TRAFFIC-RELATED MORTALITY IN MOLDOVA

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DOI: https://doi.org/10.36004/nier.es.2020.2-12
JEL Classification: I18, J10, R41
UDC: 314.42(478)

ABSTRACT

This article analyses the mortality caused by road accidents in Moldova depending on the degree of involvement of pedestrians, cyclists, motorcyclists, drivers and passengers of transport units, depending on age and sex. Results suggest that traffic-related mortality in Moldova has shown an increased incidence among the young and working-age population, where a significant difference between males and females is observed. Among the youth, traffic-related deaths register between 10-27% of the overall mortality in both sexes. The risk exposure of dying in a traffic accident decreases with age and is less significant in the retired ages. During the years 1998-2015, avoidance of traffic-related deaths would have assured an increase in life expectancy between 0.40-0.56 years in males, and 0.09-0.23 years in females. The continuous increase in the number of transport units on public roads, as well as in the number of hours spent in traffic, influences the degree of exposure to the risk of death or injury as a result of road traffic accidents. Trauma resulting from road accidents increases the incidence of premature mortality and disability among the population, which is reflected by the decrease of healthy life expectancy. It is ascertained that the road accident mortality requires a detailed and comprehensive analysis given the multitude of factors influencing deaths and injuries related to a traffic accident among the population. Thus, in order to improve road safety and reduce mortality incidence among traffic participants, a range of actions has to be implemented by the liable actors, including through the international experience.

Keywords: *traffic accidents, external causes of death, avoidable mortality, traffic-related injuries, road safety.*

În prezentul articol este analizată mortalitatea cauzată de accidentele rutiere în funcție de gradul de implicare a participanților la trafic (pietoni, bicicliști, motocicliști, șoferi și pasageri al unităților de transport), după vârstă și sex. Rezultatele sugerează că mortalitatea cauzată de accidentele rutiere înregistrează o incidență sporită în rândul populației tinere și în vârstă de muncă, unde este observată o diferențiere semnificativă între bărbați și femei. În vârstele tinere, decesele prin accidentele rutiere înregistrează între 10-27% în mortalitatea generală la ambele sexe. Expunerea asupra riscului de deces în rezultatul accidentelor rutiere scade odată cu avansarea în vârstă și este mai puțin semnificativă în vârstele de pensionare. În anii 1998-2015, evitarea deceselor cauzate de accidentele rutiere ar fi asigurat o creștere a speranței de viață între 0,40-0,56 ani la bărbați și 0,09-0,23 ani la femei. Creșterea continuă a numărului de unități de transport, precum și a numărului de ore petrecute în trafic, influențează gradul de expunere riscului de deces sau vătămare ca urmare a accidentelor rutiere. Traumatismele rezultate în urma accidentelor rutiere sporește incidența mortalității premature și dizabilităților în rândul populației, ceea ce se reflectă asupra descreșterii speranței de viață sănătoase. Accidentele rutiere necesită o analiză detaliată și cuprinzătoare, având în vedere multitudinea factorilor care influențează numărul de decese și traumatisme în rândul populației. Astfel, pentru a îmbunătăți siguranța rutieră și a reduce incidența mortalității în rândul participanților la trafic, este necesară implementarea unui șir de acțiuni, inclusiv prin utilizarea experienței internaționale.

Cuvinte-cheie: *accidente rutiere, cauze externe de deces, mortalitate evitabilă, siguranță rutieră.*

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В данной статье анализируется смертность от дорожно-транспортных происшествий в Молдове в зависимости от степени вовлеченности различных категорий населения (пешеходов, велосипедистов, мотоциклистов, водителей и пассажиров транспортных средств), а также по полу и возрасту. Результаты показывают, что смертность, связанная с дорожными транспортными пришествиями (ДТП), вызывает существенные потери среди молодого и трудоспособного населения. В молодых возрастах, смертность, связанная с ДТП, составляет 10-27% от общей смертности для обоих полов. Подверженность риску смерти в ДТП уменьшается с возрастом и менее значительна для пенсионеров. В течение 1998-2015 гг. предотвращение смертей, связанных с ДТП, обеспечило бы увеличение продолжительности жизни на 0,40-0,56 года у мужчин и 0,09-0,23 года у женщин. Постоянный рост количества транспортных средств, а также количества часов, проведенных в движении, влияет на степень подверженности риску смерти или травматизма в результате ДТП. Травмы, полученные в результате ДТП, увеличивают численность преждевременных смертей и инвалидности среди населения, что отражается в снижении продолжительности здоровой жизни. Дорожно-транспортные происшествия требуют подробного и всестороннего анализа с учетом множества факторов, влияющих на травматизмы и смертность среди населения. Повышение безопасности дорожного движения и снижение уровня смертности, могут быть достигнуты, в том числе, за счет применения международного опыта.

Ключевые слова: *дорожно-транспортные происшествия, внешние причины смерти, предотвратимая смертность, безопасность дорожного движения.*

This article was elaborated within the State Programme (2020-2023) 20.80009.0807.21, „Migrația, schimbări demografice și politici de stabilizare a situației".

INTRODUCTION

The gradual increase in the number of vehicles and transport units, as well as in the number of hours spent in traffic, has a direct influence on the risk of exposure to death or injury as the result of road accidents. Deaths due to traffic accidents cause significant losses among the young and working-age population, which has direct economic consequences. Injuries, as a result of traffic accidents, also may have a tangential effect on premature deaths, peoples' disabilities, and to contribute to the reduction in years of a healthy life span.

Persons under the incidence of risk-involvement in road accidents endure their consequences depending on the role of involvement in traffic, registering differentiation in mortality/morbidity rates for drivers, passengers, bicyclists, pedestrians, etc. The traffic-accident risk exposure differs considerably depending on populations' characteristics, such as age, sex, urban/rural residence, and other socioeconomic factors. Effective policy programs regarding traffic accidents diminution could prevent a certain number of deaths and traumas, which will improve the population's health and reduce economic losses.

Even though reducing road accident mortality is one of the main goals on the government's agenda, some legislative aspects, the constant increase in the number of cars on public roads, existing pedestrian and road infrastructure are maintaining relatively high mortality and injury incidence, especially compared to developed countries.

The purpose of this paper is to emphasize mortality dynamics due to traffic-related accidents in Moldova, as well as assessing population losses depending on age, sex, and the degree of involvement in a road traffic accident (pedestrian, pedal cyclist, motorcycle rider, car occupant, and others). The presented research is a country-level study, thus, at the regional level, traffic-related mortality may register a different incidence.

LITERATURE OVERVIEW

Traffic-related mortality and injuries in Moldova have been studied by different field researchers, which allows this problem to be regarded from an economic, social, demographic, public health, etc., perspective. A general overview regarding mortality caused by traffic accidents in Moldova was carried out by Bargan, where attention was focused on population losses (Bargan, 2016). Gagauz and Pahomii have highlighted a significant loss among the young population in Moldova as a result of motor vehicle

accidents (Gagauz & Pahomii, 2017). Moreover, it was pointed out that traffic-related deaths' are not uniformly distributed within a calendar year (Palanciuc & Cemirtan, 2015).

An important attention was paid to emergency medical help and post-traumatic interventions to the persons involved in traffic accidents (Ciobanu, 2011). It was highlighted that traffic speed, road infrastructure, existing legislation and regulations have a strong association with traffic accident incidence (Bricicaru & Burlacu, 2015).

Deaths caused by traffic accidents are presented as one of the major contributors to external mortality (Pahomii & Ştîrba, 2018) that can be avoided as a result of the improvement of road infrastructure and various policy implementations (Stirba & Pahomii, 2019).

Existing cross-country studies that approach traffic-related mortality highlight a relatively high incidence of mortality in Moldova with certain similarities to the countries in the region (WHO, 2015).

DATA AND METHODS USED

Data on cause-of-death distribution by age and sex were retrieved from the WHO mortality database, which presents a set of available years between 1996-2016[1] (WHO Mortality Database). In the presented research deaths were grouped in by major causes: pedestrian injured in transport accident (V01-V09); pedal cyclist injured in transport accident (V10-V19); motorcycle rider injured in transport accident (V20-V29); car occupant injured in transport accident (V40-V49); other land transport accidents (V30-V39, V50-V90).

Considering distorted population statistics in Moldova due to out-migration underestimation, provided calculations were based on estimated population distribution by age and sex, which includes a series of data where the last available year is 2015 (Penina, Jdanov, & Grigoriev, 2015). An accurate and recalculated official population distribution by age and sex has only been available since 2014 (NBS Database).

In order to perform life expectancy decomposition abridged life tables were calculated for each year in the analysed period, with the last opened age-group interval of 85+ for males and females.

Standardised death rates (SDR) were calculated based on the New European Standard Population (Eurostat, 2013).

RESULTS AND DISCUSSIONS

During the last decades, deaths due to traffic accidents have registered a steady and slightly fluctuating distribution in absolute values, with observed improvements in the last-analysed years. The number of annual deaths varied depending on population characteristics such as age and sex distribution, as well as their degree of participation in traffic as pedestrians, pedal cyclists, motorcycle riders, and car occupants.

The number of traffic-related deaths during the analysed years had been in a strong association with two important factors: population dynamics (that registered constant decrease due to natural decline and out-migration) (Gagauz et al., 2016) and a constant increase in the number of cars. Existing demographic waves, that resulted from age distribution dynamics, contributed through the years to certain changes in population risk exposure of being involved in a traffic accident.

Figures 1 and 2 show absolute numbers of traffic-related deaths by main causes for males and females. As we can see, the number of pedestrians who died in a traffic accident has decreased gradually since 1998 for both sexes, with a more accentuated numerical decline in males. Thus, the number of pedestrians who died in a traffic accident decreased from 147 males and 57 females in 1998 to 35 males and 29 females in 2016. This significant decline could be a result of the continuous implementation of road safety policies as well as improvements to automobile construction by manufacturers.

Even the number of deaths among pedal cyclists and motorcycle riders in a traffic accident is relatively low comparing to the overall number of deaths, we must point that the risk exposure of these traffic participants is highest, comparing with pedestrians and car occupants. The main reason for high-risk involvement in a traffic accident among cyclists and motorcyclists is due to their vulnerability from the perspective of infrastructure and road safety (including neglected safety rules

[1] *Since 1998 data are not covering the left bank of the Nistru River.*

such as wearing a helmet, speeding, etc.). At the same time, these traffic participants suffer the most severe health consequences from a road traffic accident, after which the resulting injury could lead to disability or death.

Considering the steady increase in the number of cars during the analysed period (Public Services Agency, 2020), as well as the observed suburbanization process towards main cities (Ştîrba, 2017), which lead to an increase in the number of hours spent in traffic, a significant diminution in the mortality due to traffic accidents was difficult to be expected. A challenging side in traffic-related mortality analysis is the national cause-of-death codification. Thus, a major number of deaths caused by traffic accidents are codified as V89.2 (person injured in unspecified motor-vehicle accident, traffic), which makes it difficult to distinguish the type of car-collision in which passengers and drivers were involved. Since 1998, a constant increase in the number of deaths that resulted in a vehicle collision was observed for both sexes. Consequently, a decreasing trend in the registered number of deaths due to car accidents was highlighted for males and females within the years 2009-2016.

An important step in mortality diminution due to traffic accidents was made in the context of the implementation of the National Strategy for Road Safety (Government Decision, 2011), that, besides the organizational factors, were focused on reducing behavioral negligence in road traffic (not wearing a seat belt, speeding, texting while driving, drunk driving, etc.), as well as raising awareness of traffic accidents. Besides that, some changes were introduced in the administrative and criminal codes to toughen penalties for violations and neglect of traffic rules. In addition, an important factor was the constant increase in the level of car safety, which helps to preserve the lives and health of drivers and passengers.

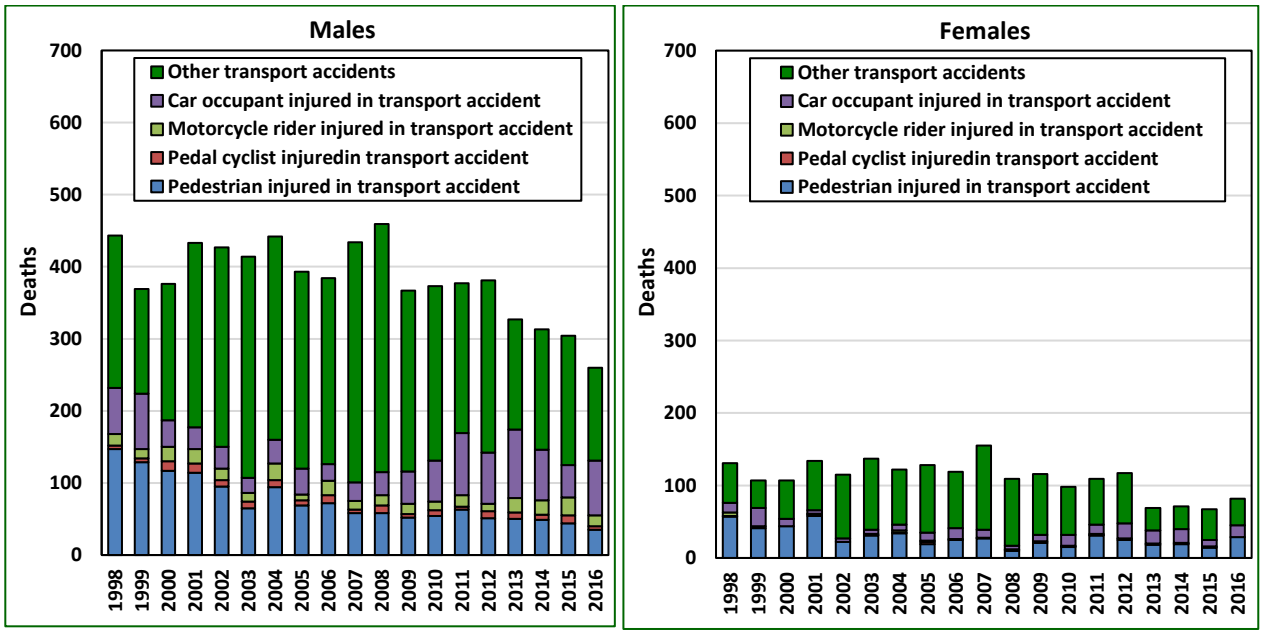

Figure 1-2. Number of traffic-related deaths by causes and sex, Moldova, 1998-2016
Source: WHO Mortality Database.

Traffic-related deaths have a significant contribution to overall mortality within the young population, for males and females (Figures 3-4). Such a situation resulting due to insignificant mortality incidence by other causes of death in young age groups, and relatively high-risk exposure to be involved in a traffic accident. Even the share of traffic-related deaths in overall mortality decreases starting with the age of 35 among both sexes, the probability of dying or being injured in a road accident is relatively high until the age of 60, especially for males. Thus, with advancing age, when the probability of death caused by degenerative diseases (circulatory system diseases, cancers, etc.) increases, deaths caused by road accidents have an insignificant contribution to the total number of deaths among the retirement age groups.

Even though the traffic-related number of deaths in overall mortality in the period 2007-2016 shows a greater influence on particular age groups, comparing to the years 1997-2006 (Figures 3-4), this is rather due to changes in general mortality. Moreover, an observed mortality diminution since 2008 has had a different pace in incidence reduction depending on the causes of death. Thus, traffic-related deaths continue causing significant losses among the young population, reaching between 10% and 27% in the total number of deaths in the age groups 5-9, 10-14, 15-19, 20-24, 25-29, and 30-34, for males and females.

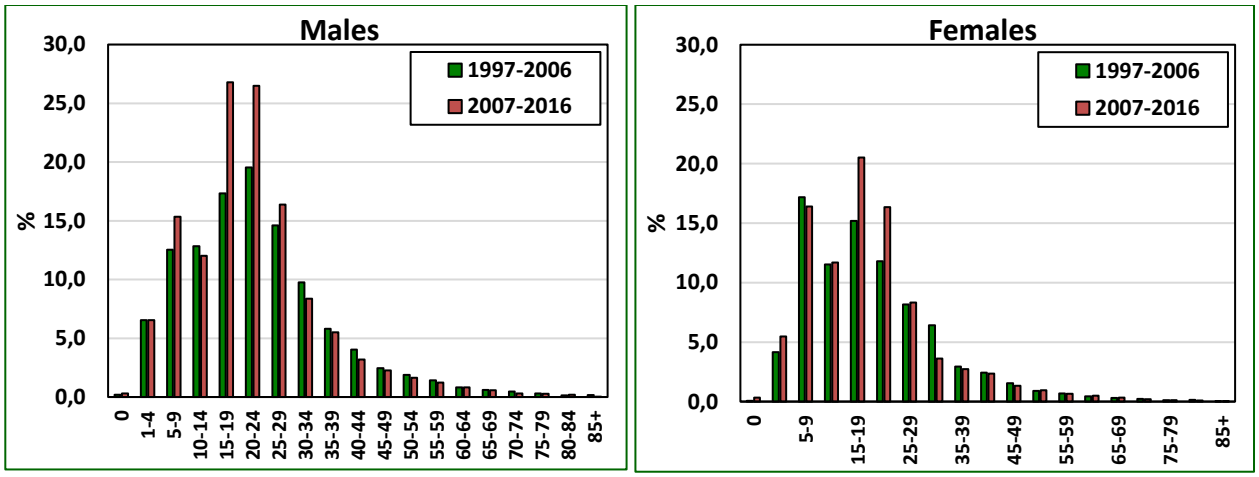

Figure 3-4. The share of traffic-related deaths in overall mortality in Moldova, by age and sex, for the 1997-2006 and 2007-2016 periods

Source: Own calculations based on data from (WHO Mortality Database) and (Penina, Jdanov & Grigoriev, 2015).

Traffic-related standardised death rate (SDR) by main causes (Figures 5-6) denotes an increase in the number of deaths for both sexes during 1999-2008. Since 2009, the number of deaths per 100 thousand population has registered a steady decrease. Despite highlighted changes in SDR due to traffic-related mortality dynamics over the years, a pronounced gap between the number of deaths in males and females has been observed. Thus, in males, the number of traffic-related deaths per 100 thousand population increased from 25.2 in 1999 to 29.4 in 2001, 30.7 in 2004, and 32.8 in 2004; after which, decreasing to 26.2 in 2011, 23.4 in 2013, and 21.4 in 2015. For females, the number of traffic-related deaths per 100 thousand population rose steadily from 6.8 in 1999 to 8.6 in 2003, and 9.5 in 2007, followed by a decrease to 7.7 in 2009, 7.5 in 2011, and 4.4 in 2015.

The number of pedestrians who died in traffic accidents decreased constantly during 1999-2015 in both sexes. Thus, in males, the number of deaths among pedestrians per 100 thousand population dropped from 9.8 in 1999 to 4.3 in 2015. In females, the number of pedestrians who died in traffic accidents per 100 thousand population decreased from 3.0 in 1999 to 1.0 in 2015. Even the observed diminution in mortality amongst pedestrians involved in a traffic accident was highlighted during the analysed years, the number of deaths (per 100 thousand population) in this population cohort being higher than those registered in developed countries.

Deaths among cyclists and motorcyclists are largely associated with males, due to the risk-exposure they face, considering their greater involvement in using this type of transport, compared to females. Therefore, the number of deaths in male cyclists per 100 thousand population ranged between 0.3 and 1.0 during the years 1999-2015. Motorcycle riders among males, who died in a traffic accident, registered between 0.7 and 1.7 deaths per 100 thousand populations within the years 1999-2015, with accentuated peaks in 2004 and 2015.

During the analysed years most of the deaths that occurred in traffic accidents are related to car occupants (drivers and passengers). At the same time, with the present traffic-related cause-of-death codification, it is challenging to distinguish the circumstances of deaths as a result of road accidents which involve cars, as well as commercial and public transport. Thus, a large number of deaths in the analysed period were codified as deaths caused by other transport accidents.

The standardized mortality rate for persons who have died as a driver or passenger has the highest share in overall road accident mortality during the analysed years. Besides this, a significant difference in mortality is observed between males and females, which could be explained as the result of a higher number of hours spent in traffic by males, including by professional reasons, as well as different behavioural risk-involvements, such as speeding, improperly worn seat belt, texting while driving, and other disregards for traffic rules. Traffic-related deaths among drivers and passengers also have a significant interconnection with road surface quality and road infrastructure maintenance.

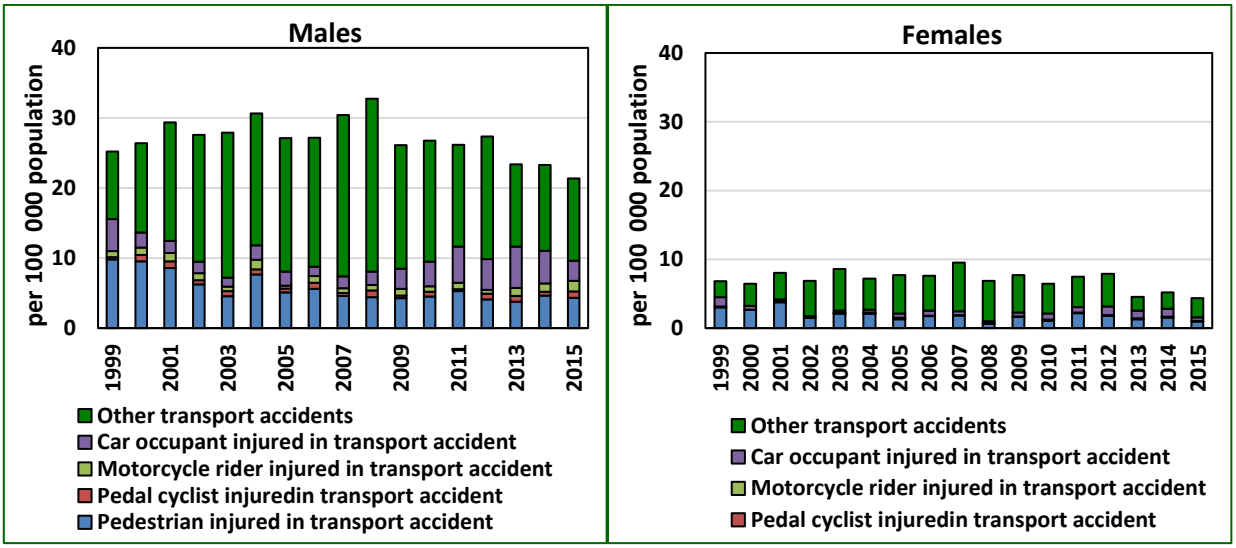

Figure 5-6. Traffic-related standardised death rates by causes and sex, Moldova, 1999-2015

Source: Own calculations based on data from (WHO Mortality Database) and (Penina, Jdanov & Grigoriev, 2015).

Life table distribution of deaths (d_x) that occurred in road traffic accidents show different incidence between males and females (Figures 7-8). Age distribution of traffic-related deaths within the hypothetical cohort emphasizes an oscillating increase among males in aged 15-19, 20-24, and 25-29, followed by a steady decrease in subsequent years. In females, traffic-related deaths are smoother distributed during the lifetime, with less significant losses among the population aged 0-14 and 85+. During the analysed period, cumulative losses within hypothetical cohorts registered about 1.5% in males and 0.5% in females.

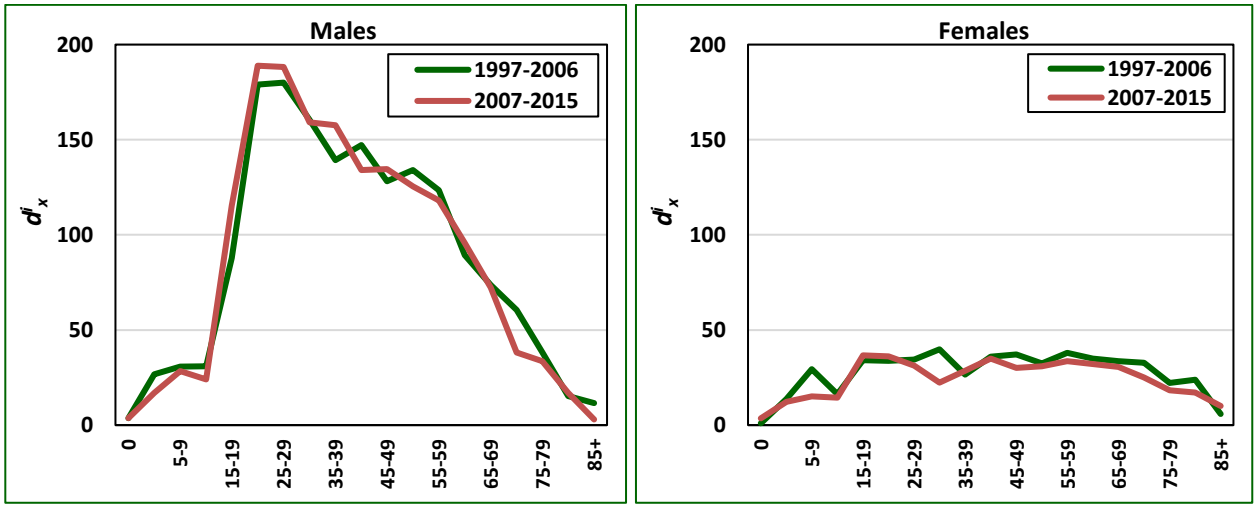

Figure 7-8. Life table distribution of deaths caused by traffic accidents by age and sex, Moldova, 1997-2006 and 2007-2015

Source: Own calculations based on data from (WHO Mortality Database) and (Penina, Jdanov & Grigoriev, 2015).

Deaths caused by road traffic accidents have had influenced a notable decrease in life expectancy within the analysed period, for both males and females (Figure 9). The observed losses in males' life expectancy due to traffic-related mortality, within the analysed period has shown fluctuated values between 0.40 and 0.56 years, with some improvements in the last observed years. In females, deaths caused by road accidents decreased life expectancy between 0.09 and 0.23 years during 1998-2015. Life expectancy losses due to traffic-related mortality, despite the absolute number of annual deaths, depend largely on the age of the persons' deaths. Thus, the deaths among the young population lead to greater losses in the number of person/years.

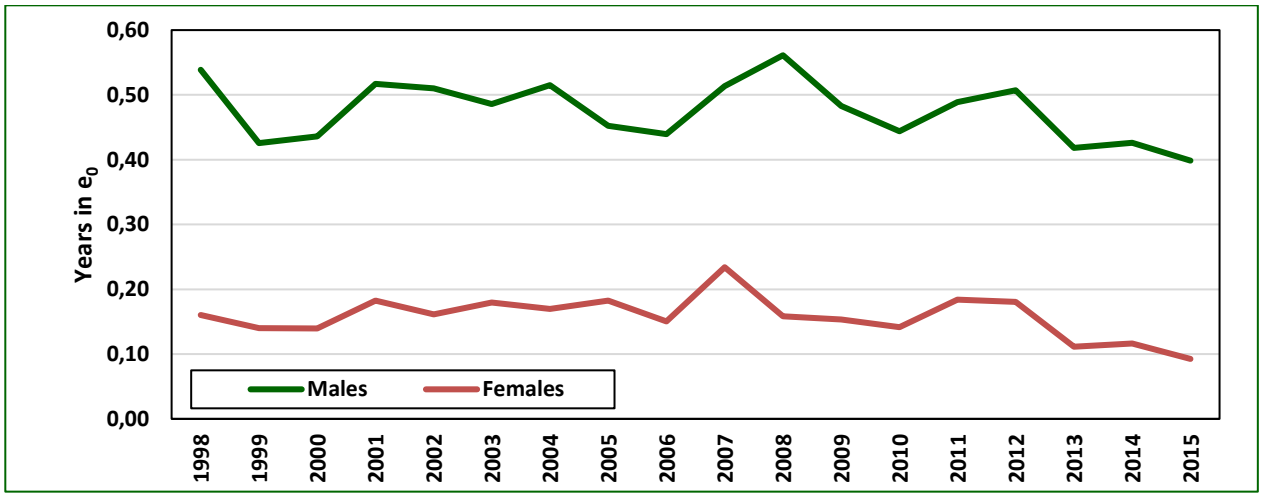

Figure 9. The average annual losses in life expectancy dynamics as a result of traffic-related mortality in Moldova, by sex, 1998-2015

Source: Own calculations based on the data from (WHO Mortality Database) and (Penina, Jdanov & Grigoriev, 2015).

The results presented show a country-level analysis regarding mortality caused by road accidents. Therefore, it is understood that mortality incidence from road traffic accidents differs between regions. Considering the lack of data regarding vital events registration and population exposure from the territory on the left bank of the Nistru River, the following region was not included in the research presented. It should be pointed, that 'small numbers' among specific causes of death may cause a fluctuating trend in mortality dynamics.

The number of traffic-related deaths generally depends on multiple factors (road infrastructure, law and traffic regulations, technical conditions of the vehicles, the number of traffic participants, etc.), and a single road accident may lead from zero to multiple deaths and injuries. Therefore, accidents need to be analysed in order to prevent them, as well as to ensure road safety.

CONCLUSIONS

During the analysed period, traffic-related mortality in Moldova has shown an increased incidence among the young and working-age population, where a significant difference between males and females was observed. The general trend in mortality caused by traffic accidents is emphasizing a slow decrease in synthetic indicators and absolute numbers, which is a result of the National Strategy for Road Safety implementation, as well as road infrastructure development, and steadily raising awareness of the danger of accidents in road traffic. The annual number of deaths due to road accidents derives largely from the population structure change, given that specific age groups of the population are most exposed to the risk.

The results suggest that the subject of road accident mortality requires a detailed and comprehensive analysis given the multitude of factors influencing deaths and injuries related to a traffic accident among the population. The presented research is not covering multiple factors that are influencing populations' health, morbidity, and injuries that may lead to premature death. Thus, the steady increase in the number of cars on public roads is increasing the volume of exhaust gases

and rubber dust from tires, which may lead to cancers and respiratory diseases, but also increases the risk-exposure of being injured in a traffic accident.

In the context of avoiding deaths and injuries caused by road accidents, a notable increase in life expectancy may be observed, mostly in males. A considerable diminution of mortality due to traffic accidents is possible in a condition of synergic actions of liable actors towards the approached problem. Thus, significant improvements to road infrastructure are needed in order to ensure road safety among traffic participants. Besides this, national policies related to traffic mortality diminution must consider existed international experience, which has shown considerable success.

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ARTICLE HISTORY
Received 24 June 2020
Accepted 14 December 2020