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ROAD TRAFFIC INJURIES AND THE PROMOTION OF HEALTHY ROAD SAFETY BEHAVIOR AMONG POPULATION

331.02 – HYGIENE

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CONTENT

CONCEPTUAL LANDMARKS OF THE RESEARCH

The actuality and importance of the addressed topic. Road traffic injuries are a public health problem with a worldwide spread. Annually, at the global level, as a result of road traffic injuries, more than 1.35 million people die, and 20-50 million people suffer from various injuries, mostly affecting young people between the ages of 15-29 years old. Road injuries is the eighth cause of death worldwide, and if effective measures will be not taken, by 2030 it will occupy the fifth position [1**,** 2**,** 3, 4, 5]. In the global burden of diseases, injury accounts for 10% of the total number of deaths, with a third resulting from road crashes [1, 6].

According to the directive documents of the World Health Organization and reports of the United Nations, the mortality caused by road injuries correlates with the level of income per inhabitant: the lower the income, the higher the mortality [1,7]. The risk of dying in a road crash is more than 3 times higher in low-income countries than in high-income ones [1, 8, 9], thus causing a negative social and economic impact for the affected individuals, their families and the country as a whole [10, 11, 12].

According to the Sustainable Development Goals, adopted by the United Nations General Assembly in 2017 [13], the Republic of Moldova engaged in reduction by 50% the number of deaths and injuries caused by road crashes by 2030, in order to achieve objective 3 Health and well-being and ensure access to safe, affordable and safe transport systems, accessible and sustainable for all by achieving goal 11 Sustainable cities and communities.

There are many factors that contribute to road traffic crashes and road injuries, and most of them are preventable [1, 14, 15]. Violation of traffic rules, distracted driving, driving under the influence of alcohol, road conditions, adverse weather factors and the human factor are among the main factors responsible for the occurrence of road injuries [14]. In the Republic of Moldova, pedestrians are the people most often involved in road crashes, followed by vehicle passengers and drivers, motorcyclists and cyclists [16, 17]. Most of the deaths due to road crashes are recorded in the age group between 15-44 years [5]. The risk of causing severe or fatal injuries increases with the violation of the permissible speed limit and decreases with its reduction, so that most road users survive a collision at a speed of up to 30 km/h and receive severe injuries or fatal at a speed of over 50 km/h [18].

The planning and carrying out of public awareness and education initiatives play a significant influence in the prevention of car crashes [19, 20]. A variety of initiatives are launched annually in a range of countries to promote safe driving habits by informing drivers, motorcyclists, cyclists, and pedestrians of pertinent information. Thanks to their efficacy, these initiatives have contributed to a decrease in both traffic accidents and injuries. The European Union countries with the best safety score are: Sweden, Great Britain and the Netherlands, and the countries with the lowest score are: Romania, Bulgaria and Croatia [1, 9]. Therefore, in our country, in addition to the measures taken, it is necessary to develop good systems for monitoring and analyzing this phenomenon.

The Republic of Moldova is currently in the process of developing a new national road safety strategy, guided by the strategic vision of the world plan for the next decade. This supports the need for the current research, which also aligns with the priorities of the Ministry of Health, the objectives of the National Health Strategy "Health 2030", the Law on State Supervision of Public Health No. 10-XVI of 2009, the Road Safety Strategy of the Republic of Moldova for the period 2011-2020 and the National Program for the prevention and control of priority non-communicable diseases in the Republic of Moldova for the period 2023-2027.

The aim of the study: identifying and assessing the causes of road injuries and developing measures to prevent them among the adult population of the Republic of Moldova.

Objectives of the study:

1. Analysis and evaluation of the existing international and national normative framework in the field of road injury prevention.
2. Assessment of morbidity and mortality due to road injuries among the adult population of the Republic of Moldova.
3. Identification and assessment of the causes of road crashes and injuries.
4. Development and argumentation of road injury prevention measures among the population of the Republic of Moldova.

Scientific research methodology. The research has a multidisciplinary and intersectoral approach, by collecting, analyzing and interpreting the results regarding the road safety of the population at different stages and levels, and is carried out in accordance with the research design. A total of four retrospective (three quantitative and one qualitative), cross-sectional, descriptive studies were carried out to evaluate and analyze the current aspects of morbidity and mortality from road injuries, to create the profile of the adult who required medical care as a result of a road injury. Mixed research and data collection methods were applied.

Scientific problem. Multifactorial analysis of the indicators that characterize road safety in the Republic of Moldova, with the identification of risk factors for road injury, the creation of the profile of the person who required medical care as a result of a road injury and the development of road injury prevention measures among the population.

The novelty and scientific originality of the obtained results. The multidisciplinary approach in the collection, analysis and interpretation of the results presented in this thesis is current and presents elements of originality compared to the studies carried out so far in the Republic of Moldova. This research argues for the need to develop a long-term road safety strategy to reduce road injuries nationally and increase road safety among the population. To facilitate the development of evidence-based road injury prevention programs, it is proposed to create a system for monitoring road crashes and road injuries in the country by compiling a data register on road crashes and injuries comparable to those in EU countries. For the first time, evidence-based data were obtained on the characteristics of road injury and people who have suffered from road crashes according to addressability for emergency medical assistance; a model was developed to evaluate the risk factors in the occurrence of road injury; the COM-B model tool of changing problematic behavior in road traffic was applied and a series of representations, in territorial profile, of areas with a high risk of crashes and road injury in the country was developed.

The theoretical significance. The study represents a piece of scientific research in the area of identifying and evaluating risk factors for road injury and is one of a number of public health policies established by the Ministry of Health. The findings of the study will be used in the undergraduate and graduate training programs for students and residents, as well as in the ongoing education of doctors in the fields of health promotion and health education.

The applicative value of the research. The research's findings served as the foundation for the development and implementation of measures to prevent road injuries. These measures included developing information, communication, and community education programs, disseminating cartographic representations of areas at high risk of crashes and road injuries, assessing risk factors for road injuries, and advocating for the development of a national register of road crashes and injuries that is comparable to that of the EU countries. Certain intersectoral

activities were established for all actors interested in the prevention of road injuries during the research, and joint activities with specialists from the territorial Public Health Centers, the National Public Security Inspectorate, and local public authorities were organized. The research's findings were also put to use in the development and implementation of long-term actions aimed at reducing the frequency of crashes and associated injuries on the country's roadways.

Implementation of research results. The findings of this research will be used in the day-to-day work of experts from the National Public Health Agency and the National Public Security Inspectorate, as well as in undergraduate and graduate study programs at the Department of Preventive Medicine, *Nicolae Testemitanu* State University of Medicine and Pharmacy.

Approval of the scientific results. The results of the research were presented and discussed within the following scientific forums: The annual scientific conferences of the *Nicolae Testemitanu* State University of Medicine and Pharmacy. Chisinau (2018, 2019, 2020, 2021, 2022); The 3rd International Conference on Non-Communicable Diseases "Health risk factors and prevention of injuries and diseases", Chisinau, June 05-07, 2019; VIII Congress of specialists in the field of public health and health management with international participation, Chisinau, October 24-25, 2019; the 7th Bucovina International Congress in Medicine and Pharmacology of students and young researchers (BIMCO 2020), online, Chernivtsi, Ukraine, April 7-8, 2020; International Medical Congress for Students and Young Doctors (MedEspera), Chisinau, September 24-25, 2020; National Conference with International Participation "A safe environment - protected health", Chisinau, November 12-13, 2020; SAVIR 2021 Conference: Injury and Violence Prevention in a Changing World: From Local to Global, online, OH, USA, April 05 – 09, 2021; Virtual Pre-conference Global Injury prevention Showcase. Innovation, Engagement, Action: For a safe future (SAFETY 2022), Adelaide, Australia, March 22-26, 2021; Annual Conference of the European Association of Centers of Medical Ethics (EACME): SMART ETHICS. TRENDS TO THE FUTURE, Cluj-Napoca, September 9-11, 2021; The 4th International Conference on Non-Communicable Diseases Injury and Violence Prevention - Global Perspectives (online), Tbilisi, June 21-22, 2021; Trauma and Injury Network Meeting (online), Fogarty International Center/ NIH, USA, August 16, 2021; The 1st National Scientific Conference with international participation "One Health" approach in a changing world, 04-05 November 2021, Chisinau, Republic of Moldova; SAVIR Conference: Injury prevention for the Ages: Advancing violence and injury research across the lifespan, USA, March 30- April 1, 2022; EU-Safety 2022- Safety in a Digitized and Fast-Changing World. How Smart Will Injury Prevention Get? Vienna, Austria, June 23-24, 2022; Doctoral Programs in Public Health and social sciences. Final International Conference, Yerevan, Armenia, September 12-16, 2022; 38th edition of the Balkan Medical Week "Perspectives of Balkan Medicine in the post COVID-19 era", Chisinau, June 7-9, 2023.

At the same time, the research results were also approved in the framework of two pilot projects for young researchers within the iCREATE international project "Increasing Research Capacities in Eastern Europe", period 2016-2022, financed by the National Institutes of Health: the pilot project "Injury morbidity and mortality of various etiologies in the Republic of Moldova", scientific supervisors: Serghei Cebanu, MD, PhD, professor, Angela Cazacu-Stratu, MD, PhD, associate professor (January 1 - December 31, 2018); and the pilot project "Road injury prevention among population of the Republic of Moldova", scientific adviser: Cara Hamann, associate professor, College of Public Health, University of Iowa, United States (April-December 2020)

The research results were discussed and approved at the meeting of the Hygiene Discipline, Department of Preventive Medicine, *Nicolae Testemitanu* State University of Medicine and Pharmacy (minutes no. 14 of 29.05.2023), at the meeting of the Scientific Seminar within State *Nicolae Testemitanu* University of Medicine and Pharmacy, profile 331. Public health, specialties: 331.01 Epidemiology; 331.02 Hygiene; profile 333. Occupational health and biomedicine, specialty 331.01 Occupational hygiene (minute no. 3 of 28.06.2023).

Publications on the thesis topic. 41 papers were published, of which: 1 chapter in a collective monograph, 2 articles in ISI, SCOPUS journals, 3 articles in peer-reviewed foreign journals, 8 articles in peer-reviewed national journals (category B), 1 article in international scientific collections, 26 abstracts in the proceedings of national and international scientific conferences; 25 participations with oral communications (including posters), 2 innovator certificates.

PhD thesis structure. The thesis is presented on 183 pages, it includes the list of abbreviations, the list of figures and tables, introduction, 4 chapters, the synthesis of the results obtained, general conclusions, practical recommendations, the bibliography with 176 sources, the compartment with the annexes, the statement regarding the assumption of responsibility and the CV the author.

The positive approval of the Research Ethics Committee of the *Nicolae Testemitanu* State University of Medicine and Pharmacy was obtained for the doctoral thesis (minute no. 2 of March 4, 2020). At the same time, research capacities were developed through the successful completion of: the CITI program: Human Research, Group 1-Biomedical-IRB-01, Stage 1-Basic Course offer by University of Iowa and the Research Ethics and Methodology Program, offered by the Ichan School of Medicine from Mount Sinai, New York, United States of America in partnership with the Iuliu Haţieganu University of Medicine and Pharmacy in Cluj-Napoca, Romania, 2019-2021.

THESIS CONTENT

1. ROAD INJURIES – A CURRENT PUBLIC HEALTH PROBLEM

The peculiarities of road injuries were reviewed by noting the global aspects, the normative framework, the international and national programs in the prevention of road injuries, the risk factors in the occurrence of crashes and road injuries, as well as the good practices and preventive measures, their trends and perspectives. The analysis culminates with the presentation of modern approaches in maintaining road safety oriented towards a safe environment for road traffic participants, capable of contributing to the establishment of specific objectives in the future national strategy for road safety in the Republic of Moldova.

2. RESEARCH MATERIALS AND METHODS

A multidisciplinary approach was used to accomplish the goals and purpose stated in the current study in collecting, analyzing and interpreting data on the road safety of the population according to the research design, presented on figure 1.

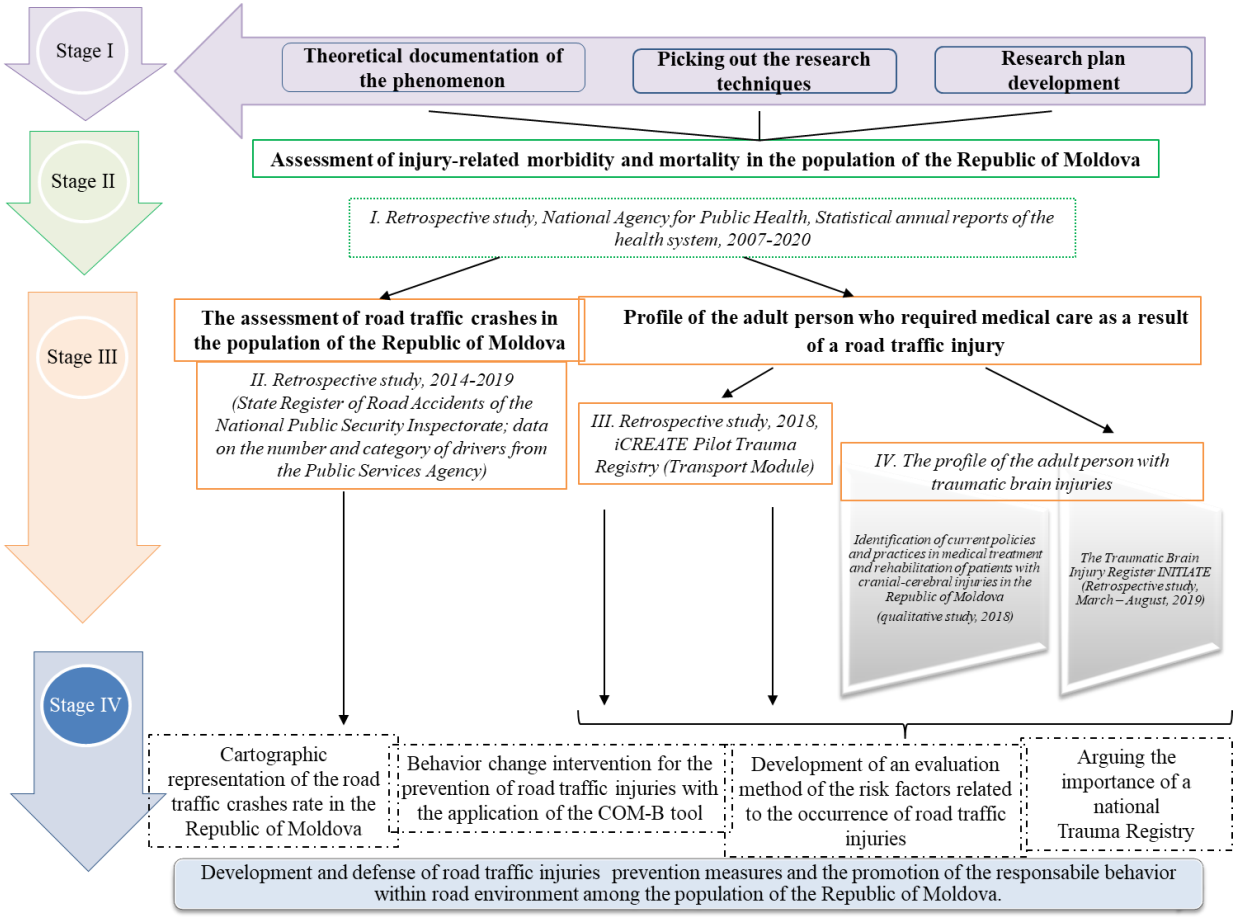

Figure 1. **Study design**

At **the 1st stage**, the theoretical documentation was carried out, by studying specialized bibliographic sources, choosing data collection and research methods, developing the research plan. The data of bibliographic sources were studied and described in a narrative way, reflecting the problem of crashes and road injuries, and the risk factors in their occurrence.

At **the 2nd stage**, a cross-sectional, retrospective, descriptive study was carried out regarding the general evaluation of injuries and a specific analysis of road injures among the adult population of the Republic of Moldova for the period 2007-2020. The data were extracted from the medical statistical yearbooks of the National Agency for Public Health, and statistical description and analysis was performed. Using Microsoft Excel 2021 and IBM SPSS Statistics 20, the maximum, minimum, chronological average, minimum and standard deviation, dispersion was calculated; the amplitude of the recorded variations was analyzed by indicating the corridor of fluctuations between μ and $\pm \sigma$; the confidence intervals (CI_{95}), the mathematical values of the tendency, coefficient of determination (R2), and the regression formula (Y).

The 3rd stage was divided into several parts:

The **first part** included a cross-sectional, descriptive, retrospective study on the analysis and evaluation of road crashes in the country's population based on data extracted from the automated information system "State Register of Road Accidents" of the National Public Security Inspectorate for the period 2014-2019. Data information on drivers classified by age groups, gender and the districts of the country, as well as the administrative-territorial units of the country in files with the extension .shp – geospatial vector data format for the Systems software, were taken from the Public Services Agency geographic information at district level, according to an agreed structure. With the use of the data from both registers, we were able to investigate the specific features of crashes and create district-level graphical representations of the locations most vulnerable to collisions and injuries.

In the **second part**, the profile of the person who suffered an injury in a vehicle crash that required medical care was examined. In this regard, two particular studies were conducted:

a. Focused on the adult who has suffered an injury of a car crash- retrospective, descriptive and analytical cross-sectional study. All injuries resulting from a road crash were analyzed (all adults involved in a motor vehicle crash as a driver, passenger, pedestrian or cyclist) registered during 12 months (2018) at the Institute of Emergency Medicine were analyzed, using data from the iCREATE Pilot Trauma Registry "Increasing Capacity in Research in Eastern Europe", international project no. 2D43TW007261-11, implementation period 2016-2021, funded by the National Institutes of Health, USA (favorable opinion of the Research Ethics Committee of the *Nicolae Testemitanu* State University of Medicine and Pharmacy no. 43 of 15.08.2018). Data from the pilot registry were collected retrospectively by applying the iCREATE questionnaire based on information from medical records of injured patients, without direct contact with patient, initially on paper and then using the RED Cap (Research Electronic Data Capture) - an electronic, in-browser data software with metadata and workflow methodology for the design of clinical and translational research databases, designed to support data capture for various research studies. The data collection tool contains general data and 5 additional compartments. The Transport section contains information describing the role of the injured person in the accident, the type of vehicle involved, the use of safety devices.

b. Focused on the adult with traumatic brain injury (TBI) as a result of a car crash- all traumatic brain injuries resulting from a road crash registered at the Institute of Emergency Medicine were analyzed, using data from the INITIaTE Registry: International collaboration to increase the Surveillance of Traumatic Brain Injuries in Europe, international project no. 5R21NS098850, funded by the US National Institutes of Health, conducted in parallel in 3 countries: Armenia, Georgia and Moldova. The research included 2 stages:

1. Qualitative descriptive study (2018) with the study and identification of existing practices and policies regarding the treatment and rehabilitation of TBI patients in the Republic of Moldova. Were conducted 7 face-to-face structured interviews with health professionals. The interview guide was modeled according to a standard operating procedure with a set of open-ended questions. The interviews lasted between 30 minutes and an hour and a half. With the specialist's permission, the interviews were audio recorded and used for transcription and research purposes only.

2. Retrospective cross-sectional study (March 1-August 31, 2019), regarding the particularities of TBI patients from the road environment. The data of the INITIaTE pilot register, compiled on the basis of the information presented by the Institute of Emergency Medicine, conducted over a period of 6 months, with the inclusion of adult patients with an ICD10 with any type of head injury, were used. Transport-related head injuries were examined according to demographic, patient and crash characteristics. The electronic data collection tool for the pilot registry was the INITIaTE questionnaire, the REDCap electronic data collection tool loading data, and analyzed with IBM SPSS Statistics 20 and Microsoft Excel 2021.

At **4th stage**, a method for evaluating risk factors for road crashes and injuries and an intervention to change road behavior for the prevention of road injuries was developed using the COM-B tool. This tool allowed to identify ways of behavior changes and aspects that can be changed, mainly in capabilities, opportunities and motivation, and development of an own intervention to change the problematic road behavior. Additionally, cartographic representations of the road crashes and road injuries in the Republic of Moldova were performed, and arguments were made for the necessity of establishing a national trauma register.

3. PARTICULARS OF MULTIANNUAL MORBIDITY AND MORTALITY OF ROAD CRASHES AND INJURIES IN THE REPUBLIC OF MOLDOVA

3.1.The general characteristic of injuries among the adult population in the period 2007-2020

Knowledge of the multiannual dynamics of morbidity and mortality in a population or subgroups of populations is of great importance for the development of policy documents, strategies and national plans. Consequently, we deemed it essential to delineate the prevalence of the investigated phenomenon within the adult population of the Republic of Moldova. In the digital register of health data, through the lens of the statistical yearbooks of the health system within the National Agency for Public Health, all types of injuries are in the category of traumatic injuries, poisoning and other consequences of external causes (S00-T98). In the general prevalence of the population for the period of 2007-2020, traumatic injuries, poisoning and other consequences of external causes in the Republic are ranked VIII with 3321.6±781.4 cases per 100 thousand population in the general population and on the place IV with 8363±2568.8 cases per 100 thousand population in the Chisinau municipality. The injury incidence values (figure 2) indicate a decreasing trend in the number of cases for the last 14 years (2007-2020); in the Republic of Moldova, new cases decreased by 2.3 times in the general population, the average being 3061.3±895.96 cases (from 3583.3 cases per 100 thousand population to 1529 cases) and by 2.6 times among adults, the average being 2721.3±957.53 (from 3347.2 cases per 100 thousand population to 1270.1 respectively).

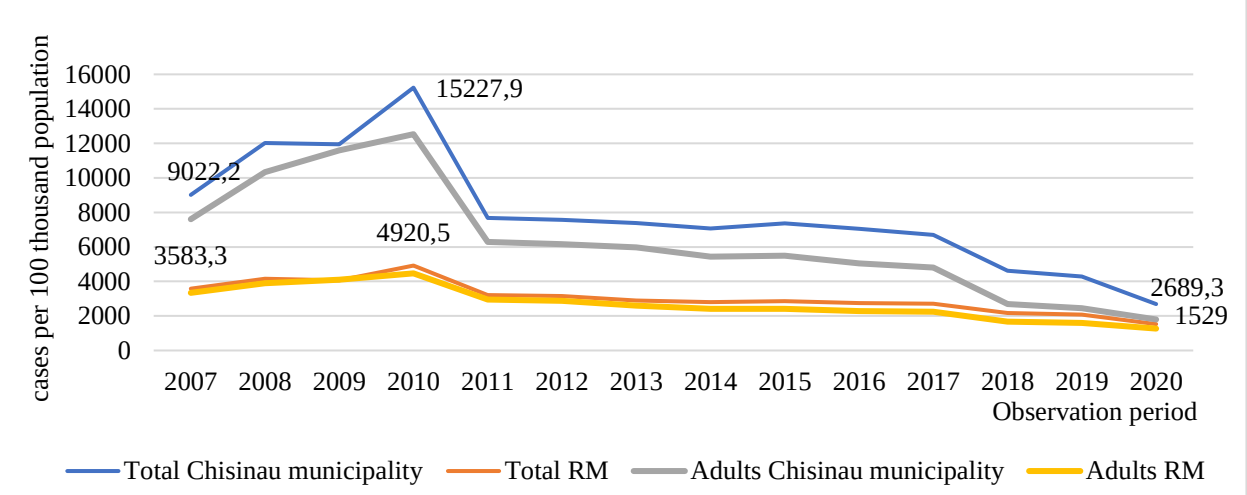

Figure 2. **The incidence of injury in the Chisinau municipality and in the Republic of Moldova, for the period 2007-2020, per 100 thousand population**

In the Chisinau municipality, a decrease was observed in the incidence of injury of 3.3 times in general population (from 9022.2 cases per 100 thousand population to 2689.3 cases respectively) with the average of 7902.3±3315.33 cases and of 4.2 times among adults (from 7605.4 cases per 100 thousand population at 1797.6 cases) the average being 6301.4±3260.94 cases.

The average of population mortality indicators by the main causes of death, for the period 2007-2020, ranks injury and poisoning in fourth place in the Republic of Moldova (with 81.3±13 cases per 100 thousand population) and in the Chisinau municipality (54.5± 10.7 cases per 100 thousand population). According to the mortality indicators of the population according to the types of injuries and poisoning (figure 3), injury caused by road crashes ranks second both in the

republic (11.6±2.45 cases per 100 thousand population) and in the municipality (8.3±2.69 cases per 100 thousand population).

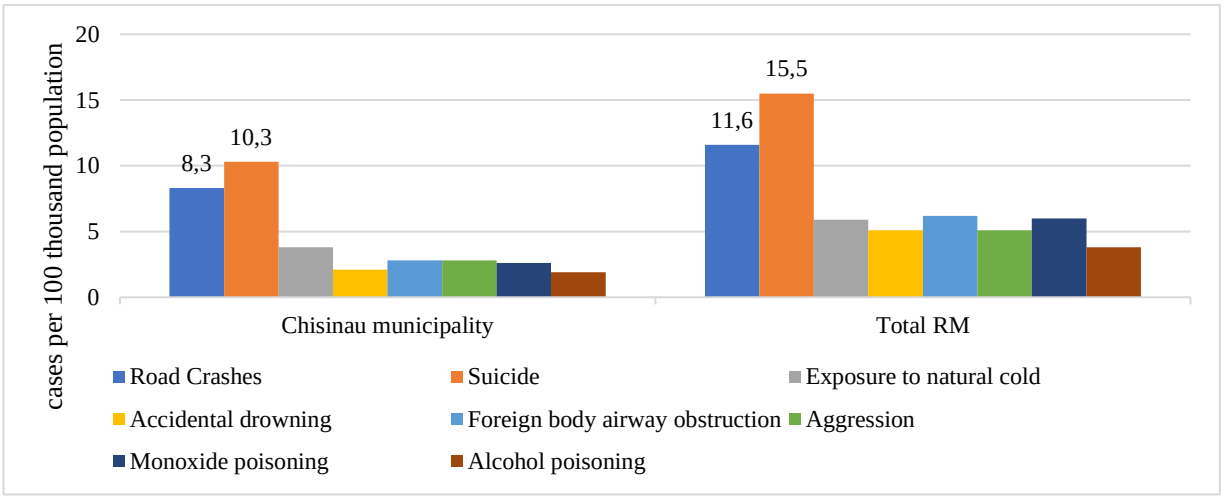

Figure 3. **Mortality of the population by types of injuries and poisoning in the Chisinau municipality and in the Republic of Moldova as a whole, average for the period 2007-2020, per 100 thousand population**

With reference to the mortality of the population (figure 4) caused by traffic crashes during the years 2007-2020 in the Chisinau municipality and in the Republic of Moldova as a whole, there is an obvious tendency to decrease (2 times) - from 16.5 ± 2, 45 cases per 100 thousand population to 8.2 ± 2.45 cases respectively in the republic and from 14.5 ± 2.69 cases per 100 thousand population to 5.7 cases ± 2.69 respectively in the municipality (2.5 times).

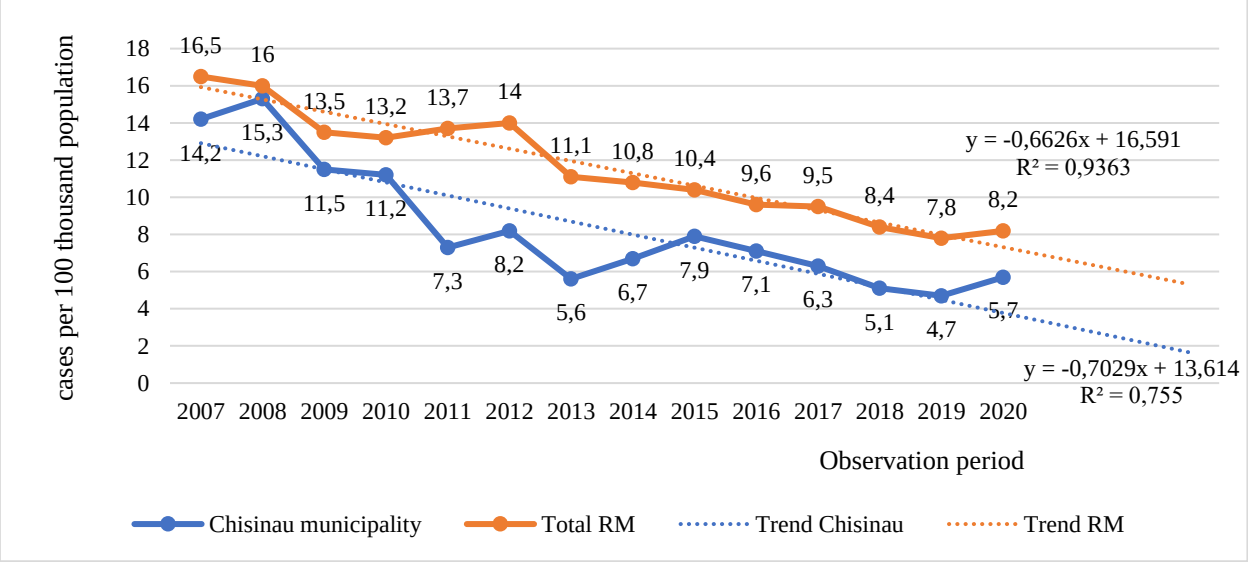

Figure 4. **Mortality of the population due to traffic crashes in the Chisinau municipality and in the Republic of Moldova as a whole for the period 2007 - 2020, per 100 thousand population**

3.2.The specific characteristic of injuries and road crashes

In the period of 2014-2019, 13117 road crashes were registered, their number increasing by 1.8%: from 2017 cases (15.4%, CI_{95} 13.80-16.95) in 2014 to 2254 of cases in 2019 (17.2%, CI_{95} 15.63-18.74). On average, during the study period, 2185.8 ± 116.88 cases of road crashes were registered. Territorially, the most road crashes, 51.3% (CI_{95} 50.08-52.47), were registered in the Chisinau municipality, followed by the Balti municipality with 3.8% (CI_{95} 2.08-5, 44),

Criuleni with 3.7% (CI_{95} 2.04-5.40), Orhei with 3.3% (CI_{95} 1.66-5.02) and Telenesti with 2% (CI_{95} 0.26-3, 65). The majority of road crashes occurred on Fridays - 15.8% (CI_{95} 14.23-17.37), followed by Mondays with 14.7% (CI_{95} 13.12-16.28) and on Sunday by 14.6% (CI_{95}13.02-16.18). The causes of road crashes are multiple and diverse. Throughout the observation period, pedestrian collisions predominated, constituting an average of 36.2% (CI_{95} 34.87- 37, 60).

During the observation period, a number of 21,920 people involved in road crashes were registered. Each road accident occurred with the involvement of at least one person and in approximately half of the cases two people were injured. Of these, 14,526 (66.3%, CI_{95} 65.50-67.04) cases of easy injuries, 5540 (25.3%, CI_{95} 24.13-26.42) cases of severe injuries and 1854 cases of death (8.5%, CI_{95} 7.19-9.72). The average number of injuries throughout the study period was 3653.3±126.84 cases per year, including deaths. Of those injured, 1336.5±99.44 were among females, while 2295.7±52,38 was among males. Table 1 reveals that of the total number of injured individuals, 13,774 (62.8%, CI95 62.03–63.64) were reported among men and 8019 (36.6%, CI_{95} 35.53–37.64) among women. Among people older than 18 years, was registered 19,790 cases of various injuries, of which 45.2% (CI_{95} 44.35-46.41) belong to the 31-64 age group, following the age group 25-30 years with 14.2% (CI_{95}12.92-15.50), and the age group of 21-24 years with 10.1% (CI_{95} 8.73-11.37). On average, during the observation period, 3298.3±137.13 people over 18 years old were injured, among them 1496.7±107 people aged between 31-64 years old, 468.7±55.81 people aged 25-30 years old, 331.5±41.71 people aged 21-24 years old, and the fewest 197.8±12.37 people aged 18-20 years old. More than half of road crashes resulted in minor injuries (65%, CI_{95} 64.72-77.35), 1/4 – severe injuries (24.5%, CI_{95} 24.34-26.74), and deaths were recorded in 8.9% (CI_{95} 7.60-10.26) of the cases.

Table 1. **The rate of road crashes and injured persons, in the period 2014-2019**

Years, gender			**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
Crashes		**N**	2017	2091	2159	2316	2278	2254	**13115**
		%	15,4	15,9	16,5	17,7	17,4	17,2	
		CI_{95}	13,80-16,95	14,37-17,51	14,90-18,03	16,11-19,21	15,81-18,93	15,63-18,74	
Injured persons*	**Woman's**	**N**	1187	1272	1314	1408	1462	1376	**8019**
		%	34,4	35,3	35,9	37,4	38,4	37,9	**36,6**
		CI_{95}	31,69-37,1	32,65-37,9	33,27-38,46	34,91-39,96	35,87-40,86	35,37-40,5	35,53-37,64
	Men's	**N**	2246	2315	2337	2332	2330	2214	**13774**
		%	65,1	64,2	63,8	62	61,1	61	**62,8**
		CI_{95}	63,11-67,05	62,25-66,15	61,83-65,73	60,03-63,97	59,16-63,12	59,01-63,07	62,03-63,64
	Missing data	**N**	18	19	13	21	19	37	**127**
		%	0,5	0,5	0,4	0,6	0,5	1	**0,6**
		CI_{95}	-2,81-3,85	-2,73-3,78	-2,88-3,59	-2,63-3,75	-2,67-3,67	-2,22-4,26	-0,74-1,90
	Total	**N**	3451	3606	3664	3761	3811	3627	**21920**
		%	15,7	16,5	16,7	17,2	17,4	16,5	
		CI_{95}	14,53-16,96	15,24-17,66	15,51-17,92	15,95-18,36	16,18-18,59	15,34-17,76	

* Injured persons (indicated in our own databases N Injury, represents the total number of deaths, severely and easy injured persons; e.g., N Injured persons = N Deaths + N Severe injuries + N Easy Injuries)

With regard to the category of the traffic participant, the data showed that 14,425 people of all ages suffered, for 437 (3%, CI_{95} 1.42-4.64) the category indication was missing, which

constitutes an average of 72, 8±54.46 cases. The most numerous injured categories involved in road crashes are pedestrians - a third or 4838 people (33.5%, CI_{95} 32.22- 34.88), on average 806.5±54.49 cases, followed by drivers - 3199 people (22.2%, CI_{95} 20.74- 23.62), on average 533.2±33.02 cases, and the passengers in the vehicle - 2787 cases (19.3%, CI_{95} 17.85- 20.79) on average 464.5±22.34 cases. Next in the ranking, in order of decreasing weight, are motorcyclists 786 people (5.4%, CI_{95} 3.86-7.04), on average 131±22.02 cases, cyclists with 468 people (3.2%, CI_{95} 64- 4.85), on average 78±25.71 cases, passenger transport with 590 cases (4.1%, CI_{95} 2.49-5.69), on average 98.3±11.60 cases, and motorcycle passengers with 255 cases (1.8%, CI_{95} 0.15-3.39), on average 42.5±5.09 (table 2).

Table 2. **Injured persons involved in road crashes according to the category of the participant involved in road traffic**

Category of the participant	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total (N/%)**		**CI_{95}**
Cyclist	60	68	74	54	87	125	**468**	**3,2**	1,64- 4,85
Rider	0	1	0	0	0	0	**1**	**0,0**	-1,62- 1,64
Driver of another type of vehicle	10	11	14	17	25	24	**101**	**0,7**	-0,93- 2,33
Driver of the transport of loads	21	22	14	15	23	23	**118**	**0,8**	-0,81- 2,44
Driver of the passenger transport	8	8	12	10	10	9	**57**	**0,4**	-1,23- 2,02
Car driver	510	520	534	596	534	505	**3199**	**22,2**	20,74- 23,62
Scooter driver	67	63	54	30	42	70	**326**	**2,3**	0,65- 3,87
Teamster	28	21	27	27	25	23	**151**	**1,0**	-0,58- 2,67
Motorcyclist	110	136	122	106	155	157	**786**	**5,4**	3,86- 7,04
Passenger of another type of vehicle	8	15	10	7	9	19	**68**	**0,5**	-1,16- 2,10
Passenger of the transport of loads	8	15	9	13	10	13	**68**	**0,5**	-1,16- 2,10
Passenger of passenger transport	90	95	84	107	116	98	**590**	**4,1**	2,49- 5,69
Passenger of the hypomobile transport	14	15	16	11	20	18	**94**	**0,7**	-0,97- 2,28
Car passenger	450	462	503	478	446	448	**2787**	**19,3**	17,85- 20,79
Bicycle passenger	2	3	1	2	4	5	**17**	**0,1**	-1,51- 1,75
Motorcycle passenger	45	45	36	39	40	50	**255**	**1,8**	0,15- 3,39
Scooter passenger	13	12	9	5	10	14	**63**	**0,4**	-1,19- 2,07
Pedestrian	779	751	797	901	774	837	**4839**	**33,5**	32,22- 34,88
Missing data	30	53	55	69	181	49	**437**	**3,0**	1,42- 4,64
Total	2253	2316	2371	2487	2511	2487	**14425**	**100**	

In the State Register of road accidents, crashes with or without injuries, they are classified into 3 groups: road crashes with the participation of several types of transport - 5675 cases (39.3%, CI_{95} 38.07-40.61); crashes involving vehicles and pedestrians - 4727 cases (32.8%, CI_{95} 31.43-34.11); and crashes involving a single vehicle - 4023 cases (27.9%, CI_{95} 26.50-29.27).

The most vulnerable category to road crashes - pedestrians, are most often involved in buffering on the spaces intended for their circulation, in a proportion of 41.6%; one third (33.3%) - irregular crossing or stationery on the carriageway side of the road, and 13.9% - driving on the right side of the road. The next category of people vulnerable to traffic - drivers, were involved in road crashes with the participation of one or more vehicles. The most frequent

were side collisions (35.4%) or frontal collisions traveling from opposite directions (12.3%) and hitting an obstacle outside the roadway (18.3%). Passenger transport drivers were also involved in side collisions (26.3%), frontal collisions (22.8%) and collisions with off-road obstacles (14%). Cargo transport drivers, according to the data, were involved in reversals at a rate of 39%, collided with an off-road obstacle at 20.3%, and were engaged in frontal collisions at 9.3%. Vehicle passengers, the third category of road traffic vulnerable individuals, were particularly exposed to rear impact (36.1%) through lateral or frontal collisions (12.6%) or with rear impact involving an obstacle (16.3%). It should be noted that cyclists, motorcyclists, and motorcycle passengers also fall into the category of road traffic vulnerable individuals.

3.3. Analysis and assessment of road traffic injuries according to health care addressability

According to the obtained data, a profile was created of the adult person who required medical care as a result of an injury from the road environment. With reference to the demographic data, the adult traumatized persons (n=433) who sought medical care at the Emergency Department of the Institute of Emergency Medicine were aged between 18-91 years, the average age was 41.1 ± 16.36 years, of which men 63.7% (n=276, CI_{95} 58.07-69.41), women 33.9% (n=147, CI_{95} 26.29-41.60) and in 2.3% (n=10, CI_{95}-7-11.62) unknown. Among the 18–39-year old age group with a road injury, which constitutes half of all registered cases (52%), men prevailed (36.3%) (figure 5).

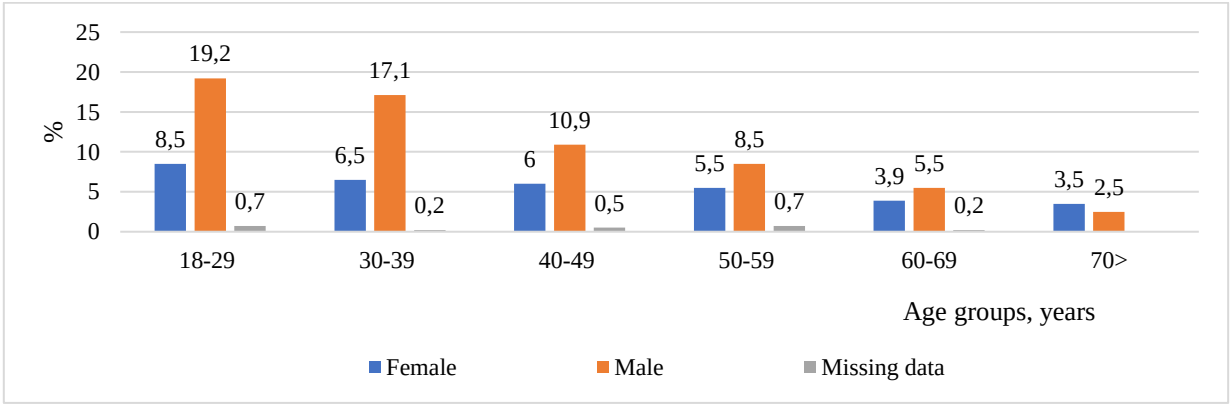

Figure 5. **Distribution of the observation group by age group and gender, %**

Of the total number of injured persons who sought emergency medical assistance, 42.3% (CI_{95} 35.11- 49.42) were treated in inpatient conditions, 41.6% (CI_{95} 34.37-48.77) were treated inpatient and discharged with follow-up observations. In 6.7%% (CI_{95} -2.40-15.80) of the cases, people were examined without being hospitalized, 6.5% (CI_{95} -2.64-15.58) received treatment without requiring observation later, and 6.7% (CI_{95} -2.40-15.80) were discharged without treatment, 0.7% (CI_{95} -8.69-10.08) were transferred to another medical institution.

In 45% (CI_{95} 38.05-52.02) of road crashes, people were moving from one place to another with a light vehicle, in 11.3% (CI_{95} 2.45-20-19) - as pedestrian, in 9.5% (CI_{95} 0.51-18.43) - in a two-wheeled vehicle, in 2.3% (CI_{95}-7.00-11.62) - on a bicycle, in 1.6 % (CI_{95}-7.73-10.96)- in a heavy vehicle, and in 27% (CI_{95} 18.97-35.07)- the means of transport was not specified. As a co-participant, light vehicles are also noted, involved in 40.4% (CI_{95} 33.14-47.69), an unspecified obstacle- 27.7% (CI_{95} 19.71-35.72), neither homologous- 19.2% (CI_{95} 10.70- 27.64), with pedestrians- 1.8% (CI_{95}-7.48-11.18), with two-wheeled vehicle- 1.8% (CI_{95} -7.48 -11.18), with a heavy vehicle- 1.6% (CI_{95} -7.73- 10.96), or with a transport without a motor- 0.9% (CI_{95}-8.45-

10.30) (table 3). The chi-square test of independence ($\chi 2$) to assess the relationship between the means of transport involved in a road accident and age groups showed a significant relationship between these two variables ($\chi 2 = 32.79$; $p = 0.00786$). Every third injured patient (28.4%, CI95 20.44-36.92) was a driver at the time of the injury, and every fourth (25.2%, CI95 17.03-33.32) former pedestrian or passenger (20.3%, CI_{95}11.92-28.73). Males predominated in all injury groups ($\chi 2 = 22.45$; $p = 0.00001$).

Table 3**. Characteristics of the vehicle type and the co-participant in crash**

	Vehicle type			**Co-participant in road crash**		
	N	**%**	**CI_{95}**	**N**	**%**	**CI_{95}**
Not specified	117	27,0	18,97-35,07	120	27,7	19,71-35,72
The all-terrain motor vehicle	4	0,9	-8,45-10,30			
Bicycle	10	2,3	-7,00-11,62	4	0,9	-8,45- 10,30
Heavy vehicle	7	1,6	-7,73-10,96	7	1,6	-7,73-10,96
Light vehicle	195	45,0	38,05-52,02	175	40,4	33,14-47,69
Another mode of transport	8	1,8	-7,48-11,18	24	5,5	-3,61-14,70
Other non-motorized / non-motorized transport	2	0,5	-8,94-9,86	4	0,9	-8,45-10,30
Pedestrian	49	11,3	2,45-20,19	8	1,8	-7,48-11,18
The two-wheeled vehicle	41	9,5	0,51-18,43	8	1,8	-7,48-11,18
No counterpart				83	19,2	10,70-27,64
Total	**433**	**100%**		**433**	**100%**	**0,06-1,94**

Most of the people injured in road crashes – 39% (CI_{95} 31.68-46.38) were diagnosed with fractures, 29.8% (CI_{95} 21.90-37.68) – with contusions/bruises, 9.2 % (CI_{95} 0.26-18.21) – with concussions/brain injuries, 9.7% (CI_{95} 0.75-18.65) – with open wounds. The most affected body parts were head (18.2%, CI_{95} 9.73-26.76), face (8.3%, CI_{95}-0.71-17.33), lower part of the leg (8, 3%, CI_{95} 0.71-17.33) and chest (6.7%, CI_{95} –2.40-15.80). Of the total number, 27% (n=117) suffered a double or multiple injuries, including 41% (CI_{95} 27.11-54.94) – contusion and bruises, 29.9% (CI_{95} 14.74 -45.08) – fractures, 20.5% (CI_{95} 4.36-36.67), and 6% (CI_{95}–11.59-23.55)-concussion/traumatic brain injuries.

In the first hour after the accident, 94 people (21.7%, CI_{95} 13.37-30.04) sought emergency medical assistance, between 1 and 4 hours – 88 people (20 .3%, CI_{95} 18.24-34.41) and after more than 4 hours – 114 people (26.3%, CI_{95} 18.24-34.41). More than half (53.2%) – sought medical care after 40-60 min after the injury, 29.8% – in the first 20-40 min, and only 17% – in the first 20 min.

Most cases of road injuries were recorded on Mondays (15.5%, CI_{95} 6.81-24.13), Fridays (14.5%, CI_{95} 5.84- 23.26) and on Sundays (13.4%, CI_{95} 4.63-22.16). On these days, the age groups of 18-29 years old and 30-39 years old suffered the most, and on Tuesdays and Wednesdays – from the age group of 30-39 years old. During the day, two peaks in the production of TR are highlighted: the first in the interval 08.00-12.00 (27.2%, CI_{95} 17.64-36.79), the most pronounced, and the second in the interval 16.00-20.00 (23.6%, CI_{95} 13.80-33.42). The 18-29 years old age group registers the most cases between 20:00 and 00:00 (7.2%), the 30-39 years old age group - between 16:00 and 20:00 (7.2%), and the age groups of 40-49 years old, 50-59 years old and > 70 years old – in the first half of the day between 08.00 and 12.00 (5.6%, 3.9% and 3.6% respectively).

3.4.Analysis and assessment traumatic brain injuries as a result of a road crash after addressability to medical assistance

Identification of existing practices and policies regarding the treatment and rehabilitation of the patient with traumatic brain injuries in the Republic of Moldova. During the study period, it was observed that traumatic brain injuries (TBI) were rising, the number of hospitalizations increased, as well as the number of people who required treatment or rehabilitation services. The most common mechanisms that lead to traumatic brain injuries were fall injuries and road crashes, among children and the elderly cerebral traumas from falls predominate, and among young people and adults - road injuries prevail. Traumatic brain injuries represent the totality of primary, secondary and late injuries to the skull and brain produced by the direct or indirect action of a mechanical agent. According to the data obtained from the interviews with health specialists from the hospitals included in the project, it was elucidated how the system of pre-hospital care works, definitive care, treatment and care of patients with TBI in hospitals, access to rehabilitation, general gaps in the treatment and prevention of TBI and the resources allocated to TBI at the country level.

Profile of the patient with TBI resulting from road traffic accident in relation to addressability data for emergency medical assistance. The profile of the adult person with TBI resulting from addressability to emergency departments was established based on data from the INITIATE pilot registry. During the studied period, 368 patients with TBI, 201 adults, were registered. 113 (30.7%, CI_{95} 22.20-39.21) patients with TBI as a result of a road accident of all ages, 63 exceeding the age of 18 (55.8%, CI_{95} 46.59-64.91). TBI following a road accident were registered in people aged between 18 and 79 years, average 46.7±17.2 years. More exposed to this type of injuries were people above 60 years old age group with a weight of 23.28% (CI_{95} 11.96-32.49), followed by those in the 19-29 years old age group with 22.2 % (CI_{95} 11.96-32.49) and 30-39 years with 17.5% (CI_{95} 8.09-26.83). The most affected by TBI were men (74.6%, CI_{95} 62.16-87.05). The highest number of cases was recorded in August (22.2%, CI_{95} 0.44-44.00), with June closely following at 19% (CI_{95} -3.17-41.27). Most of the injuries occurred in the urban environment (87.3%, CI_{95} -78.50-96.10), unintentional (98.4%, CI_{95} 95.30-101.52) and most of the cases have arrived at the hospital by ambulance (95.2%, CI_{95} 89.85-100.63).

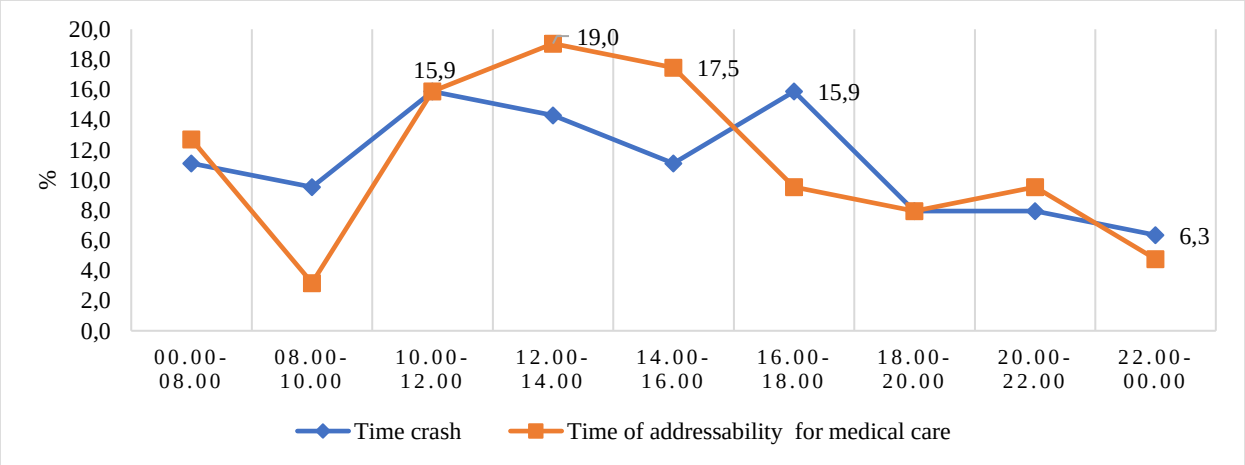

Figure 6. **Reporting of TBI cases caused by road traffic depending on the time of the crash and the time of addressability for emergency medical assistance, %**

The highest rates of TBI were recorded between 10.00-12.00 and 16.00-18.00 (15.9% each, CI_{95} -2.10-33.85), and the fewest road crashes between 22.00-00.00 (6, 3%, CI_{95} –12.62-25.32). The peak times of seeking medical care in case of TBI (figure 6) were 12.00-14.00 (19%,

CI_{95}–6.61-44.70) and 14.00-16.00 (17.5%, CI_{95} –10.66-45.58). Between the hours of 10.00-12.00 and 16.00-18.00 the highest rates of TBI and referral for medical care were recorded.

Most TBIs occurred with the participation of pedestrians, accounting for 49.2% (CI_{95} 31.60-66.80), predominantly among individuals aged over 60 (14.3%). A percentage of 25.4% (CI_{95} 4.07-46.73) occurred as a result of road crashes with motor vehicles, notably among individuals aged 40-49 (7.9%). TBIs resulting from motorcycle crashes represented 12.7% (CI_{95} 10.37-35.77). TBIs from bicycle crashes were 11.1% (CI95 12.17-34.37), while public transport-related TBIs were 1.6% (CI_{95} 22.99-26.19) (figure 7).

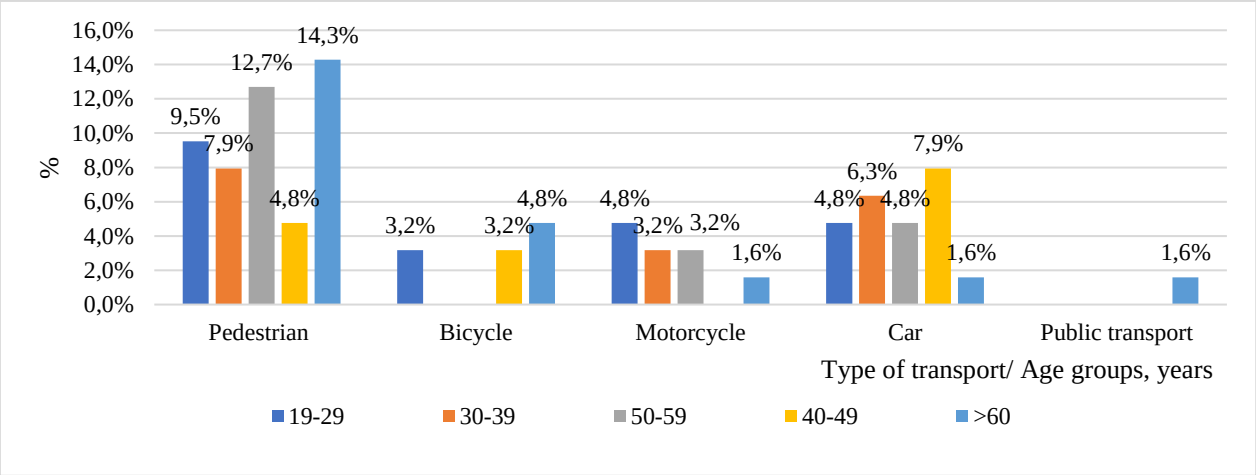

Figure 7. **Distribution of traumatic brain injuries according to the type of transport involved, %**

Regarding the injured persons, pedestrians comprised 47.6% (CI_{95} 5 29.75-65.49), followed by drivers at 33.3% (CI_{95} 13.17-53.50) and passengers at 19% (CI_{95} –3.17-41.27). Men had the highest incidence of head injuries among pedestrians (42.6, CI_{95} 20.88-64.22) and similarly prevailed in drivers (36.2%, CI_{95} 13.33- 59.01) and passengers (21.3%, CI_{95} -4.09-46.64) (figure 8).

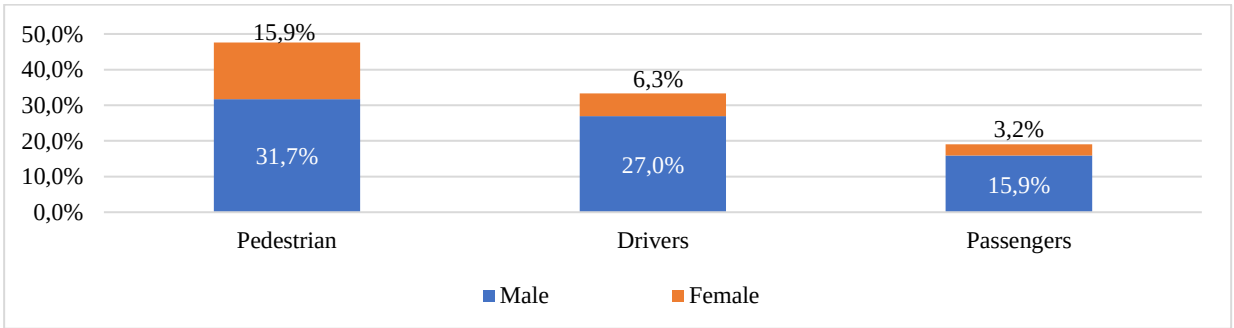

Figure 8. **Distribution of traumatic brain injuries among road traffic participants, %**

The Glasgow Coma Scale (GCS) was used to evaluate the patients' level of consciousness in order to determine the severity of their TBIs. Consciousness of TBI patients was assessed at three points: the injury site, the emergency department, and the time of discharge. At the injury place, patients with minor GCS (13–15 p) had a state of consciousness of 77.8% (CI_{95} 66.14–89.42), medium GCS (9–12 p) was 19.1% (CI_{95} 3.17–41.27), and severe GCS (8) was 3.2% (CI_{95} 21.11–27.45). At the emergency department, all required resuscitation medical care were given, however, only 55.6% (39.10-72.02) were in a minorly conscious state, medium – 31.8% (CI_{95}11.35-52.15), and severely – 2.7% (CI_{95} -8.53-13.93). Patients' clinical conditions varied as they neared discharge, with patients with minor GCS making up 79.4% (CI_{95} 68.15-90.59), and severe GCS making up 20.6% (CI_{95} -1.37-42.63).

4. DEVELOPING THE TERRITORIAL PROFILE OF REGIONS WITH A HIGHER RISK OF ROAD CRASHES AND INJURIES AND TAKING STEPS TO ENCOURAGE RESPONSIBLE BEHAVIOR

4.1.Territorial distribution of road crashes and injuries in the Republic of Moldova

The most road crashes per 100 thousand population occur in the Chisinau municipality (category 181-271), followed by the Center area with the districts of Strășeni, Ialoveni, Cimișlia, Criuleni, Călărași, Orhei, Telenești and Edineț with a rate of 86-181 cases per 100 thousand population. The Chisinau municipality also stands out with the highest rate of road crashes per 1,000 people with a driver's license, followed by the districts Orhei, Sângerei and Florești. When analyzing the distribution of severe road injuries and deaths from road crashes in the period 2014-2019 (figure 9) on the districts of the country per 1000 road crashes illustrated in quartiles, the districts with the highest rate of this variable (713-1,119) stand out, namely: districts from the South area – UTA Gagauzia, Cantemir, Cimișlia, Ștefan Vodă and districts from the Center-North area – Ungheni, Șoldănești, Florești and Râșcani. The districts of Cahul, Nisporeni, Strășeni, Călărași, Telenești, Rezina, Sângerei, Drochia, Soroca and Edineț fall into class 2 with the rate of severe road injuries and deaths per 1000 road crashes of 630-712. The lowest rate of this variable (262-514) was recorded in some districts of the Center area (Leova, Ialoveni Criuleni, Orhei), Chisinau municipality, and the North (Dondușeni and Briceni) (figure 9).

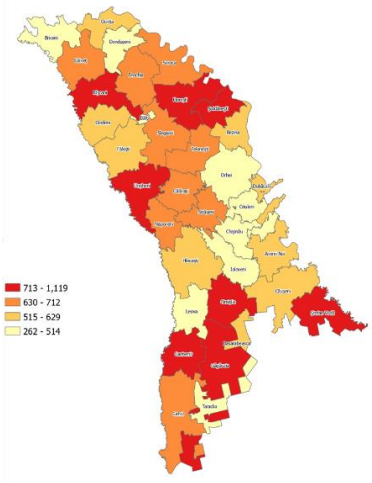

Figure 9. **Distribution of severe road injuries and deaths in the country's districts for the period 2014-2019 (quartiles) per 1000 road crashes**

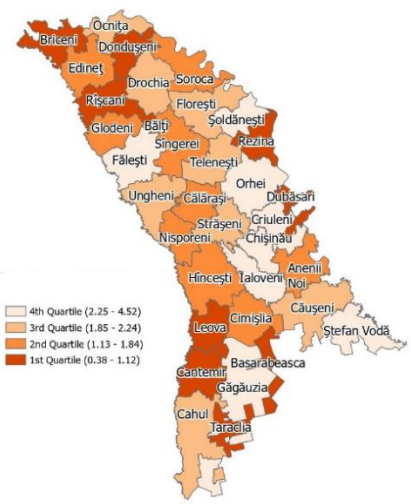

Figure 10. **Territorial distribution of road crashes for the period 2014-2019 (quartiles) per 1000 people with a driving license**

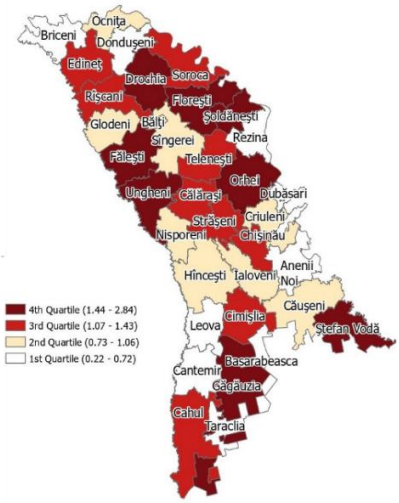

Figure 11. **Territorial distribution of severe injuries and injuries for the period 2014-2019 (quartiles) per 1000 people with a driving license**

According to the distribution of road crashes per 1,000 people with a driving license (figure 10), the districts of Leova, Cantemir, Taraclia, Dubăsari, Rezina, Râșcani, Dondușeni, Briceni are in the first quartile (0.38-1.12). Among the districts with the fewest road crashes per 1,000 people with driving licenses are Fălești, Șoldănești, Orhei, Criuleni, Ialoveni, Ștefan Vodă, Basarabeasca, UTA Găgăuzia and the municipality of Chișinău. The rate of severe road injuries and deaths per 1000 people with a driving license (figure 11) was higher (1.44-2.84) in the districts of UTA Gagauzia, Basarabeasca, Ștefan Vodă, Orhei, Ungheni, Fălești, Soldănești, Florești, Drochia. Briceni, Dondușeni, Rezina, Leova, Anenii Noi, Cantemir and Taraclia are among the districts with the fewest severe road injuries and road traffic deaths per 1000 people with a driving license.

Fălești district stands out with the highest rate of road crashes per 1000 persons with a male driver's license (14.3-35), along with eight other districts - Șoldănesti, Orhei, Criuleni, Ialoveni, Ștefan Vodă, Basarabeasca, UTA Gagauzia and the Chisinau municipality. At the same time, the municipality of Fălești, along with the municipalities in the same category, such as Orhei, Ștefan Vodă, Basarabeasca, Găguzia, Șoldănesti, also registers the highest rate of deaths and severe road injuries per 1000 males with a driver's license (9.6-18), also from the districts Drochia, Florești, Ungheni. For 7 districts of the country, Leova, Cantemir, Rezina, Dondușeni, Briceni, Anenii Noi and Taraclia, were specific lower rate of deaths and severe road injuries among men per 1000 individuals with driver's license.

The Chisinau municipality was characterized by the highest rate of road crashes per 1000 individual of the female gender with a driver's license (55.9-85.4), common with 8 other districts of the country, such as Orhei, Fălești, Șoldănești, Florești, Drochia, Ștefan Vodă, Basarbeasca and UTA Găgăuzia.

For the districts of Fălești, Șoldănești, Florești, Drochia, Ștefan Vodă, Basarbeasca and UTA Găgăuzia, the most road crashes deaths and severe injuries were specific. In the category of deaths and severe road injuries among women per 1000 females with driving license (8.5-17.5) was held by: Ștefan Vodă, Basarbeasca, UTA Gagauzia, Ungheni, Fălești, Telenești, Șoldănești, Florești and Drochia. By excluding Telenești and including Soroca, we obtained the top of the districts with the highest rates of severe road injuries and deaths per 1000 people with a female driver's license. The rate of severe road injuries and deaths per 1000 people with a female driver's license was lower in the districts where high values of this variable were recorded, with the exception of Cimișlia and Taraclia districts, but with the inclusion of Anenii Noi district and Chisinau municipality.

The distribution of severe road injuries and deaths by gender per 100 thousand population (figure 12-13), allowed highlighting the districts with specific aspects of the distribution of injuries between male and female driver's license holders.

Thus, in the districts of Telenești, Călărași, Cimișlia, and the Chisinău municipality, the highest rate of severe road injuries and deaths in both genders was recorded (45.2-84.5 female persons, 129.9-188.5 male persons), including tEdineț, Drochia, Ungheni – mostly among female drivers, and Râșcani, Florești, Nisporeni, Ștefan Vodă - only for male drivers. The lowest rate of deaths and severe injuries among women was noted in the districts of Cahul, Taraclia, Basarabeasca, Leova, Ialoveni, Sângerei, Șoldănești and Dondușeni, and among men with driving licenses in the districts of Taraclia, Basarabeasca, Leova, Hâncești, Rezina, Soldănești and Dondușeni.

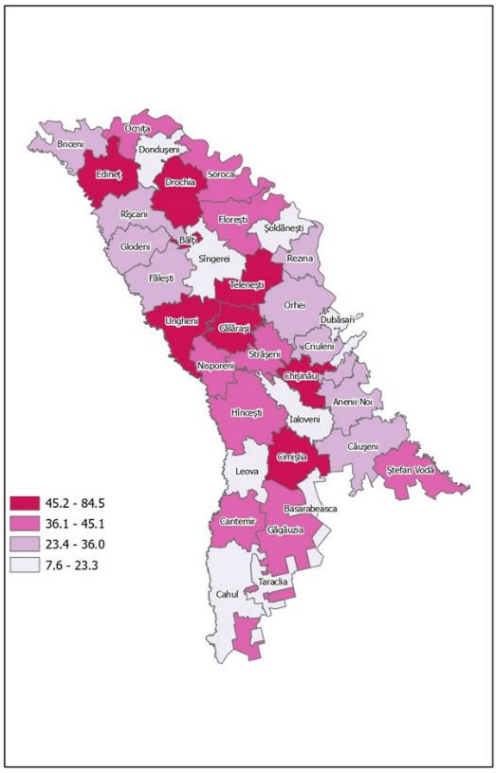

Figure 12. **Distribution of deaths from road injuries and severe road injuries among women with driving licenses, per 100 thousand population (quartiles)**

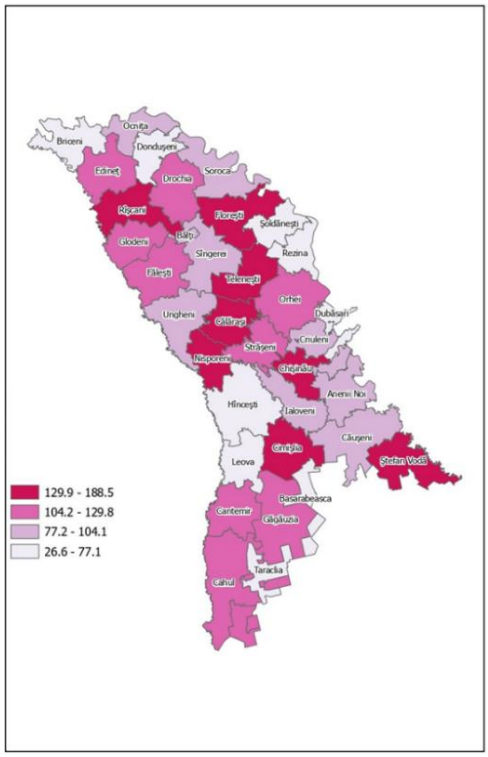

Figure 13. **Distribution of deaths and severe road injuries among men with a driving license, per 100 thousand population (quartiles)**

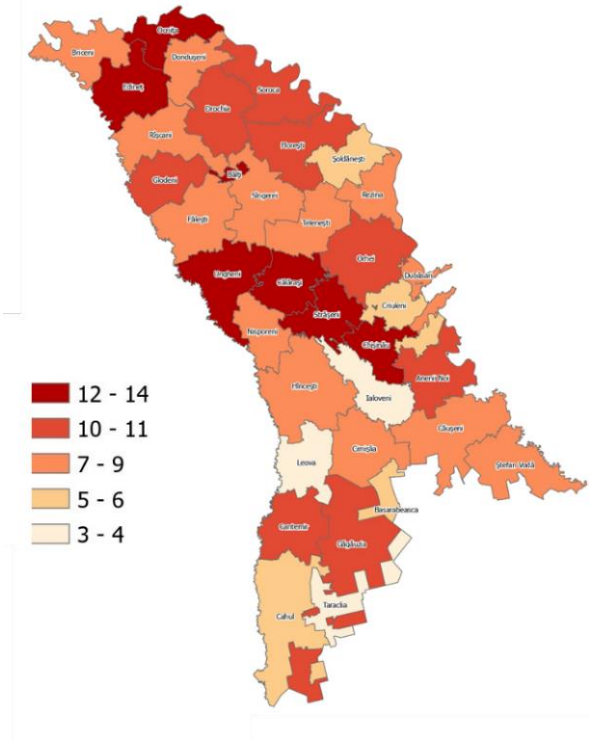

Figure 14. **Road injury Composite Score**

The composite score (SC) designed on the basis of 3 variables (deaths and severe injuries per 100 thousand population, deaths and injuries in vulnerable age groups and the ratio of deaths and severe injuries in women and men), highlights the districts that consistently rank at a very high or very low level based on several important characteristics of the road crash (figure 14). Out of all the districts of the country, 6 of them: Ungheni, Călăraşi, Străseni and Chișinău, Ocnița and Edineț municipalities have the highest SC, 12-14, meaning that in these districts the 3 selected variables were closely related to the occurrence of an road crash and road injuries.

The districts: Cantemir, UTA Gagauzia, Anenii Noi, Orhei, Glodeni, Florești, Drochia, Soroca had a composite score of 10-11, and the districts of Ialoveni, Leova and Taraclia had the lowest score (3-4).

4.2. Scientific argumentation of measures to prevent and control crashes and road injuries

The method of evaluating risk factors in the occurrence of road injuries. The current method of assessing road safety risk factors enables the study of major causes in road injury occurrences. It was developed on the basis of the cause-effect diagram, which is supported by the fish skeleton diagram developed by Kaoru Ishikawa in 1943. The method indicates the relationships between the major risk factors (causes) in the production of traffic injuries and their finality (effect), such as a road crashes with or without final effects (injury, disability, death). The method allowed breaking down primary causes into sub-causes and subdivisions, ensuring a comprehensive understanding of road injury triggers. The method addresses a specific problem – the prevention of road injuries – and focuses on its causes. It allows the graphic representation of several causes that could be or are the basis of the occurrence of the crash/road injury, it shows the links between the causal factors and the final effects. The method includes 5 stages: identifying and defining the result to be analyzed, formulating the problem, identifying the main causes that led to the appearance of the effect, identifying the secondary causes that led to the appearance of the effect and the overall analysis of the graphic representation obtained and the proposal of concrete remedial measures. A general description of the main and secondary factors is made, the identification of risky behavior in traffic, and based on the representation a prioritization of the factors of major importance is made. Based on the magnitude of the identified risk factors, based on this method, an in-depth analysis of environmental factors [15], behavioral factors [14] and some ethical aspects [21] in the production of road injuries was carried out (figure 15).

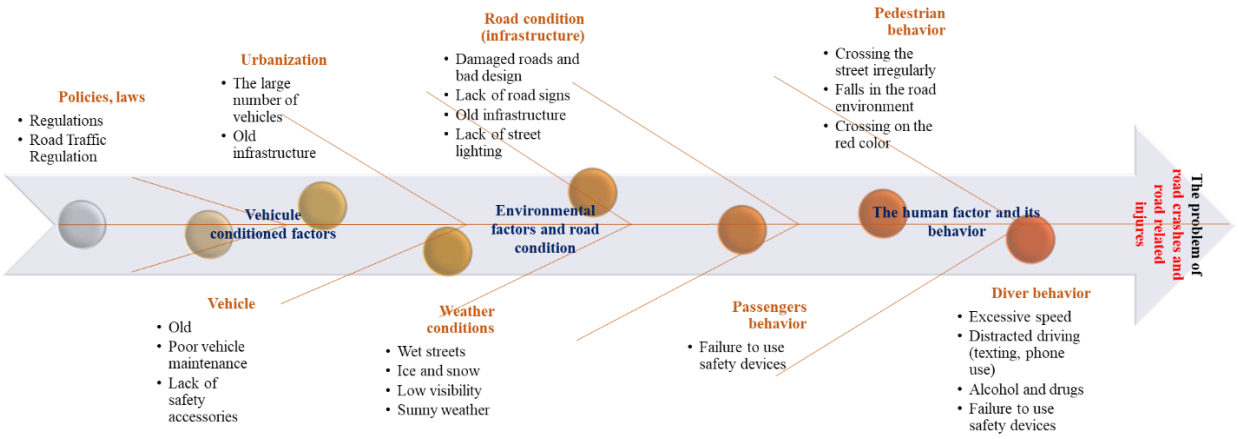

Figure 15. **Interrelationships among major risk factors for road traffic injury**

Measures to reduce risk factors and prevent road injuries among the population (COM-B). The COM-B behavior assessment model (Capacities, Opportunities and Motivation), proposed by S. Michie, 2011 [22], is a tool that allowed understanding and diagnosing risky behaviors in traffic, defining the problem in behavioral terms, selecting the target behavior, specifying it and identifying the aspects that need to be changed. This tool has been studied and applied in the Republic of Moldova to combat the burden of non-communicable diseases, to plan interventions to change traffic behavior, to identify risk factors, to empower communities, as well as for various purposes [22, 23].

Following the COM-B model, in step 1 we define the problem in behavioral terms: What is the problematic traffic behavior that you intend to change? (For example, many drivers drive

under the influence of alcohol or exceed the maximum speed limit). Who is involved in the behavior? (e.g., drivers). Where does the behavior take place? (e.g., in the car, behind the wheel). In step 2, a long list of desired behaviors is created, e.g.: The Government of the Republic of Moldova makes efforts/makes an active plea in support of promoting reforms in the field of road safety; Competent bodies monitor violations of the Road Traffic Regulation; The state will ensure that the new roads meet the technical standards; Instructors train/train future drivers at the highest level; Drivers follow all basic rules while driving; Drivers do not talk on the phone while driving; Drivers fasten their seat belts permanently while driving; The passengers of the vehicle use the safety devices; Pedestrians cross the street legally.

The next step will be to choose the target behavior from this long list of behaviors. For example, 2 of them we examine and prioritize based on 3 questions: what will be the impact of the behavior change, what will be the probability of the change, and what could the effect be.

In step 3, based on the assessment made in step 2 we choose a single behavior (e.g., drivers fasten their seat belts while driving) and try to make it as specific as possible according to principle 3 and describe the target behavior according to who has to do what, when, where, how often and with whom.

Next, in step 4 we need to understand what components of the behavior need to be changed, identify what needs to be changed to achieve the desired behavior (e.g., drivers always fasten their seat belts when behind the wheel). At this stage the COM-B components (capacity, opportunities and motivation) will be applied. Capacity refers to whether the person or persons affected by the behavior change must have the physical strength, knowledge, skills, endurance, etc., physical capacity (physical ability) and psychological capacity (the ability to engage in the necessary thought processes – understanding, reasoning). Opportunities refer to existing conditions, the social environment (e.g., it must be physically and financially accessible, socially acceptable, and there must be sufficient time); to physical opportunity (the opportunity provided by the environment) and to social opportunity (the opportunity provided by the cultural environment). At the same time, there must be enough "motivation" for people to be engage in the behavior at the relevant time. These are reflective motivation (beliefs about what is right and wrong, intentions, decisions and conscious plans) and automatic motivation (emotional responses, desires and habits resulting from associative learning and physiological states).

Taking into account the analysis carried out, we deduce that change is needed at all stages. The next steps will be to propose an intervention based on the COM-B analysis with an action plan for prevention of road injuries with a focus on vulnerable groups, choosing team members to implement the intervention and mapping stakeholders and partners, establishing the time frame for intervention and a set a preliminary budget.

Addressing ethical principles in behavior change and enhancing road culture. Taking into account the above, we can say that various measures have been taken to guarantee the safety of road users, most of them related to government programs, laws and regulations or higher fines for traffic violations. These actions have been successful implemented in some countries and less in others. Preventing road injuries necessitates a comprehensive approach involving people, vehicles, and road infrastructure. All parties must contribute to road safety to minimize the risk of road crashes. Solutions must be sought throughout the country's system and not just among drivers, road managers, engineers, law enforcement - anyone who has a direct or indirect contribution (the duty to do no harm). Vision Zero, which means that no one will be killed or seriously injured in the road environment, explicitly states that responsibility is shared between system designers and road users. The guiding principles behind this approach are that people

make mistakes, but this should not cost anyone their life, and the vehicle's safety system should be known and applied. Countries, which have adopted this system, maintain about five pillars: stakeholder involvement, ethical concept, shared responsibility while being a road user, safety philosophy and change management. Each of those involved in road traffic injuries can contribute to the improvement of road safety through his responsibility, which refers to conscience, morality, ethical behavior, culture. Culture and responsibility can be achieved through continuous education – at home, at school, at university, at work – of all current and future road users.

GENERAL CONCLUSSIONS

1. According to the results of the research carried out, in the general prevalence of the republic's population for the period 2007-2020, traumatic injuries, poisoning and other consequences of external causes ranked 8th in the general population, with 3322±781.4 cases per 100 thousand population, and on the fourth place in Chisinau municipality, with 8363±2568.8 cases per 100 thousand population. The values of the incidence of injuries caused by road traffic indicated a decreasing trend in the number of cases for the studied period. Thus, in the general population, the number of new cases decreased by 3.3 times, and in the Chisinau municipality by 2.3 times. According to the mortality indicators of the population depending on the types of injury and poisoning, injuries caused by road crashes ranked 2nd in the republic (11.6±2.45 cases per 100 thousand population) and in the Chisinau municipality (8.3 ± 2.69 cases per 100 thousand population) [15, 17,19, 25].

2. Based on the data regarding the addressability of people with road injury for emergency medical assistance, a profile was created of people hospitalized with traumatic injuries resulting from a road accident and of people with head injuries obtained through a road crash. According to iCREATE register: mean age of the road traffic patients was 41.1±16.36 years, of whom 63.7% were men and 33.9% were women. Age groups 18–29 and 30-39 experienced the highest rates of road crash. The majority of TR occurred in urban areas and calling the emergency service 112 most of the time. At the time of the accident, one out of three injured was behind the wheel, and one in four – pedestrian or passenger. One in three patients fasten their seat belt. Of the total number of people referred for emergency medical assistance, 42.3% (CI_{95} 35.11- 49.42) were hospitalized, including 39% (CI_{95} 31.68-46.38) with fractures, 29.8% (CI_{95} 21.90-37.68) with contusions/ecchymoses, 9.2% (CI_{95} 0.26-18.21) with concussions/brain injuries, 9.7% (CI_{95} 0.75-18.65) with open wounds [27].

3. During the observation period, there were 113 (30.7%, CI_{95} 22.20-39.21) patients with traumatic brain injury as a result of a road crash aged between 18 and 79 years, average age being 46.7±17.2 years, most - 63 - were >18 years old (55.8%, CI_{95} 46.59-64.91). The majority of TBI patients were males (74.6%, CI_{95} 62.16-87.05). Between the hours of 10.00-12.00 and 16.00-18.00 the highest rates of injury and addressability for medical care were recorded. Among patients with TBI, pedestrians prevailed - 47.6% (CI_{95} 29.75-65.49), followed by car drivers - 33.3% (CI_{95} 13.17-53.50) and vehicle passengers - 19% (CI_{95} –3,17-41,27). Most ARs resulting from TBI occurred in the urban environment (87.3%, CI_{95} - 78.50-96.10) and were unintentional (98.4%, CI_{95} 95.30-101.52). Most of the TBI victims were transported to medical institutions by ambulance (95.2%, CI_{95} 89.85-100.63). Most ARs involving TBI occurred in a transportation area, such as a public highway, street, road, or other related areas (77.8%, 95 CI 66.16-89.44). The majority of ARs resulting in TBI, 49.2% (CI_{95} 31.60-66.80, occurred with the involvement of pedestrians, 25.4% (CI_{95} 4.07-46.73) – of vehicles, 12.7% (CI_{95} –10.37-35.77) – of motorcycles, 11.1% (CI_{95} –12.17- 34.37) – of bicycles and 1.6% (CI_{95} –22.99- 26.19) – of public transport. According to the Glasgow Coma Scale, patients' states of consciousness tend to become better when receiving medical attention while they are in the hospital. However, a sizable percentage of patients with minimal and moderate awareness either stayed in the initial state of consciousness in the emergency department or even got worse after receiving all essential resuscitation measures and specialized therapy [28, 29, 30].

4. The cartographic representations developed on the basis of data from the national registers elucidate the specifics of road crashes and injuries in a territorial profile, segregated by age, gender, age groups vulnerable to traffic related to the total number of ARs, the total number of drivers and the total number of the population. As an evaluation indicator, the composite score that meets three variables was proposed: severe road injuries and deaths per 100 thousand population, road injuries and deaths in age groups vulnerable to traffic (<10 and >65 years) and the ratio of women to men. In five districts of the country - Ungheni, Călărași, Strășeni Ocnița and Edineț - and in the Chisinau municipality, the highest SC was recorded - 12-14, in these districts the three selected variables were most strongly related to the occurrence of a road crash and associated injuries [31].

5. Road injuries can be prevented through joint efforts, each one involved in road traffic can contribute to improving road safety through individual responsibility, awareness of road risk and improving traffic behavior. Assessing risk behavior by applying the COM-B tool allowed a behavioral diagnosis, defining the problem in behavioral terms and developing specific prevention actions. The approach for evaluating the risk factors for road safety enables analysis of the causes of road injuries, prioritization of those causes, and use of the best practices for maintaining road safety [21, 32].

PRACTICAL RECCOMANDATION

- **Recommendations for decision makers**

1. Develop a data registry, similar to those implemented in EU countries for the prevention and control of injuries and road injuries, to enhance the process of gathering and evaluating data.

2. Implementing best practices for preventing road trauma at the national level, setting measurable goals for the new national road safety plan, and ensuring that these goals are in line with international goals.

3. Providing a safe public space and safe transportation for all people by allocating requisite resources for robust road safety governance and prioritizing road safety as a paramount concern for all.

4. Systematic monitoring and evaluation of emergency department performance at all levels, ensuring ongoing training of the medical staff in the provision of high-quality emergency medical care; evaluation and improvement of medical institutions with cutting-edge resources and equipment for providing medical assistance at all levels, including emergency and critical care.

5. Strengthening the operational and institutional capabilities of the key agencies and interested parties in road safety in order to encourage and support experts in conducting modern studies on road safety.

6. Development of a multidisciplinary approaches to road safety, the encouragement of partnerships and other forms of international cooperation with the aim of enhancing road safety levels.

7. Promoting and rigorously implementing the use of vehicle safety devices, as well as increasing road traffic culture among all participants in the road traffic.

• Recommendations for specialists in the public health surveillance system

1. Review and improvement of health promotion programs with emphasis on road safety aspects, surveillance and control of road injuries and risk factors in their occurrence.

2. Inclusion of road safety and injury prevention in health promotion and disease prevention activities.

3. Involvement of young public health specialists in writing projects that contribute to the implementation of the solutions identified in improving road safety and achieving global objectives

4. Carrying out national campaigns through cross-sectoral, educational and informational activities regarding road safety among different population groups with the aim of raising awareness of risks, increasing the degree of responsibility in traffic and road culture.

5. Capitalizing on in-depth research in road safety, participation in comparative studies and systematic evaluation of knowledge and attitudes of the population towards road safety in order to increase the efficiency of road safety management systems.

6. The systematic gathering of information on road traffic injuries and crashes which would offer crucial information on the scope, nature, and effects of these events on population health.

7. The practical application of risk behavior assessment methods in the road environment, data management, and the use of cost-effective existing resources.

• Recommendations for road users

1. Raising awareness about the importance of promoting proper behavior in road traffic, regardless of whether one is a driver, passenger, pedestrian, cyclist, or motorcyclist, and in the event of a road accident – seeking medical assistance even in the absence of obvious symptoms, to ensure early diagnosis and treatment.

2. Adhering to traffic rules consistently and without exceptions

3. Increasing individual responsibility in road traffic and promoting road culture among peers.

4. Avoiding distracted driving, regardless of one's position in traffic (such as a pedestrian or a driver), and in order to decrease head injuries – motorcyclists and vehicle drivers to always wear safety equipment.

5. Literacy of all road traffic participants regarding the risks of the road environment and everyone's role in traffic.

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INFORMATION ON THE VALORISATION OF RESEARCH RESULTS
LIST OF PUBLICATIONS AND PARTICIPATION IN SCIENTIFIC FORUMS

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