which are described in the literature description of the thesis. Initially, the association of each variable with the outcome was determined using univariate regression analysis. Regression models included those variables with a p value < 0.5.

All independent variables included in the regression model were tested for collinearity using the Tolerance Test. A tolerance test value of less than 0.1 indicates collinearity of the regression independent variable and too close a correlation between them that does not allow correct conclusions to be drawn as to which of the independent variable affects the dependent variable (Field, 2013).

The multifactor analysis of KSI in RTCs was performed for all factors meeting the previously analysed and defined criteria. In the analysis of road safety habits, a separate multifactor regression analysis was performed for each road safety habit. In order to assess the association between road safety habits and one of the variables, a logistic regression was performed to adjust the individual's demographic and socio-economic factors. When the odds ratio was observed to change for at least 10%, it was accepted as relevant result of adjusting (Rothman, Greenland and Lash, 2008).

Spearman's correlation was used to determine the correlation between road safety habits. Interpretation of correlation coefficient values: 0.00–0.29 – insignificant correlation, 0.30–0.49 – weak correlation, 0.50–0.69 – moderate correlation, 0.70–0.89 – strong correlation and 0.90–1.00 – very strong correlation (Hinkle, Wiersma and Jurs, 2003).

For all statistical tests used, the significance level (p) was defined to be 0.05, thus the result was considered statistically significant in cases when the p value was < 0.05. For the calculation of the results, confidence interval (CI) of 95% was selected. Computer programs MS Excel and IBM SPSS were used for data analysis.

2 Results

2.1 Characteristics and Dynamics of KSI in RTCs in Latvia (2010–2018)

The chapter describes the results of the first stage of the research carried out within the framework of the doctoral thesis, where the persons KSI in RTCs in Latvia and the demographic and socio-economic factors of the individual were analysed, as well as the factors characterizing the conditions of RTCs and individual health risk behaviours.

2.1.1 Analysis of the Proportion of KSI in RTCs in General and in Demographic Groups

In the period from 1st January, 2010 to 31st December, 2018, a total of 57,471 adults were involved in RTCs, of which 8.6% (N = 4916; 95% CI 8.3 – 8.8) were KSI.

The trends show that in the period from 2010 to 2018, the proportion of KSI in RTCs decreased on average by 0.3 percentage points per year ($p < 0.001$) (see Figure 2.1).

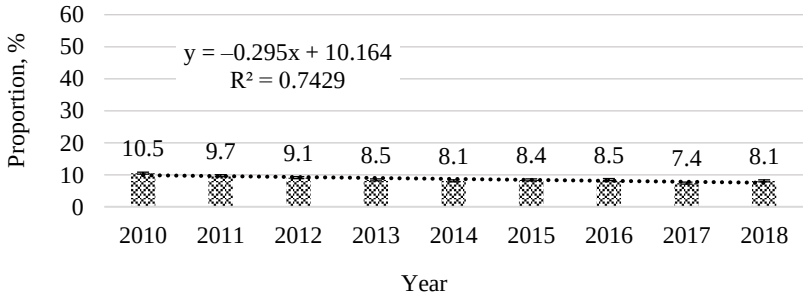

Figure 2.1 **Proportion of KSI in RTCs from 2010 to 2018**

Both the univariate association analysis and the multi-factor regression analysis show that males are 1.2 times more likely than females to get seriously injured or die in RTC. Even when adjusted with all the factors included in the analysis, the highest odds of KSI in RTC remain for the oldest (OR = 1.7) and the youngest (OR = 1.4) age group (see Table 2.1).

Table 2.1

Number, proportion and odds ratio of KSI in RTC by gender and age groups

Factor	N	%	OR (95% TI)[a]	Adjusted OR (95% CI)
Male	3519	9.0	1.2 (1.1–1.3)**	1,2 (1.1–1.3)**
Female	1397	7.6	1.0	1.0
55 and older	1399	9.8	1.5 (1.4–1.6)**	1.7 (1.5–1.8)**
45–54	855	7.2	1.2 (1.1–1.3)*	1.2 (1.1–1.3)*
35–44	827	7.3	1.0 (0.9–1.1)^{NS}	1.0 (0.9–1.2)^{NS}
24–34	1052	8.4	1.0	1,0
18–24	783	10.5	1.4 (1.3–1.5)**	1.4 (1.2–1.5)**

* [a] odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the person's gender, age, BAC, location, conditions and seasonality of RTC
* Reference category: persons involved in RTC who were not injured or were injured slightly
* $^{NS}p > 0.05$; *$p < 0.05$; **$p < 0.001$

Analysing the trends for the period from 2010 to 2018, a small statistically significant decrease of 0.3 percentage points per year on average was observed among KSI males in the youngest and oldest age groups, on average by 0.4 percentage points per year, as well as among 35 and 44-year-old respondents, on average by 0.5 percentage points per year ($p < 0.001$) (see Table 2.2).

Table 2.2

Proportion of KSI in RTC and its changes from 2010 to 2018 by gender and age groups

Year	Male	Female	18–24	25–34	35–44	45–54	55+
2010	10.8	9.5	15.7	7.0	10.4	9.8	13.1
2011	10.1	7.8	11.4	8.7	10.3	8.2	10.7
2012	9.4	8.5	8.8	7.5	7.4	8.7	12.8
2013	8.7	7.6	8.3	7.4	6.7	8.1	11.0
2014	8.8	6.6	9.3	7.1	6.4	8.4	9.4
2015	8.7	7.8	10.4	7.3	7.2	8.2	9.6
2016	8.7	8	8.4	7.7	6.5	9.0	10.4
2017	8.0	6.3	10.4	6.2	5.5	6.7	9.1
2018	8.5	7.5	8.1	6.8	6.6	8.7	10.2
% changes	-0.3^{*}	-0.2^{NS}	–0.4*	-0.1^{NS}	–0.5*	-0.1^{NS}	-0.4^{*}

* $^{NS}p > 0.05$; *$p < 0.001$

2.1.2 Analysis of the Incidence Rate of KSI in RTCs in General and in Demographic Groups

In the data analysis performed within the framework of the doctoral thesis, the incidence rates of KSI in RTC were calculated, evaluating the number of cases against 100,000 person-years.

The trends show that the incidence rate of KSI in RTC has increased on average by 1.2% per year ($p < 0.001$) during the study period (see Figure 2.2).

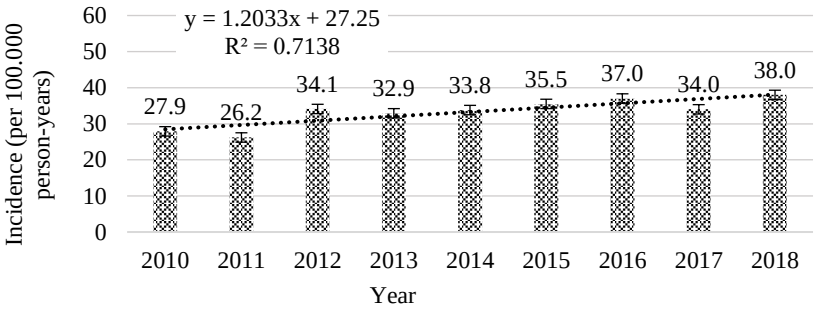

Figure 2.2 **Incidence rate of KSI in RTC from 2010 to 2018**

The incidence rate of KSI in RTC during the study period was more than three times higher among males compared to females. The statistically significant highest incidence rate of KSI in RTC is observed among 45–54-year-old persons and in the youngest age group, followed by 25–34-year-old persons involved in RTC ($p < 0.001$) (see Table 2.3).

Table 2.3

Incidence rate of KSI in RTC by gender and age groups

Factor		**Incidence per 100,000 person-years (95% CI)**
Gender	Male	49.7 (49.4–50.0)
	Female	14.9 (14.8–15.0)
Age group	55 and older	32.2 (32.0–32.4)
	45–54	54.9 (54.4–55.2)
	35–44	34.0 (33.8–34.2)
	24–34	42.5 (42.3–42.8)
	18–24	51.0 (50.7–51.3)

In the period from 2010 to 2018, the incidence rate of KSI in RTC increased statistically significantly for both genders – among females it increased by an average of 1.3% per year, but among males by an average of 0.5% per year. Analysing the trends in age groups, the largest increase in the incidence rate was

observed in the two youngest age groups, as well as among 45–54-year-old persons involved in RTC ($p < 0.001$) (see Table 2.4).

Table 2.4

Incidence rate of KSI in RTC and its changes from 2010 to 2018 by gender and age groups

Year	Male	Female	18–24	25–34	35–44	45–54	55+
2010	47.8	8.5	43.4	29.6	34.9	31.5	34.7
2011	47.3	6.3	32.0	37.3	38.3	26.0	14.2
2012	49.5	17.0	46.8	40.9	31.7	32.6	29.0
2013	48.5	15.7	44.1	41.9	31.9	33.5	26.1
2014	51.2	14.8	58.3	43.4	32.0	35.3	23.2
2015	50.6	17.8	70.6	46.8	35.9	32.8	23.4
2016	51.8	19.0	55.1	49.4	34.3	37.9	28.6
2017	49.2	16.2	71.8	42.4	29.3	31.4	25.9
2018	52.9	19.5	57.9	46.0	39.0	41.8	29.1
% changes	0.5*	1.3*	3.7*	1.7*	-0.1^{NS}	1.1*	0.1^{NS}

* $^{NS}p > 0.05$; *$p < 0.001$

2.1.3 Analysis of KSI in RTCs in Relation to BAC

Excessive alcohol level at the time of the RTC is associated with two times higher odds of KSI in RTC even when adjusted with other factors included in the analysis – gender, age, location of RTC, fixed blood alcohol concentration, conditions of the RTC and season (see Table 2.5).

Table 2.5

Number, proportion and odds ratio of KSI in RTC in relation to BAC

Factor		N	%	OR (95% CI)[a]	Adjusted OR (95% CI)
BAC	Not exceeded	643	16.4	2.2 (2.1–2.5)	2.0 (1.8–2.2)
	Exceeded	4273	8.0	1.0	1.0

* [a] odds ratio in univariate analysis
* Adjusted OR: adjusted for the person's gender, age, BAC, location, conditions and seasonality of RTC
* Reference category: persons involved in RTC who were not injured or were injured slightly
* $p < 0.001$

Analysing the trends in the period from 2010 to 2018, a statistically significant decrease in the number of KSI in RTCs compared to all persons involved in RTCs was observed on average by 0.3 percentage points per year ($p < 0.001$) for participants who had not exceeded the permitted blood alcohol concentration level from 10.1% (N = 431; 95% CI 9.2 – 11.0) in 2010 to 7.5% (N = 517; 95% CI 6.9 – 8.2) in 2018.

2.1.4 Analysis of KSI in RTCs in Relation to the Location, Conditions and Seasonality of RTC

Both univariate factor association analysis and the multifactor regression analysis show that the severity of persons involved in RTC is related to the location of RTCs – there are 1.2 higher odds to die or suffer from a serious injury in RTC on regional and local roads, as well as in cities (except Riga) (see Table 2.6).

Table 2.6

Number, proportion and odds ratio of KSI in RTC in relation to the location of RTC

Factor		N	%	OR (95% CI)[a]	Adjusted OR (95% CI)
Location of the RTC	Regional and local roads	807	9.4	1.2 (1.1–1.3)*	1.2 (1.1–1.3)*
	City	1313	9.4	1.2 (1.1–1.3)*	1.2 (1.1–1.3)*
	Main roads	769	7.6	0.9 (0.9–1.1)^{NS}	0.9 (0.9–1.1)^{NS}
	Riga	1944	8.1	1.0	1.0

* [a] odds ratio in univariate analysis
* Adjusted OR: adjusted for the person's gender, age, BAC, location, conditions and seasonality of RTC
* Reference category: persons involved in RTC who were not injured or were injured slightly
* $^{NS}p > 0.05$; *$p < 0.001$

Both univariate factor association analysis and multifactor regression analysis show that the severity of injury in RTC is related to the conditions of RTC – there are 1.2 times higher odds for KSI in RTC in poor visibility conditions (fog, rain, snow and cloudy weather), and 1.5 times higher odds at twilight and night compared to daylight (see Table 2.7).

Table 2.7

Number, proportion and odds ratio of KSI in RTC in relation to RTC conditions

Factor		N	%	OR (95% CI)[a]	Adjusted OR (95% CI)
Visibility	Poor	2597	9.5	1.2 (1.2–1.3)	1.2 (1.2-–.3)
	Good	2319	7.8	1.0	1.0
Light condition	Other	2879	11.4	1.6 (1.5–1.7)	1.5 (1.4–1.6)
	Daylight	2040	7.3	1.0	1.0

* [a] odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the person's gender, age, BAC, location, conditions and seasonality of RTC
* Reference category: persons involved in RTC who were not injured or were injured slightly; $p < 0.001$

Analysing the trends in the period from 2010 to 2018, a statistically significant decrease in KSI in RTCs compared to all persons involved in RTCs is observed in good visibility conditions on average by 0.3 percentage points per year ($p < 0.001$) from 10.4% in 2010 to 7.6% in 2018, as well as in daylight on average by 0.2 percentage points per year ($p < 0.001$) from 9.4% in 2010 to 7.6% in 2018.

The association with seasonality observed in the univariate factor analysis becomes weaker in the multifactor regression analysis, when adjusted for other factors included in the analysis, the association with the season is no longer statistically significant. In turn, a statistically significant association between the day of the week and time of the day was observed with the severity of the injured person – both before and after adjusting higher odds for KSI were on the weekend (OR = 1.4) and in the period from midnight to 7:59 (OR = 1.2) (see Table 2.8).

Table 2.8

Number, proportion and odds ratio of KSI in RTCs in relation to seasonality

Factor		N	%	OR (95% CI)[a]	Adjusted OR (95% CI)
Season	Autumn, winter	2501	9.1	1.2 (1.1–1.2)*	1.0 (0.9–1.1)^{NS}
	Spring, summer	2415	8.1	1.0	1.0
Day	Weekend	1595	11.1	1.6 (1.5–1.7)*	1.4 (1.3–1.5)*
	Week day	3321	7.7	1.0	1.0
Time	00:00-7:59	591	9.9	1.2 (1.1–1.3)*	1.2 (1.1–1.3)*
	8:00-15:59	2203	8.7	1.0 (0.9–1.1)^{NS}	1.0 (0.9–1.1)^{NS}
	16:00-23:59	2118	8.5	1.0	1.0

* [a] odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the person's gender, age, Bac, location, conditions and seasonality of RTC
* Reference category: persons involved in RTC who were not injured or were injured slightly
* $^{NS}p > 0.05$; $*p < 0.001$

Analysing the trends in the period from 2010 to 2018, a slightly sharper decrease is observed in the group of KSI in autumn and winter on average by 0.3 percentage points per year from 10.6% in 2010 to 8.2% in 2018, while in spring and summer the same group saw a decrease by 0.2 percentage points per year on average from 10.5% in 2010 to 8.0% in 2018 ($p < 0.001$). The decrease was also recorded for the weekend on average by 0.5 percentage points per year and during the day (8:00-15:59) on average by 0.3 percentage points per year ($p <0.001$). If the proportion of KSI in RTC on the weekend in 2010 was 15.6%, then in 2018 this indicator was 10.7%, while KSI during the day (from 8:00 to 15:59) in 2010 was 10.5%, and in 2018 it was only 6.7% of all persons involved in RTC.

2.2 Prevalence and Trends of Road Safety Habits in Latvia (2010–2018)

The chapter describes the results of the second stage of the research, which analysed the respondents' road safety habits – the use of reflectors, the use of seat belts in the front and rear seats of the vehicle – in relation to demographic and socio-economic factors, as well as health risk behaviours and attitudes towards road safety. The use of reflectors applies to vulnerable road users, i.e., pedestrians, while the use of seat belts applies to both drivers and passengers.

2.2.1 Road Safety Habits and Individual Demographic and Socio-economic Factors

The use of reflectors is critically low – of a total of 10,731 respondents, they are used by little more than half – 53.6% (N = 5751; 95% CI 52,6 – 54,5), with no statistically significant differences in use over the years ($p > 0,05$) (see Figure 2.3).

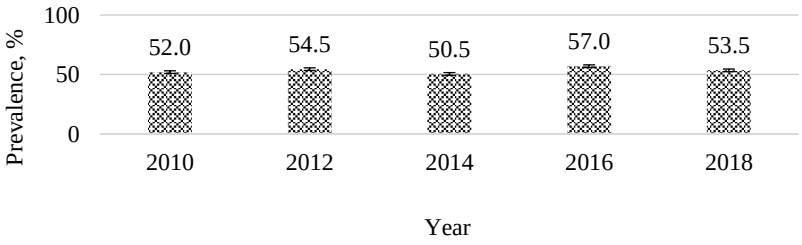

Figure 2.3 **Point prevalence of the use of reflectors from 2010 to 2018**

The use of reflectors is more common among female (OR = 2.2), and in each subsequent age group the odds ratio of using reflectors increase when adjusted for factors such as gender, age, and place of residence ($p < 0.001$). Both univariate factor analysis and multifactor regression analysis show that the highest odds for using reflectors are in rural areas, followed by large and small cities where the odds ratio is about two times higher compared to Riga. Differences in the respondent's level of education are not statistically significant ($p > 0.05$) (see Table 2.9).

Table 2.9

Number, proportion and odds ratio of the use of reflectors in relation to demographic and socio-economic factors

Factor		N (%)	OR (95% CI)[a]	Adjusted OR (95% CI)
Gender	Female	3841 (62.3)	2.3 (2.1–2.5)*	2.2 (2.1–2.5)**
	Male	1910 (41.9)	1.0	1.0
Age group	55+	1513 (64.5)	2.6 (2.2–2.9)**	2.3 (2.0–2.6)**
	45–54	1215 (59.0)	2.0 (1.7–2.3)**	1.8 (1.6–2.1)**
	35–44	1163 (54.4)	1.7 (1.4–1.9)**	1.5 (1.3–1.7)**
	25–34	1103 (46.3)	1.2 (1.1–1.4)*	1.3 (1.1–1.4)*
	18–24	757 (41.9)	1.0	1.0

Continuation of the Table 2.9.

Factor		N (%)	OR (95% CI)[a]	Adjusted OR (95% CI)
Place of residence	Large cities	3841 (57.9)	2.0 (1.8–2.2)*	2.0 (1.8–2.3)**
	Small cities	1077 (56.4)	1.9 (1.7–2.1)*	1.9 (1.7–2.1)**
	Rural area	2055 (63.7)	2.6 (2.3–2.8)*	2.7 (2.4–2.9)**
	Capital city	1470 (40.7)	1.0	1.0
Level of education	Higher	3109 (53.7)	1.1 (1.0–1.3)^{NS}	-
	Secondary	2274 (53.9)	1.1 (1.0–1.3)^{NS}	-
	Primary	365 (50.6)	1.0	-

* [a] odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the individual's demographic and socio-economic factors (gender, age, place of residence)
* Reference category: the use of reflectors – sometimes/never
* $^{NS}p > 0.05$; *$p < 0.05$; **$p < 0.001$

Analysing the trends for the period from 2010 to 2018, no statistically significant changes were recorded between the genders, age groups, or in relation to the level of education ($p > 0.05$). However, the use of reflectors in the analysed period in connection with the place of residence has increased in large cities by an average of 1.9 percentage points in each survey year from 50.0% in 2010 to 64.2% in 2018, and increased in Riga by an average of 1.3 percentage points in each survey year, respectively from 37.4% to 47.0%, but it has decreased in small towns by an average of 1.4 percentage points in each survey year from 59.1% in 2010 to 48.5% in 2018 ($p <0.001$).

The use of seat belts in the front seat is relatively high – they are almost always used by 93.1% (N = 9989; 95% CI 92.6 – 93.6) of a total of 10,731 respondents. Analysing the trends in the period from 2010 to 2018, a small statistically significant increase by an average of 0.8 percentage points in each survey year ($p <0.001$) is observed (see Figure 2.4).

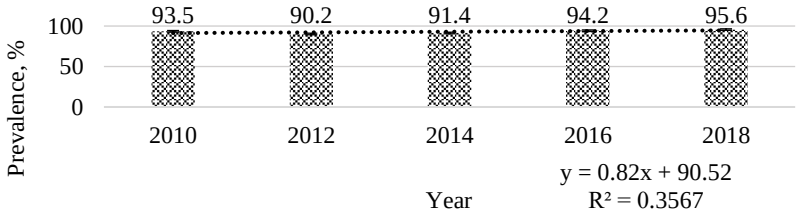

Figure 2.4 **Point prevalence of the use of seat belts in the front seat from 2010 to 2018**

Both univariate factor analysis and the multifactor regression analysis show that females have two times higher odds of wearing a seat belt than males. (see Table 2.10).

Table 2.10

Number, proportion and odds ratio of the use of seat belts in the front seat in relation to demographic and socio-economic factors

Factors		N (%)	OR (95% CI)[a]	Adjusted OR (95% CI)
Gender	Female	5891 (95.5)	2.4 (2.1–2.8)*	2.2 (1.9-2.5)*
	Male	4098 (89.8)	1.0	1.0
Age group	55+	2229 (91.0)	1.7 (1.3–2.1)*	1.7 (1.3–2.1)*
	45–54	1924 (93.4)	1.3 (1.0–1.6)^{NS}	1.3 (1.0–1.6)^{NS}
	35–44	1994 (92.2)	1.2 (0.9–1.6)^{NS}	1.2 (0.9–1.6)^{NS}
	25–34	2198 (93.4)	1.1 (0.9–1.4)^{NS}	1.1 (0.9–1.4)^{NS}
	18–24	1644 (95.1)	1.0	1.0
Place of residence	Large cities	1867 (94.0)	1.1 (0.9–1.4)^{NS}	-
	Small cities	1776 (92.9)	0.9 (0.7–1.1)^{NS}	-
	Rural area	2971 (92.1)	0.8 (0.7–1.0)^{NS}	-
	Capital city	3375 (93.5)	1.0	-
Level of education	Higher	5479 (94.6)	2.7 (2.1–3.5)*	2.4 (1.9–3.0)*
	Secondary	3881 (92.0)	1.7 (1.4–2.3)*	1.7 (1.3–2.2)*
	Primary	630 (86.6)	1.0	1.0

* [a] odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the individual's demographic and socio-economic factors (gender, age, level of education)
* Reference category: the use of seat belts – sometimes/never
* $^{NS}p > 0.05$; *$p < 0.001$

When adjusted for factors such as gender, age and level of education, the age-related association with seat belt use is weakening and is no longer statistically significant in most age groups, remaining only among respondents aged 55 and over, who have 1.7 times higher odds to use a seat belt when compared to 18–24-year-old respondents. Respondents with secondary education have 1.7 times higher odds, but respondents with higher education have 2.4 times higher odds to use a seat belt when compared to respondents with primary education. Differences related to the respondent's place of residence are not statistically significant ($p > 0.05$).

Analysing the period from 2010 to 2018, the trends of the use of seat belt in the front seat of the vehicle have been similar among gender and age groups, as well as in relation of place of residence. In turn, a statistically significant increase is observed in connection with the level of education for respondents with primary education of an average 1.1 percentage points in each survey year ($p < 0.001$) from 85.0% in 2010 to 94.3% in 2018.

Although during the analysis period the use of seat belts in the rear seat has increased by an average of 2.4 percentage points with each subsequent year of survey, overall, they are almost always used by only 54.7% of respondents (N = 5873; 95% CI 53,8 – 55,7) (see Figure 2.5).

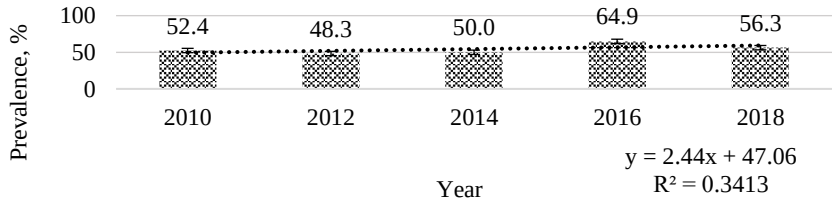

Figure 2.5 **Point prevalence of the use of seat belts in the rear seat from 2010 to 2018**

Both the univariate factor analysis and the multifactor regression analysis show that females have almost two times higher odds for the use of seat belts compared to males. The individual's age is associated with this analysed road safety habit – ages 25 to 54 have 1.3 times higher odds, while 55-year-olds and older respondents have 1.6 times higher odds of wearing a seat belt in the front seat compared with the younger group of respondents (see Table 2.11).

Table 2.11

Number, percentage and odds ratio of the use of seat belts in the rear seat in relation to demographic and socio-economic factors

Factors		N (%)	OR (95% CI)[a]	Adjusted OR (95% CI)
Gender	Female	3635 (58.9)	1.5 (1.4–1.6)**	1.4 (1.3–1.5)**
	Male	2238 (47.1)	1.0	1.0
Age group	55+	1420 (60.5)	1.7 (1.5–2.0)**	1.6 (1.4–1.8)**
	45–54	1118 (54.2)	1.3 (1.2–1.6)**	1.3 (1.2–1.5)**
	35–44	1187 (55.5)	1.4 (1.1–1.7)**	1.3 (1.2–1.5)**
	25–34	1297 (54.4)	1.3 (1.2–1.6)**	1.3 (1.2–1.5)**
	18–24	852 (47.1)	1.0	1.0
Place of residence	Large cities	954 (48.0)	0.9 (0.8–1.0)^{NS}	0.9 (0.8–1.0)^{NS}
	Small cities	1087(56.9)	1.2 (1.2–1.4)*	1.3 (1.2–1.5)**
	Rural area	2000 (62.0)	1.6 (1.4–1.7)*	1.7 (1.6–1.9)**
	Capital city	18321 (50.8)	1.0	1.0
Level of education	Higher	3305 (57.0)	1.4 (1.2–1.6)**	1.6 (1.4–1.8)**
	Secondary	2215 (52.5)	1.2 (1.1–1.4)*	1.3 (1.2–1.4)*
	Primary	353 (42.5)	1.0	1.0

* [a] odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the individual's demographic and socio-economic factors (gender, age, place of residence, level of education)
* Reference category: the use of seat belts – sometimes/never
* $^{NS}p > 0.05$; *$p < 0.05$; **$p < 0.001$

Respondents with secondary education have 1.3 times higher odds, while respondents with higher education have 1.6 times higher odds for the use of seat belts compared to respondents with primary education. While those living in small towns and rural areas have 1.3 and 1.7 times, respectively, higher odds to

use seat belts compared to people living in Riga. The associations analysed have no significant change when adjusted for all the demographic and socio-economic factors included in the analysis.

In the analysis of the period from 2010 to 2018, the trends in the use of the seat belt in the rear seat of the vehicle have been similar in gender and in age groups. The analysed road safety habit has increased on average by 1.8 percentage points for respondents in small towns and by 2.1 percentage points for rural respondents for each subsequent survey year, from 45.6% and 60.0% in 2010 to 57.8% and 67% in 2018, respectively ($p < 0.05$). Similarly, a statistically significant increase was observed among respondents with primary education by an average of 2.1 percentage points ($p < 0.05$) and for respondents with primary education by an average 1.6 percentage points ($p < 0.001$) with each subsequent survey year, from 46.4% and 52.5% in 2010 to 55.2% and 63.7% in 2018, respectively.

2.2.2 Road Safety Habits in Relation to Health Behaviour

Health behaviour risk factors such as risky alcohol consumption in the last month and daily smoking are associated with lower odds for using reflectors even when adjusted for gender, age and place of residence. Respondents without excessive alcohol consumption behaviour, non-smokers and those who do not allow smoking in the car have 1.3 – 1.7 times higher odds to use reflectors. Both visiting a family doctor in the last year and a free preventive check-up with family doctor in the last three years are associated with 1.3 times higher odds of using reflectors (see Table 2.12).

Table 2.12

Number, proportion and odds ratio for the use of reflectors in relation to health behaviour risk factors

Factors		N (%)	OR (95% CI)[a]	Adjusted OR (95% CI)
Alcohol	No	5147 (56.3)	2.1 (1.9–2.4)**	1.6 (1.5–1.8)**
	Yes	604 (37.9)	1.0	1.0
Smoking	Non-smokers	2506 (61.9)	2.2 (2.0–2.4)**	1.7 (1.6–1.9)**
	Others	825 (47.8)	1.2 (1.1–1.4)**	1.1 (1.1–1.4)^{NS}
	Everyday smokers	1408 (42.6)	1.0	1.0
Smoking restrictions in a family car	No smokers in a family	2870 (58.9)	1.7 (1.6–2.0)**	1.5 (1.3–1.7)**
	Smoking not allowed	1554 (43.6)	1.3 (1.2–1.5)**	1.3 (1.1–1.4)*
	Smoking allowed	1676 (36.7)	1.0	1.0
Family doctor visits	Yes	5572 (56.1)	1.5 (1.4–1.6)**	1.3 (1.1–1.4)**
	No	1279 (46.2)	1.0	1.0
Preventive check-up	Yes	1038 (59.2)	1.3 (1.2–1.5)**	1.3 (1.2–1.5)**
	No	2563 (51.9)	1.0	1.0

* [a] odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the individual's demographic and socio-economic factors (gender, age, place of residence)
* Reference category: the use of reflectors – sometimes/never
* $^{NS}p > 0.05$; *$p < 0.05$; **$p < 0.001$

Analysing the trends in the period from 2010 to 2018, the use of reflectors has decreased on average by 1.2 percentage points ($p < 0.05$) per survey year for respondents with excessive alcohol consumption from 40.4% in 2010 to 30.2% in 2018. No statistically significant changes were observed for the other analysed factors in the analysed period ($p > 0.05$).

Factors characterizing risky health behaviours reduce the odds for using the seat belt in the front seat of the vehicle by 1.3–2.1 times. Respondents who have not excessively consumed alcohol in the last month, non-smokers and those who do not allow smoking in the car, as well as respondents who have visited a

family doctor in the last year, have higher odds in both univariate factor analysis and multivariate regression analysis, when adjusted with gender, age and level of education (see Table 2.13).

Table 2.13

Number, proportion and odds ratio of the use of seat belt in the front seat in relation to factors of health behaviours

Factors		N (%)	OR (95% CI)[a]	Adjusted OR (95% CI)
Alcohol	No	8623 (94.4)	2.8 (2.4–3.2)	2.1 (1.7–2.5)**
	Yes	1366 (85.8)	1.0	1.0
Smoking	Non-smokers	5402 (95.4)	2.6 (2.2–3.0)	1.8 (1.5–2.2)**
	Others	1633 (93.5)	1.8 (1.4–2.2)	1.5 (1.2–1.8)**
	Everyday smokers	2924 (88.9)	1.0	1.0
Smoking restrictions in a family car	No smokers in a family	4636 (95.2)	2.6 (2.1–3.2)	2.0 (1.6–2.5)**
	Smoking not allowed	2803 (93.5)	1.7 (1.5–2.0)	1.7 (1.4–2.1)*
	Smoking allowed	1483 (88.4)	1.0	1.0
Family doctor visits	Yes	7952 (93.9)	1.6 (1.4–1.9)	1.3 (1.1–1.5)*
	No	2779 (90.6)	1.0	1.0
Preventive check-up	Yes	1652 (94.2)	1.1 (0.9–1.4)^{NS}	-
	No	4628 (93.7)	1.0	-

* [a] odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the individual's demographic and socio-economic factors (gender, age, level of education)
* Reference category: the use of seat belts – sometimes/never
* $^{NS}p > 0.05$; *$p < 0.05$; **$p < 0.001$

In all years of the questionnaire, the trends in the use of seat belts in the vehicle's front seat in terms of alcohol consumption behaviours, smoking and smoking restrictions in a family car, as well as in relation to the visit to a family doctor, have been similar. A statistically significant increase in their use is only observed for respondents who have carried out a preventive health check over

the last three years on average by 1.5 percentage points ($p < 0.001$) in each survey year from 90.2% in 2014 to 96.3% in 2018.

Both the univariate factor analysis and the multi-factor regression analysis have shown that health risk behaviour is also associated with the use of the seat belt in the rear seat of the vehicle (see Table 2.14).

Table 2.14

Number, proportion and odds ratio of the use of seat belts in the rear seat in relation to factors of health risk behaviours

Factors		N (%)	OR (95% CI)[a]	Adjusted OR (95% CI)
Alcohol	No	5292 (57.9)	2.4 (2.1–2.7)**	2.1 (1.9–2.4)**
	Yes	581 (36.4)	1.0	1.0
Smoking	Non-smokers	3404 (60.1)	1.7 (1.6–1.9)**	1.5 (1.4–1.7)**
	Others	927 (53.1)	1.3 (1.2–1.5)*	1.2 (1.1–1.4)*
	Everyday smokers	536 (46.4)	1.0	1.0
Smoking restrictions in a family car	No smokers in a family	2924 (60.0)	2.0 (1.8–2.2)**	1.8 (1.6–2.0)**
	Smoking not allowed	1705 (56.8)	1.7 (1.5–2.0)**	1.7 (1.5–1.9)**
	Smoking allowed	725 (43.2)	1.0	1.0
Family doctor visits	Yes	4501 (56.6)	1.4 (1.3–1.5)**	1.2 (1.1–1.3)**
	No	1371 (49.3)	1.0	1.0
Preventive check-up	Yes	1089 (62.1)	1.3 (1.2–1.5)**	1.3 (1.1–1.4)**
	No	2748 (55.6)	1.0	1.0

* [a] odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the individual's demographic and socio-economic factors (gender, age, level of education, place of residence)
* Reference category: the use of seat belts – sometimes/never
* [NS]$p > 0.05$; *$p < 0.05$; **$p < 0.00$

Respondents without excessive drinking behaviours, non-smokers and individuals in whose families smoking is not allowed in the car, as well as respondents who have visited their family doctor in the last year, see 1.2 to

2.1 times higher odds of use of seat belts in the rear seat, even when adjusted for gender, age, educational level and place of residence.

During all years of the questionnaire, the trends in the use of seat belts in the vehicle's rear seat in terms of alcohol consumption behaviours, smoking and smoking restrictions in a family car, as well as in relation to the visit to a family doctor, have been similar. A statistically significant increase in their use is only observed for respondents who have carried out a preventive health check over the last three years, on average, by 3.2 percentage points ($p < 0.001$) in each survey year from 57,7% in 2014 to 64.2% in 2018.

2.2.3 Road Safety Habits in Relation to the Individual's Attitude Towards Road Safety

The individual's attitude towards road safety is associated with the use of reflectors in a number of groups and does not change significantly. Even when adjusted for demographic and socio-economic variables such as gender, age and place of residence, the odds of using reflectors are still higher for respondents who agree with statements on the need for the use of seat belts even on short journeys (OR = 2.3) and at speeds up to 40 km/h (OR = 2.7), as well as those who agree that penalties for traffic violations should be more severe (OR = 1.9) (see Table 2.15).

Table 2.15

Number, proportion and odds ratio of the use of reflectors in relation to attitude towards road safety

Attitude towards road safety		N (%)	OR (95% CI)[a]	Adjusted OR (95% CI)
Seat belt should be used in short journeys	Yes	1224 (59.3)	2.6 (1.9–3.4)**	2.3 (1.7–3.1)**
	No	84 (36.2)	1.0	1.0

Continuation of the Table 2.15

Attitude towards road safety		N (%)	OR (95% CI)[a]	Adjusted OR (95% CI)
Seat belt should be used at speeds up to 40 km/h	Yes	1254 (58.9)	2.9 (2.1–4.1)**	2.7 (1.9–3.8)**
	No	54 (32.9)	1.0	1.0
Seat belt should always be used	Yes	1268 (57.9)	2.2 (1.4–3.2)**	2.0 (1.3–3.0)**
	No	40 (38.8)	1.0	1.0
Driving within the speed limit reduces the chance of getting into a traffic collision	Yes	1224 (59.3)	1.4 (1.1–1.8)*	1.2 (0.9–1.5)^{NS}
	No	174 (50.0)	1.0	1.0
Penalties for violations of traffic rules should be stricter	Yes	1224 (64.2)	2.1 (1.8–2.5)**	1.9 (1.6–2.3)**
	No	429 (46.3)	1.0	1.0

* [a]odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the individual's demographic and socio-economic factors (gender, age, place of residence)
* Reference category: the use of reflectors – sometimes/never
* $^{NS}p > 0.05$; *$p < 0.05$; **$p < 0.001$

The individual's attitude towards road safety is associated with the road safety habit itself in both univariate factor analysis and multi-factor regression analysis when adjusted for gender, age and educational level. The attitude that the seat belt should be used in a variety of situations is associated with 5.4 to 9.7 times (depending on the specific question) higher odds for using the seat belt in the front seat of the vehicle. A negative attitude towards drunk driving and a positive attitude towards compliance with speed limits increase the odds ratio for the use of seat belts by 2.8 and 1.9 times, respectively (see Table 2.16).

Table 2.16

Number, proportion and odds ratio of the use of seat belts in the front seat in relation to attitude towards road safety

Attitude towards road safety		N (%)	OR (95% CI)[a]	Adjusted OR (95% CI)
Seat belt should be used in short journeys	Yes	1978 (96.0)	6.7 (4.6–9.8)**	5.4 (3.6–8.0)**
	No	181 (78.0)	1.0	1.0
Seat belt should be used at speeds up to 40 km/h	Yes	2041 (95.9)	9.0 (6.0–13.5)**	7.6 (5.0–11.2)**
	No	118 (72.0)	1.0	1.0
Seat belt should always be used	Yes	2090 (95.4)	10.3 (6.15–16.3)**	9.7 (6.0–15.6)**
	No	69 (67.0)	1.0	1.0
Driving a car under alcohol influence increases the chance of being involved in a collision	Yes	2075 (94.6)	3.1 (1.7–5.6)**	2.8 (1.5–5.1)**
	No	84 (84.8)	1.0	1.0
Driving within the speed limit reduces the chance of getting into a traffic collision	Yes	1845 (94.9)	2.0 (1.3–3.0)*	1.9 (1.2–2.8)**
	No	314 (90.2)	1.0	1.0
Penalties for violations of traffic rules should be stricter	Yes	1313 (96.0)	2.2 (1.6–3.2)**	2.1 (1.4–3.0)**
	No	846 (91.5)	1.0	1.0

[a]* odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the individual's demographic and socio-economic factors (gender, age, level of education)
* Reference category: the use of seat belts – sometimes/never
* $^{NS}p > 0.05$; *$p < 0.05$; **$p < 0.001$

The results of the analysis of the associations confirm the association between the individual's attitude towards the use of seat belts and the road safety habit even when adjusted for gender, age, level of education and place of residence. The attitude that the seat belt should be used in different situations is associated with 1.9 to 3.1 times (depending on the specific question) higher odds for the use of seat belt in the front seat of the vehicle. Similarly, the odds of this habit are increased by negative attitudes towards drunk driving (OR = 1.8),

positive attitude towards compliance with speed limits (OR = 1.3) and support for the need for stricter penalties for violations (OR = 1.7) (see Table 2.17).

Table 2.17

Number, proportion and odds ratio of the use of seat belt in the rear seat of the vehicle in relation to attitude towards road safety

Attitude towards road safety		N (%)	OR (95% CI)[a]	Adjusted OR (95% CI)
Seat belt should be used in short journeys	Yes	1397 (67.8)	3.2 (2.5–4.3)**	3.0 (2.3–3.9)**
	No	91 (39.2)	1.0	1.0
Seat belt should be used at speeds up to 40 km/h	Yes	1472 (67.0)	3.5 (2.5–4.8)**	3.1 (2.3–4.4)**
	No	61 (37.2)	1.0	1.0
Seat belt should always be used	Yes	1438 (65.7)	2.0 (1.4–3.0)**	1.9 (1.3–2.8)**
	No	50 (48.5)	1.0	1.0
Driving a car under alcohol influence increases the chance of	Yes	1436 (65.6)	1.7 (1.1–2.6)*	1.8 (1.2–2.6)**
	No	52 (52.5)	1.0	1.0
Driving a car under alcohol influence increases the chance of being involved in a collision	Yes	1436 (65.6)	1.7 (1.1–2.6)*	1.8 (1.2–2.6)**
	No	52 (52.5)	1.0	1.0
Driving within the speed limit reduces the chance of getting into a traffic collision	Yes	1279 (65.8)	1.3 (1.1–1.6)*	1.3 (1.1–1.6)*
	No	201 (60.1)	1.0	1.0
Penalties for violations of traffic rules should be stricter	Yes	960 (70.2)	1.8 (1.4–2.1)**	1.7 (1.4–2.1)**
	No	528 (57.1)	1.0	1.0

* [a]odds ratio is calculated for each factor separately
* Adjusted OR: adjusted for the individual's demographic and socio-economic factors (gender, age, level of education, place of residence)
* Reference category: the use of seat belts – sometimes/never
* [NS]$p > 0.05$; *$p < 0.05$; **$p < 0.001$

2.2.4 Relationship Between Road Safety Habits

Road safety behaviours – the use of reflectors, the use of seat belts in the front and rear seats of the vehicle – are interlinked. A correlation was observed between the use of reflectors and seat belts in the front seat of the vehicle ($r = 0.20$; $p < 0.0001$) and the use of reflectors and seat belts in the rear seat of the vehicle ($r = 0.24$; $p < 0.0001$), as well as between the use of seat belts in the front and rear seats of the vehicle ($r = 0.27$; $p < 0.0001$). Although all mutual correlations are statistically significant, the relationship of the Spearman's correlation coefficient for the analysed traffic safety behaviours was assessed as insignificant ($r < 0.30$).

3 Discussion

The aim of the doctoral thesis was to describe KSI in RTC and their risk factors from 2010 to 2018, to study the road safety habits of the adult population of Latvia during the same period, as well as to clarify the relationship between the habits and individual factors, health behaviour, and attitude towards road safety factors. The analysis of the literature shows that road safety is a multi-dimensional global public health issue, where interaction between different sectors should be assessed and taken into consideration, and solutions at different levels and frameworks should be involved. Taking into consideration the current paradigm of road traffic injuries as a predictable and thus also preventable event, not only information on demographic and socio-economic factors characterizing an individual is used in the planning of interventions. In developing a deeper understanding of interconnectedness and their causation, health-related factors, road safety attitudes and independent effects are also relevant. The association of these factors in the Latvian adult population is analysed in the doctoral thesis in order to compare them with the results obtained in studies in other countries.

Based on the results of the thesis, it can be concluded that the **first hypothesis** put forward in the thesis, which assumed that the number of KSI in RTC in Latvia has decreased over a nine-year period, and safe habits have improved, was partially confirmed. Trends show that between 2010 and 2018, the proportion of KSI in RTCs decreased among all persons involved in RTCs, while the analysis of the incidence rate of KSI in RTCs per 100 000 person-years, show an increase in the trends. On the other hand, the analysis of traffic safety habits shows that the use of seat belts in the front seat and rear seat of the vehicle has slightly increased, but the differences in the use of reflectors over the years are not statistically significant.

The **second hypothesis** of the thesis, which proposed an association between road safety habits and the individual's health behaviour, was fully

confirmed. Associations were observed between the three road safety habits analysed – the use of reflectors, the use of seat belts in both the front and rear seats, and health behaviours such as risky alcohol consumption, daily smoking and not performing an annual preventive check-up at the family doctor.

The **third hypothesis** proposed in the thesis, which suggested that the attitude towards the use of seat belts, intoxicated driving and compliance with the prescribed speed limits was different among respondents with safe and unsafe traffic habits, was partially confirmed. A statistically significant association was found between attitudes towards seat belt use and all three studied road safety habits. On the other hand, the association between the attitude towards drunk-driving and compliance with the prescribed speed and safety behaviours, when adjusted for demographic and socio-economic factors, remained only for the use of seat belts in the front and rear seats of the vehicle.

The analysis performed within the framework of the thesis shows that in the period from 2010 to 2018 the proportion of KSI persons in RTCs from all persons involved in RTCs in Latvia has decreased, while the incidence rate per 100 000 person-years has increased in the same period. The data from this study regarding the change in trends are consistent with the results of other studies. Information published in national and global databases shows that the proportion of deaths from those involved in RTCs is declining in Europe as a whole (WHO, 2018). There is also a reduction in Latvia in the number of KSI in RTCs from 2010 to 2018, while the overall dynamics of the number of serious injuries is generally increasing (Road Traffic Safety Plan for 2021–2027, 2021). Meanwhile, a large-scale study published in 2020 on the global burden of traffic collision-related injuries recorded a reduction in mortality and an increase in the standardized incidence rate in most countries since 1990 (James et al., 2020), and a study published in 2019 on persons seriously injured in RTCs in Sweden show an increase in the incidence rate per 100 000 inhabitants (Värnild, Larm, Tillgren,

2019). In general, changes in the number, proportion, incidence and mortality rates of KSI in RTCs are explained by changes in both the total number of RTCs and their structure, including differences between different subgroups, increased motorization and urbanization globally, and implemented prevention policies, including medical assistance. The interpretation of the data of the analysis carried out in the context of the doctoral thesis should take into consideration that the proportion of KSI in RTCs has been calculated from all persons involved in RTCs, and this number has increased in the analysed period. On the other hand, data on the population in the respective period were used to calculate the incidence rate, and the population has decreased between 2010 and 2018. Also, it cannot be ruled out in this calculation of the incidence rate that KSI may suffer from RTCs repeatedly, which is also emphasized elsewhere, especially in the youngest (18–24) age group (Gicquel et al., 2017).

The case definition is important in the interpretation of the results of epidemiological studies. In the Statistical Databases of RTCs and Consequences used in the doctoral thesis, a person killed shall be someone who was killed at the scene of the collision or died from complications within 30 days following the collision, but a seriously injured person shall be someone who was injured and provided with medical assistance and treated at a hospital for more than 24 hours. This approach is based on the European Commission's guidelines and has been used in the relevant database since 2004, and has been used in other countries (OECD, 2010), but the criterion on the serious injuries is very general. Different approaches to the classification of seriously injured persons in RTCs and different case definitions are also highlighted in other studies and expert discussions (International Expert Network and Database on Road Safety, 2015). The severity of the injury is determined on the basis of information gathered by the police from the RTC site, information provided by medical staff, such as at the time of emergency and in cases where the person is hospitalized, and by

combining information from several sources, and taking into consideration such criteria as the injured body parts, structures and extent (WHO, 2010; Värnild, Larm, Tillgren, 2019). However, in general, the EU member states use different methodologies for accounting seriously injured persons. There have been debates for proposing a uniformed methodology for accounting RTC injuries and Latvia also plans to implement it. Thus, the results obtained in the analysis of KSI in RTC performed within the framework of the doctoral thesis are comparable with the results of other studies in terms of trends, but not in numerical values and figures due to possible different case definitions.

In order to protect vulnerable road users – pedestrians, reflectors are used during the dark hours of the day. The legislation of the Republic of Latvia also stipulates that during the dark hours of the day pedestrians both in populated areas and outside populated areas must use a light reflector when walking on the carriageway or on the shoulder. The results of the thesis show that they are almost always used by just over half of the respondents, and no significant changes were observed during the analysed period. Given that the use of reflectors is only relevant in a specific region with a relatively long dark time of day, limited studies are available for individual countries. Studies show that the use of reflectors is similar in the Baltic States and Scandinavia (National Institute for Health and Welfare, 2007; National Institute for Health Development, 2019), but with an increasing trend. For example, in Finland in the period from 2010 to 2014 the proportion of reflector users in populated areas increased by 12 percentage points as a result of targeted interventions (Pöysti, 2015).

In turn, seat belts should be used for the safety of drivers and passengers. In all EU Member States, the law requires the use of seat belts in a vehicle and, in the long term, this road safety behaviour has improved and has even become the norm in a large part of the public, regardless of where they sit in the car. A report published in 2017 shows that in most countries the proportion of seat

belt use in the front seat is 95% and higher, such as in the Czech Republic, Denmark, Finland, Sweden, the United Kingdom, Germany, France, the Netherlands and Lithuania, while the proportion is not below 80% in all other EU countries. On the other hand, the use of seat belts in the rear seat of the vehicle in some countries exceeds 80%, e.g., in Denmark, Finland, France, Poland, and in some countries amounts to 95% and higher, e.g., in the Czech Republic, Germany, the Netherlands and Lithuania (International Expert Network and Database on Road Safety, 2017). The analysis of Latvian data shows that the proportion of seat belt use in the front seat of the vehicle has improved over time and is gradually approaching the level of other European countries, exceeding 95% in 2018. Unfortunately, the use of seat belts in the rear seat of the vehicle in Latvia is still critically low. Although the percentage of the seat belt usage in the rear seat has increased by 2 percentage points between 2010 and 2018 in each subsequent survey year, they are still almost always used in general by only 53.6% of respondents. In the literature, the differences between the use of seat belts in the front and rear seats are mainly explained by the fact that people feel relatively safer when travelling in the back of the vehicle. One of the reasons is the calculations that show that passengers in the rear seat are indeed less likely to be both killed and seriously injured in a RTC compared to those in the front seat of the vehicle, but it should be emphasized that it is under condition that all possible safety measures including seat belts are used appropriately (Smith and Cummings, 2004). Another explanation is that children or people who do not drive their own vehicle on a daily basis but use the services of a taxi or other carrier are more likely to sit in the rear seat, thus not associating these seats in the vehicle as potentially dangerous and consider the use of seat belts less necessary (Trowbridge and Kent, 2009; Beck, Kresnow and Bergen, 2019). Despite the relatively safer travelling in the rear seat of the vehicle, in combination with the relatively low use of seat belts, and the fact that there are

fewer other safety features in the rear seat, such as front airbags and the nature and severity of RTC injuries, rear seat passengers are highlighted in publications as a significant RTC risk group (Durbin et al., 2015; Bose et al., 2017). This shows that, in general, the awareness for using seat belts, no matter where you sit in the vehicle, including when travelling as a passenger in any car, is not sufficient and requires a comprehensive approach to establish it in the society.

The results of the doctoral thesis generally confirm the association between gender, age and KSI in RTC, as well as demographic and socio-economic factors such as gender, age, place of residence, level of education and road safety habits.

Males have been identified in the scientific literature as one of the main risk groups for RTC for several decades. The WHO points out that male RTC mortality is higher in all regions of the world and in all age groups, regardless of income levels, which is explained by both longer times spent in road traffic and higher risk-taking compared to females (WHO, 2004). Studies of road safety habits in other countries also highlight males as a risk group for both the use of reflectors (Wall, 2009) and the use of seat belts (Shinar, 2001; Boal, Li and Rodriguez-Acosta, 2016), largely explained by males' riskier behaviour when compared with females. D. M. Buss believes that the process of society's evolution in itself has led to the need for males to take greater risks (D. M. Buss, 2008). In P. Ulleberg's cluster analysis in Norway, the majority of risky drivers in the subgroup were “thrill seeking” males (P. Ulleberg, 2001). The results of a study in Israel have also identified males as “thrill seekers” as opposed to females, who prefer safer choices (Rosenbloom and Wolf, 2002). Therefore, in road safety research, the skills and driving abilities of the driver are not emphasized as much as the willingness to take risks (Iversen and Rundmo, 2002).

The analysis of KSI in RTCs included in the thesis also shows higher odds for males (OR = 1.2). Both the univariate analysis of safety habits and their

associated factors, as well as when adjusted for demographic and socio-economic factors, showed 1.4–2.2 times higher odds for analysed road safety habits for Latvian females compared to males.

In general, research shows that both gender and other factors, such as personality, attitude, behaviours, and so on are undeniably related to the habits of the individual in road traffic and, consequently, the risk of road traffic injuries. Researchers also point out that the gender gap is narrowing over time, citing the growing proportion of females in road traffic, the expansion of traditional female roles in society and more active participation in social life (Laapotti, Keskinen and Rajalin, 2003). The views on the extent to which each of the factors influences the risks of collisions and the interaction between the various factors are different, and therefore further and in-depth research is necessary. Studies point to time and distance travelled in road traffic, the availability and use of different vehicles as an additional factor that prevents an accurate assessment of the role of gender (Borrell et al., 2005; Oltedal and Rundmo, 2006; Zhang and Chan, 2016). There are also researchers who explain the gender differences in RTCs largely by differences in alcohol use (Kelley-Baker and Romano, 2010). Consequently, in general, it is essential not only to highlight males as a risk group for RTCs, but also to understand other interaction factors, thus allowing more targeted prevention measures. It is also possible that the results of this research on gender gaps would be different if additional factors such as the length of driving experience and the distance travelled daily were included, as well as an analysis of the time spent and distance travelled during work and vacation trips.

The analysis of persons involved in RTCs included in the thesis shows that the highest proportion of KSI is in the oldest (55 and older) and youngest (18–24 years) age groups, while the highest incidence rate (per 100 000 person-years) is in the 45–54 age group, followed by the youngest (18–24 years) age group. According to the WHO, globally over half of all RTC deaths are made up

by population aged 15–44. In high and middle-income countries, the main risk group is 15 to 29-year-olds, while in low-income countries the main risk group is the elderly over the age of 60 (WHO, 2004). The analysis of road safety habits also shows that both the use of reflectors and the use of seat belts are the lowest among the youngest respondents and the odds ratio for using them increase with each subsequent age group. The high proportion of the younger adult population can be explained in the same way as other researchers have done – little experience and unnecessary risk-taking in road traffic, such as inadequate speed and manoeuvres, ignoring distance, as well as the lack of awareness of risks and potentially dangerous situations, and the overestimation of their skills. On the other hand, there is an increasing need for a sense of safety, as the confidence in one's own skills decreases, and the need for safety features and compliance with road safety rules in general (Rhodes, Brown and Edison, 2005; Bernhoft and Carstensen, 2008; Delhomme, Verlhiac and Martha, 2009).

In the data analysis of the thesis, the association between age and road traffic habits such as the use of reflectors and the use of seat belts in the rear seat remains both in the univariate analysis and when adjusted for demographic and socio-economic factors. On the other hand, statistically significant association remains for the use of seat belts in the front seat of the vehicle among respondents aged 55 and older when adjusted for the defined factors, but decreases in other age groups.

In general, the analysis of the results indicates an interaction and impact of age, risky health behaviours, and attitudes. Data collected by other researchers also show that younger road users are more likely to forget to use seat belts or indicate that they are uncomfortable and cause discomfort, while older road users indicate that the use of seat belts has already become a habit (NHTSA, 2007). Thus, the results of this research indicate that in the youngest age groups,

individuals need additional incentives in order to make safe behaviour in road transport a permanent habit.

The study confirmed the association between the injury severity sustained in the RTC and the location of the RTC – higher odds for serious and fatal RTCs are observed on regional and local roads (OR = 1.2), as well as in other cities (OR = 1.2) compared to capital city Riga. This is consistent with the discussions of other researchers on the high rates of KSI in RTCs on regional roads, both in comparison with residential areas and highways, explaining this with infrastructure, less developed and implemented safety measures on regional roads and their distance from administrative centres, including the provision of emergency services if necessary (Prato, Rasmussen and Kaplan, 2013; Värnild, Larm Tillgren, 2019). The capital also has more widespread speed limits (traffic lights, traffic lights with speed sensors, speed bumps) and means of controlling the speed limits.

Similarly, the analysis of the doctoral thesis confirms the association between population density and the use of reflectors, and the use of seat belts in the rear seat of the vehicle – in Riga, where the population density is the highest in Latvia, both safety habits are the worst. In rural areas, the odds for seat belt use in the rear seat of the vehicle are 1.7–2.7 times higher, and in large and small cities they are 1.3–2.0 times higher compared to people living in Riga.

Differences in the use of reflectors could be explained by infrastructure that is specific to the capital, including better lighting, traffic intensity and lower average speed, which generally suggests that safety measures are less necessary compared to other populated and less populated areas in Latvia. It should be stressed that the use of reflectors has not been studied extensively in scientific literature, taking into consideration also regional specificities, i.e., the darkness of the day and therefore the prevalence and necessity. At the same time, pedestrian habits have been studied in general and the use of reflectors can be

explained in the same way as the factors which are used to describe this habit in general and as set of interactions between different factors, like personality traits, demographic factors, attitude towards road safety and perception of risks, as well as social responsibility and the behaviour of other pedestrians, i.e., the probability of safely crossing a road is higher if other pedestrians do the same (Zhou, Horrey and Yu, 2009; Zhou and Horrey, 2010; Wall, 2009; Nordfjærn and Şimşekoğlu; 2013). A comprehensive study of 19 European countries identified three groups: pedestrians who comply with road safety and have a positive attitude towards it; pedestrians who mostly do not comply with road safety and have a negative attitude towards it and this group was largely composed of the youngest age groups. In turn, the third group was pedestrians with a positive attitude towards road safety, but mixed habits resulting from other factors, incl. traditions, norms, social environments and attitudes in each country (Papadimitriou, Theofilatos and Yannis, 2013). The results of this study can also be explained by all these factors, including the special nature of Riga as the capital of Latvia, by highlighting the lower odds for the use of reflectors among the youngest age groups where social responsibility has not yet strengthened compared to the elderly population.

In the context of differences in urban and rural areas in the use of seat belts, there are different discussions in the literature. Often regions with lower population density and people living outside of cities are identified as a risk group for insufficient use of seat belts, which is explained by different social standards, lower incomes and educational levels, other behaviours such as increased alcohol use, including drunk driving, and generally a more common view that the use of seat belts is not an effective protection at the time of a collision (Strine et al., 2010; Beck et al., 2017; Beck, Kresnow and Bergen, 2019). Meanwhile, less frequent use of seat belts in populated areas, similar to less frequent use of reflectors, by other authors is explained by an interaction of

several factors – personality traits, demographic factors, attitudes towards road safety and the perception of different risks, for example, by perceiving cities as relatively safe environments with relatively low driving speeds, as well as inconvenience and discomfort in wearing seat belts (Zabihi, Davoodi and Nordfjærn, 2019). The researchers note that differences in the use of seat belts are linked not only to population density, but also to the various regulatory frameworks, which often in large countries are different in different administrative areas and in relation to the population in them, as well as encourage discussion that similar interventions can produce different results in different density populations (Ash, Edwards and Porter, 2014). Consequently, the results of this study highlight the need to put more emphasis on road safety elements in relation to different populations living in different areas, in such a way that they are less likely to follow the negative example of other road users and do not put themselves at risk, but to choose to participate in road traffic safely.

Similar to the research published in other scientific literature, the differences in road safety habits in relation to different education levels have also been reported within the framework of the thesis. In each consecutive education level group, the percentage of seat belt users is higher compared to the lower-level education group. The seat belt in the front of the vehicle is almost always used by 86.6% of the respondents with primary education, 92.0% of respondents with high school degree and 94.6% of respondents with unfinished or completed university degree, while the seat belt in the rear seat of the vehicle is used by 42.5%, 52.5% and 57.0% of respondents, respectively. In literature, the differences in road safety habits in individuals with different education levels are based on the fact that the level of education is linked to behaviour and other factors, including occupation, income, household environment and neighbourhood, as well as traditions, social and cultural environments (Braver,

2003; Ameratunga, Hijar and Norton, 2006). Individuals with a higher level of education have better knowledge of traffic safety, as well as understanding and attitudes about the need to comply with security measures, while individuals with a lower level of education list police control and penalties as the main reason for using seat belts (Wells, 2002, Demirer, Durat and Haşimoğlu, 2012). In addition, researchers indicate that differences between different levels of education in road safety data are more pronounced among younger adults than among seniors (Borrell et al., 2005). The interpretation of the results of the thesis in relation to the level of education should also take into consideration the bilateral relationship between age and acquired education, as well as changes in society, where acquiring higher education is postponed and a few years are spent primarily on gaining experience, and therefore, part of respondents in the younger age groups have not yet obtained higher education. In the light of the overall trends and lessons learned from other studies, a lower level of education is an essential indicator for the planning of interventions to improve traffic safety habits and highlights the need for interventions to promote traffic safety and reduce related injury before the age of 18, i.e., in secondary education institutions.

The analysis of scientific literature shows that alcohol use and disorders associated with it are a major risk factor for both injuries as a whole and injuries in road traffic increasing the risk of RTCs and the severity of injuries. The WHO has been calling for a number of decades for increased attention and for policies at both international and national levels to significantly restrict and reduce alcohol use by road users. Calculations show that presence of alcohol in both drivers and passengers, and also pedestrians, increase the risk of RTCs and injuries multiple times (WHO, 2004). The analysis of the data carried out within the framework of the study also shows that individuals at the time of the RTC with excessive BAC level have two times higher odds to be KSI in RTC.

However, alcohol use is a global problem which reaches beyond RTCs, so the overall consumption habits of alcohol were also studied within the health risk behaviour prism of this study. Risky alcohol use was defined for respondents who had taken at least six units of alcohol in a single drinking event during the last month. The thesis confirms that respondents without risky alcohol consumption behaviours have 1.6 times higher odds of using reflectors and 2.1 times higher odds of using seat belts in both the front and rear seats of the vehicle. It should be mentioned that excessive use of alcohol has also been analysed in the scientific literature as a protective factor – by engaging in various health promotion and disease prevention activities, users believe that this allegedly compensates for other health risks (Ettner, French and Popovici, 2010). However, in relation to road safety, it is more common to point to general risky behaviour, which includes both excessive use of alcohol and non-compliance with road safety. Similarly, individuals who excessively consume alcohol may have altered cognitive functions, inability to assess the severity of the situation and slower response rates, as well as generally less interest and motivation to engage in health promotion measures, including using seat belts (Ball, Kirkpatrick and Brenneman, 2005; Liang and Chikritzhs, 2015; Liu et al., 2016), and in addition the data show that nearly a third of recorded drivers under the influence drive intoxicated again (Bogstrand et al., 2015).

The results of the doctoral thesis confirm that everyday smokers have 1.5 to 1.8 times higher odds for all analysed traffic safety habits compared to non-smokers. Similarly, respondents in whose family smoking in the car is not allowed have 1.3 to 1.7 times higher odds for wearing seat belts compared to those who allow smoking in family cars, including when adjusted for demographic and socio-economic factors consistent with studies in scientific literature. The observed association is explained both by the fact that the two behaviours analysed – smoking and non-compliance with road safety

regulations – represent a risky attitude towards their health, as well as by the fact that picking up, unpacking, lighting and holding a cigarette reduces the person's focus, coordination, response rate and manoeuvring abilities. Similarly, studies confirm that smoking results in reduced concentration levels of carbon monoxide which reduces driver's alertness and increases response time, alters the choice of speed and distance, which are important components of safe driving (Koushki and Bustan, 2006; Bakiri et al., 2013; Ferdinand and Menachemi, 2014).

In specialist discussions, the role of primary care professionals in shaping and strengthening patient attitudes, as well as in conducting road safety interventions, is emphasized as an important and cost-effective approach (Ellis et al., 2000; Daniels et al., 2002). Primary health care is the first point of contact with the health care system and its task is to solve the main health problems of the population using the simplest and most cost-effective approaches (WHO, 1978). The evidence also confirms that the most effective behavioural change interventions are those that are simultaneously and consistently targeted at both the general public and the community and individual level (National Institute for Health and Care Excellence, 2007), including primary health care. The Public Health Guidelines for 2014–2020 also highlight that "family doctors provide general healthcare to patients enrolled in their practice; are involved in health promotion and health education; provide a multi-sectoral approach to patient health issues", and stress that "a family doctor should be the central person behind the patient; it is necessary to develop a network of family doctors' practices, to improve team work, as well as to extend the competence and motivation of the family doctor to engage not only in disease diagnosis and treatment, but also in health promotion and disease prevention" (On the Road Safety Plan 2014–2016, 2014). Therefore, in the thesis the analysis of risky health behaviours in relation to road safety habits includes data on preventive visits to the family doctor, i.e., free preventive exams. Data from this study show

that respondents who had visited their family doctor over the past year are more responsible at using both reflectors and seat belts. When adjusted for demographic and socio-economic factors, these respondents have 1.2 to 1.3 higher odds of safe driving habits compared with those who have not visited their family doctor in the past year. The observed association is similar to the information observed in the scientific literature, where the association between the behaviours, including risky health habits and the use of health care services, is explained both with risky behaviour as a whole and in relation to social determinants, such as reduction in economic inequality usually results in increase in the use of seat belts, as well more frequent use of health services, which in turn can be explained by overall infrastructure and availability, and social and economic environment (Borzecki all., 2005; Harper and Lynch, 2007; Şimşekoğlu and Lajunen, 2008). There is also a discussion in the literature that individuals with risky health behaviours are less likely to consult with primary health professionals, including in order to avoid in-depth health tests that may indirectly contribute to adverse health effects in the long term (Hunkeler et al., 2001).

In turn, the association of road safety habits with preventive health check-ups in this study was confirmed in connection with the use of reflectors and the use of seat belts in the rear seat of the vehicle. The explanation for this could be the different understanding and interpretation of respondents on what constitutes a free preventative health check-up at their family doctor and the manipulations included in it. This is also confirmed by the considerably different data in the study conducted by the Centre for Disease Prevention and Control, in which the question is formulated identically to the one included in this study – where 76.8% of respondents indicated that they have visited their family doctor in the last year, while the majority of respondents (63.4%) indicated that they had never performed a free preventive health examination at their family doctor (Centre for

Disease Prevention and Control, 2019a). It is possible that if the questionnaire were supplemented with explanatory information on the nature of the health examination and the included manipulations, the results of the study would be different.

It should be noted that the regulatory enactments governing primary health care activities in Latvia do not currently specifically address road safety in the framework of prevention, but one of the sub-objectives of the Public Health Guidelines 2014–2020 is "to promote a healthy and safe environment, reduce trauma and mortality from external causes of death" (2014). The results of the study confirm positive changes in health behaviours and trends in patients who have received information about health risks at the primary health care professional, including information on not wearing a seat belt, and less frequent risky behaviours of the individual, if awareness is further promoted by the health care professional (Logsdon, Lazaro and Meier, 1989; Ozer et al., 2011; Institute of Medicine and Board on Population Health Public Health Practice, 2014). In a study conducted in the US, 60% of respondents also indicated that they would like to receive information from their family doctor and discuss road safety issues during their annual health check-ups (Oboler et al., 2002). Based on the analysis of the scientific literature and the results of this study, road traffic habits can be used to plan interventions at the primary health care level to improve the habits of the adult population.

Therefore, the results of this research confirm the association of the above-mentioned health behaviour factors – excessive alcohol consumption, smoking and less frequent visits to the family doctor – with poorer road traffic habits. This highlights the need to further educate primary health professionals on the safety of the population in traffic, related factors and behaviours, as well as to create significant long-term response to the reduction of injury and external causes of death.

Road safety habits in relation to attitudes towards road safety in this study were analysed in several sections: attitudes towards the use of seat belts, attitudes towards intoxicated driving, attitudes towards observing certain speed limits and attitudes towards penalties for traffic violations. Hence, individuals with a positive attitude towards the use of seat belts have 1.3–9.7 times (depending on the specific question) higher odds for using them in the front and rear seats of the vehicle. As in other studies, the analysis carried out within the framework of the thesis shows that relatively short journeys made over short distances, as well as at relatively low speeds, for example, in populated areas, are considered by individuals to be relatively safe with less need for seat belts (Transportation Research Board, 2003; Cunill et al., 2004). However, the results of this study show that individuals with a positive attitude towards the use of seat belts also have 2.0–2.7 times (depending on the specific question) higher odds for using reflectors. It has already been mentioned that the use of reflectors has not been extensively studied in the scientific literature, but the behaviour of both pedestrians and drivers in general has been studied. The association between an individual's behaviour and different road safety habits is explained in a similar way as the factors that are identified in the analysis, interpretation, and prediction of road safety habits in general, and separately by personality traits, demographic factors, highlighting the awareness and perception of various risks, and by social responsibility (Zhou, Horrey and Yu, 2009; Wall, 2009; Nordfjærn and Şimşekoğlu; 2013; Zabihi, Davoodi and Nordfjærn, 2019).

Studies in other countries and in the analysis carried out in the thesis confirm the association between attitude towards drunk-driving and road traffic habits: respondents who agreed that driving under the influence of alcohol increases the risk of being involved in a collision had 2.8 times higher odds for the use of seat belts in the front seat of the vehicle and 1.9 times higher odds in the rear seat compared to respondents who disagreed with these statements. In

the literature, as one of the additional explanations for the differences in risk identification is mentioned the fact that responses given by the respondents may correspond to the desired rather than the real situation. In the analysis carried out in this study, only 4.3% of respondents also stated that they did not agree with the statement "Driving under the influence of alcohol increases the risk of being involved in a collision", where the method of obtaining answers, which was the direct (face to face) interview with the respondent, should also be taken into consideration. In turn, data from a study of 22 European countries show that driving after consuming alcohol is a fairly common behaviour throughout Europe, indicated by 43% of respondents in Southern Europe, 19% in Western Europe, 11% in Eastern Europe and 7% in Northern Europe (SARTRE, 2004), as well as in a survey carried out in Latvia in 2017, 18% of respondents admitted that they had driven a car with BAC that exceeds the permitted level (CSDD, 2017).

Inadequate driving speed has been identified as one of the main safety risk factors in road safety (European Transport Safety Council, 2015). 15.2% of respondents in this study disagree with the statement "Driving at the speed limit reduces the possibility of being involved in a collision", although this proportion of individuals is lower than the reported 25–35% in other studies (Schroeder, 2003; Yannis et al., 2016). Results of the multifactor logistic regression analysis shows that respondents who agree with this statement have 1.9 times higher odds to use seat belts in the front seat of the vehicle and 1.3 times higher odds to use them in the rear seat. In literature, the association between attitudes and road safety behaviours is based on the individual's view of participation in it, which in turn influences intentions and behaviour in road traffic, which will form as behaviour over time. There are significant differences in attitudes between individuals with and without risky road traffic habits, so there is an agreement with other authors that opinions influence the decision to engage in risky

situations, including speeding, not wearing a seat belt, etc. (Horvath, Lewis and Watson, 2012). Although attitudes are not the only factor influencing behaviours, it is also important to understand the link between other motivating factors and unsafe driving practices in order to explain them. The theory of planned behaviour is widely used in the analysis of associations, which is shaped by attitude, subjective norm, and perceived behavioural control (Elliott, Armitage and Baughan, 2003; Letirand and Delhomme, 2005; Warner and Åberg, 2008).

The analysis in the doctoral thesis shows that more than half (55.4%) of respondents agree that penalties for road traffic violations should be stricter and trends are similar to other countries, e.g., study carried out in 32 countries shows that an average of 65% of Europeans support a stronger road safety policy on the use of safety belts (Nakamura et al., 2020), while a study of 22 European countries published earlier showed that a total of 59% of the population supports stronger policy for speeding violations (SATRE, 2004). Consequently, the results of this research confirm that individuals who support stricter penalties for road traffic offences are also more responsible in all the road safety behaviours analysed, both in the use of reflectors (OR = 1.9) and in the use of seat belts in the front (OR = 2.1) and rear seats (OR = 1.7).

In the interpretation of research results, the instrument used should be taken into consideration, e.g., the “Health Behaviour among Latvian Adult Population” study uses data from face-to-face interviews led by interviewers, in which respondents reported information themselves. It is noted in the scientific literature that self-reported information on individuals' behaviours, including traffic safety behaviours, can be inaccurate, and it may be reported in a more favourable way. For example, various design studies carried out in the United States show that data on self-reported seat belt usage from telephone interviews is approximately 10 percentage points higher than data from random observations in high traffic intensity areas, providing a rapid overall assessment

of the use of seat belts. However, it is emphasized that self-reported surveys are the only source of analysis of interdependent factors, including analysis of demographic and socio-economic nuances, and these questionnaires are the only source for studying the attitudes and raising awareness about the reasons why individuals do not use the safety measures that are offered and available (Transportation Research Board, 2003). The trend of the participants to provide the desired rather than truthful answers, from the prevention point of view can also be evaluated positively because that points to the fact that respondents know the right answers and they at least have theoretical knowledge.

It should also be taken into consideration that the cross-sectional design of the research and database used in this thesis does not allow to evaluate the true direction of the cause-effect mechanism. At the same time, the observed association between traffic safety habits and associated factors, as well as KSI in RTC and the associated factors studied exists regardless of the true direction of the cause-effect mechanism. The results of the thesis show that adults with poorer road safety habits also have other risky health behaviours, such as smoking and alcohol abuse, not visiting their family doctor, as well as risky attitudes towards road safety in general. The results of the research confirm that the identification of potential risk factors and their interactions is essential both in the planning and evaluation of interventions and in-depth research to cover the long-term public health policy in cross-sectoral cooperation.

Conclusions

KSI in RTCs

1. Between 2010 and 2018, the percentage of KSI in RTCs has decreased on average by 0.3 percentage points per year, while the incidence rate of KSI in RTCs per 100 000 person-years has increased on average by 1.2% per year.

Road safety habits

2. The use of reflectors is insufficient in Latvia and has not changed significantly between 2010 and 2018, in general they are almost always used by a little more than half (53.6%) of respondents.
3. The use of seat belts in the front seat of the vehicle in Latvia has increased slightly between 2010 and 2018 from 93.5% to 95.6% and is approaching the level of other European countries, while the slight increase in the use of seat belt in the rear seat from 52.4% to 56.3% is still low.

Individual demographic and socio-economic factors

4. Males have higher odds of being fatally or seriously injured in RTCs, and they have worse traffic safety behaviours.
5. The highest odds of being fatally or seriously injured in RTCs are among the elderly (55 years and older) and the youngest (18 to 24 years) persons, while the worst traffic safety habits are observed in the youngest (18–24 years) age group.
6. The lowest odds of seat belt usage are for respondents with primary education, the odds increase with each higher level of education.
7. The odds of being fatally or seriously injured in RTCs are higher if the crash occurs on regional and local roads, as well as in other cities compared to

Riga, while the worst safety behaviours are observed in residents of Riga, followed by other cities compared to rural areas.

Risky health behaviours

8. Exceeded permitted BAC at the time of the RTC increases the odds of the person involved in RTC of being fatally or seriously injured; individuals with excessive alcohol consumption behaviours have worse road safety habits.
9. Smokers and individuals in whose families smoking is allowed in the car have worse road safety habits.
10. The odds for safe road habits are lower among persons who have not visited their family doctor during the last year.

Attitude towards road safety

11. Worse road safety habits are observed among respondents with negative attitudes towards wearing seat belts and tougher penalties for traffic violations.
12. Lower odds of wearing seat belts are among respondents with a careless attitude towards driving under the influence of alcohol and respect for speed limits.

Practical recommendations

Public health policy makers should drive prevention of RTC injuries as one of the priorities of cross-sectoral cooperation in reducing mortality from external causes of death.

Injury prevention program makers should base road safety campaigns on a variety of theoretical health promotion and prevention foundations by using a variety of approaches (not just informative and educational), including activities that emphasize a change in attitudes and behaviours, and combine informative, educational, reinforcement, and establishing mechanisms. Greater attention should be paid to:

- ✓ regular use of reflectors;
- ✓ regular use of seat belts in the rear seat of the vehicle;
- ✓ promotion of positive attitude towards using seat belts also on relatively short journeys and at low speeds.

Road traffic safety campaign creators, such as the Road Traffic Safety Directorate and municipal health promotion coordinators, should aim targeted activities at high-risk target groups:

- ✓ 18–24-year-old age group;
- ✓ smokers;
- ✓ excessive alcohol users.

Municipalities should differentiate road safety interventions, taking into consideration geographical differences, which suggests that more attention should be paid to:

- ✓ reducing the number of KSI in RTCs on regional and local roads;
- ✓ increasing the use of reflectors and seat belts in the rear seat of the vehicle for inhabitants of Riga.

The Coordinators of the Latvian National Healthy Municipalities Network should make road traffic collision injuries one of their priorities, both

in gathering examples of good experience and in promoting the exchange of experience and ideas at regional level, and in planning and implementing joint interventions.

The Ministry of Health, which is responsible for the public health sector, should promote the strengthening of the role of primary health professionals in the reduction of trauma and external causes of death, including the promotion of safe road habits and prevention of injuries.

Primary health professionals should be provided with a greater initiative in reducing risky health behaviours in their patients and thus changing traffic safety behaviours and overall health-related behaviours and strengthening their behaviours in the long term.

The Centre for Disease Prevention and Control, in accordance with the functions specified in regulatory enactments, should provide methodological support to primary health care specialists:

- ✓ by developing educational programs based on evidence, experience and inter-sectoral cooperation for the preparation of primary healthcare professionals to work with traffic safety issues, incorporating these programs into the everyday routine activities;
- ✓ by providing informative support for the implementation of prevention interventions in the population as a whole and in risk groups.

In *medical institutions* strengthen the operation of emergency and inpatient reception departments on the weekends, evening and night hours when most fatal and serious collisions are recorded, and ensure appropriate staffing and infrastructure.

Public health analysts should include in the programs of the assessment of the effectiveness of road safety policy and monitor not only the indicators describing the changes of RTCs changes and their trends, but also regularly

obtain and analyse information on the habits and attitudes of the population, which would allow to evaluate changes and trends.

Public health professionals should initiate, plan, implement and monitor road safety research in close cross-sectoral cooperation, using and improving existing instruments, thereby ensuring a comprehensive, rather than fragmented approach to tackling the current public health challenges in the long term.

The implementers and researchers of the "Health Behaviour among Latvian Adult Population" study should review the questionnaire, evaluate the questions included in it in connection with current research trends in Europe, and supplement the existing tool by including data on the experience of the driver widely studied elsewhere, for example:

- ✓ respondent's most frequent manner of travelling in the vehicle: the driver, passenger in the front seat, passenger in the rear seat of the vehicle;
- ✓ the length of the driving experience;
- ✓ history of RTCs and the severity of injuries over a specific period of time;
- ✓ the nature of travelling in the vehicle in relation to work duties and leisure;
- ✓ the average distance travelled over a given time period.

Publications and theses

Publications included in international databases (Web of Science, SCOPUS)

1. Bukova-Zideluna, A., Villerusa, A., Lama, A. 2018. Characteristics of Alcohol-Related Road Traffic Collisions in Latvia. *European Journal of Public Health*, 28 (4). doi: 10.1093/eurpub/cky218.279.
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5. Bukova-Zideluna, A., Villerusa, A., Lama, A. 2016. An overview of injured bicyclists in traffic collisions: Analysis of traffic collision database in Latvia for the period 2010–2014. *International Research Council on the Biomechanics of Injury*, pp. 1–7.

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1. Bukova-Zideluna, A., Villerusa, A., Pudule, I. 2019. Comparison between the risks in road safety behaviour in urban and rural areas in Latvia in 2016. *SHS Web of Conferences*, 68, 01008. doi: 10.1051/shsconf/20196801008.

Peer-reviewed local publications

1. Bukova-Žideļūna, A., Villeruša, A., Pudule, I. 2016. Latvijas pieaugušo iedzīvotāju ceļu satiksmes paradumu analīze. *RSU Zinātniskie raksti: 2015. gada medicīnas nozares pētnieciskā darba publikācijas*. 293.–299. lpp.

Thesis and presentations in international conferences

1. Bukova-Zideluna, A., Villerusa, A., Pudule, I. 2021. Association between road safety behaviour and careless health behaviour in Latvian adult population. *RSU Research week 2021*, Riga, Latvia, presentation.
2. Bukova-Zideluna, A., Villerusa, A., Grinberga, D., Pudule, I., 2019. The relationship between use of reflectors and use of preventive health care in Latvia: year 2016. *RSU Conference*, Riga, Latvia, poster.

3. Bukova-Zideluna, A., Villerusa, A., Lama, A. 2018. Characteristics of Alcohol-Related Road Traffic Collisions in Latvia. *European Public Health Conference*, Ljubljana, Slovenia, poster.

4. Bukova-Zideluna, A., Villerusa, A., Pudule, I. 2018. The relationship between smoking habits and unsafe behaviour on the roads. *The 13th World Conference on Injury Prevention and Safety Promotion*, Bangkok, Thailand, poster.

5. Bukova-Zideluna, A., Villerusa, A., Pudule, I. 2018. Comparison between the risks in road safety behaviour in urban and rural areas in Latvia in 2016. *Society. Health. Welfare. Conference*, Riga, Latvia, presentation.

6. Bukova-Zideluna, A., Villerusa, A., Pudule, I. 2017. Self-reported behaviour and attitude towards using a seat belt in Latvia. *Safe Communities Conference*, Novi Sad, Serbia, presentation, moderation of the session.

7. Bukova-Zideluna, A. and Villerusa, A. 2016. Prevalence of alcohol among car drivers in road collisions in Latvia: an overview from 2010 to 2014. *The 12th World Conference on Injury Prevention and Safety Promotion.* Tampere, Finland, poster.

8. Bukova-Zideluna, A., Villerusa, A., Lama, A. 2016. An overview on pedestrians involved in traffic collisions in Latvia: Years 2010–2014. *Society. Health. Welfare. Conference*, Riga, Latvia, presentation.

9. Bukova-Zideluna, A., Villerusa, A., Lama, A. 2016. An overview of injured bicyclists in traffic collisions: Analysis of traffic collision database in Latvia for the period 2010–2014. *IRCOBI Europe Conference*, Malaga, Spain, presentation.

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1. Bukova-Žideļūna, A., Villeruša, A., Pudule, I. 2018. Atstarotāju lietošanas tendences Latvijas pieaugušo iedzīvotāju vidū. *RSU zinātniskā konference*, Rīga, Latvija, presentation.

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