



Regional and Socio-Demographic Disparities in Road Traffic Injury Outcomes in Kazakhstan

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Abstract

This study aims to assess regional and socio-demographic disparities in road traffic injury outcomes in Kazakhstan by examining accident incidence, victim distribution, and the severity of consequences across regions, gender and age groups, and road-user categories. The initial information base consisted of official statistical data from the Committee on Legal Statistics and Special Accounts and the Bureau of National Statistics for 2015-2025. The study used methods of descriptive statistics, comparative analysis, indexing of time series with the base year 2015 and normalization of the number of accidents per 100 thousand population. Additionally, the proportion of deaths among victims by region and socio-demographic groups was calculated. The results showed that the number of registered road accidents increased from 18,890 in 2015 to 36,146 in 2025 (+91.35%), and the number of injured increased from 24,055 to 49,220 (+104.6%), while the death toll decreased from 2,453 to 2,330 people. In 2025, the maximum frequency of road accidents was recorded in Almaty city (332 per 100,000 population), and the largest proportion of deaths was in the Turkestan region (14.6%); men accounted for 54.0% of all victims and 71.7% of deaths, while the proportion of deaths increased from 2.2% in the 0–17-year group to 8.4% among persons 60 years of age and older. The results indicate pronounced regional and socio-demographic heterogeneity in road traffic injuries and confirm the need for a differentiated approach to accident prevention that considers regional characteristics, the victim profile, and the potential consequences for human capital and labor potential.

KEYWORDS

Traffic Accident, Road Injury, Gender Disparity, Age Disparity, Regional Economy, Transport Economy, Transport Infrastructure

1 | INTRODUCTION

Modern socio-economic development is increasingly assessed not only through economic growth indicators but also through population safety, quality of life, and protection against everyday risks. Preserving human life and health, reducing premature mortality, and preventing injuries are essential conditions for sustainable economic development and social well-being. From an economic perspective, injuries and premature deaths generate substantial direct and indirect costs, including healthcare expenditures, rehabilitation costs, productivity losses, reduced labour participation, and additional financial burdens on households and public budgets. These consequences extend beyond affected individuals and influence labour markets, human capital accumulation, and the broader socio-economic development of territories.

Road traffic injuries represent one of the most significant public safety challenges, with considerable social and economic implications. Their consequences include premature mortality, temporary or permanent loss of working capacity, reduced household income, and increased demand for healthcare and social protection services. Moreover, the economic burden of road traffic accidents (RTAs) is distributed unevenly across population groups and territories. Differences in the incidence and severity of road traffic injuries may contribute to existing socio-economic inequalities, particularly when economically active individuals experience serious injuries or when households face additional care responsibilities and income losses.

In this context, road safety should be seen not only as an issue of transport infrastructure and compliance with traffic regulations but also as an important component of socio-economic development. According to the World Health Organization (2026), approximately 1.16 million people die annually as a result of road traffic accidents. In Kazakhstan, annual economic losses associated with RTAs are estimated at approximately USD 7 billion (Karimov, 2025). Although this figure is an indicative estimate, it highlights the potential economic significance of road traffic safety for the country. Official statistics further demonstrate the growing scale of the problem: between 2015 and 2025, the number of registered road traffic accidents increased from 18,890 to 36,146, while the number of injured persons rose from 24,055 to 49,220 (Committee on Legal Statistics and Special Accounts, 2026). Such dynamics underline the importance of examining road traffic injuries not only in terms of public safety but also in relation to their potential implications for labour resources, healthcare expenditure, and economic sustainability.

An additional concern is the uneven geographical and socio-demographic distribution of road traffic injuries. Regional disparities may reflect differences in transport infrastructure, traffic intensity, population density, road management, and access to emergency medical services. From an economic perspective, these differences are particularly relevant because regions vary in their demographic composition, labour resources, and capacity to respond to the consequences of traffic accidents. Similarly, gender and age disparities have important socio-economic implications. Higher mortality and injury rates among men may affect the eco-

nomically active population. In contrast, injuries involving children and older people may increase household care responsibilities and demand for healthcare and social support. Consequently, the analysis of road traffic injuries across population groups provides an additional perspective for understanding the unequal distribution of social and economic burdens.

Despite the growing importance of road traffic safety, aggregate national indicators alone cannot adequately reflect differences in accident incidence and severity across regions and socio-demographic groups. Identifying these disparities is essential to develop targeted preventive measures, improve regional road safety strategies, and inform public resource allocation. Such an approach is particularly relevant for Kazakhstan, where substantial regional differences in population distribution and socio-economic conditions require territorially differentiated policy responses.

Therefore, this study aims to assess regional and socio-demographic disparities in road traffic injury outcomes in Kazakhstan by examining accident incidence, victim distribution, and the severity of consequences across regions, gender and age groups, and road-user categories. By identifying territories and population groups with the most adverse outcomes, the study contributes to a broader understanding of road traffic injuries as a socio-economic challenge. It provides an empirical basis for developing targeted road safety interventions and supporting more effective allocation of public resources.

2 | LITERATURE REVIEW

Social differences in health status, mortality, and exposure to various types of trauma are considered one of the manifestations of broader social inequality. The classical concept of social determinants of health emphasizes that population health is determined not only by individual characteristics and medical factors, but also by the conditions that shape differences in the likelihood of death, morbidity, and other adverse outcomes between social groups and territories (Marmot, 2005). Furthermore, Cubbin and Smith (2002), summarizing studies on socio-economic differences in injury rates, showed that injury frequency and severity can vary significantly between population groups. Laflamme and Diderichsen (2000) demonstrated that among children and young people, road injuries are more common in groups with a lower social status and in socially disadvantaged areas. Nantulya and Reich (2003) expanded this approach by examining road injuries through the lens of social inequality, both between countries and within individual countries.

Morency et al. (2012) examined the territorial aspect of social inequality in road safety in detail. In their study of road traffic injuries in the Auckland region, New Zealand, Hosking et al. (2013) identified pronounced socio-economic and geographical differences, with the most noticeable gradient among children and adults aged 25–64. In Noland et al. (2013), conducted at the level of small territorial units in New Jersey, the study also found a link between a territory's income level and the number of people injured in traffic accidents. Subsequently, DiMaggio (2015) applied spatio-temporal analysis to pedestrian and cyclist injuries in New

York City at the census-tract level. The study enabled identification of territories with elevated injury levels and assessment of the role of socio-economic and transport characteristics in shaping spatial differences.

The main feature of the gender dimension of inequality in road safety is the higher proportion of deaths among men (Sorenson, 2011; Hanna et al., 2006). According to The Global Burden of Diseases, Injuries, and Risk Factors Study, road traffic injuries are among the leading causes of death and disability among young men (James et al., 2020).

Gender differences among road traffic victims largely reflect differences in participation in road traffic. According to Granié et al. (2025), women are consistently less represented as drivers than men and are more often passengers and pedestrians. Men, as a rule, travel longer distances and are more prone to risky driving, which is accompanied by a higher incidence of road traffic injuries. Grdinić-Rakonjac and Pajković (2026) found that men exceed the speed limit more often, regardless of conditions and road type. Women generally comply more often with established speed limits, but they are also more likely to exceed the speed limit on highways with higher permitted limits (60-80 km/h). In the study by Amarasingha and Dissanayake (2014), logistic regression data for the state of Kansas examined factors related to injury severity among male and female drivers. Advanced age does not reduce the risky behavior of men, which persists even when they are pedestrians, which is why the mortality rate among people aged 70 and older is higher for men than for women (Cordellieri et al., 2024).

The age structure of the victims is equally important, with children and the elderly being the most vulnerable. For elderly pedestrians, the likelihood of a severe or fatal injury is higher at any collision speed (Niebuhr et al., 2016). According to Holland and Hill (2010), older women are more likely to be involved in traffic accidents as pedestrians. As they age, they make increasingly risky decisions and become less accurate in assessing their walking speed. Furthermore, Tom and Granié (2011) found a high mortality rate among men aged 24–54 who were pedestrians. For children, the situation is different: at low vehicle speeds, their risk is lower than that of other groups, but once a certain threshold is exceeded, it rises sharply and becomes higher than in other groups (Niebuhr et al., 2016). Children are involved in traffic accidents less frequently than older people. However, their mortality rate remains high because of unpredictable behavior and difficulty assessing road situations, especially when crossing roads and using bicycles, scooters, and other individual mobility options (Swedler et al., 2024).

On urban roads, young men face the highest risk of road traffic injuries, even though women of the same age are more likely to drive (González-Sánchez et al., 2021). Research into the causes of this risk explains that young men are more likely to engage in risky or aggressive driving (Rhodes & Pivik, 2011). Studies have found that men are more likely than women to drive under the influence of alcohol or drugs (Oviedo-Trespalacios & Scott-Parker, 2018). According to Zabihi et al. (2019), seat belt use among men is declining on urban roads. Older drivers, along with young men, also face a high risk of injury (Zwerling et al., 2005). The high risk of

traffic injuries among older drivers is attributed to age-related declines in cognitive and sensory abilities, longer reaction times, and a reduced ability to maintain a constant distance from the vehicle ahead (Cordellieri et al., 2024; Doroudgar et al., 2017).

In Kazakhstan, studies have examined differences in road traffic injuries by gender and age, but mainly in relation to specific territories, medical institutions, or mortality rates. Aubakirova et al. (2013) analyzed regional differences in mortality from road traffic accidents using statistical data for 2004–2010 and identified territories with the most unfavorable indicators. Ibrayev et al. (2019), examining road safety on roads of republican significance for 2016–2018, identified territorial heterogeneity in accident-rate dynamics. Myssayev et al. (2014), based on data from the Regional Center for Forensic Medicine in Semey for 2006–2010, examined the characteristics of mortality resulting from road traffic accidents. In turn, Abdrakhmanova et al. (2017), using official statistics for 2013–2015, identified regional differences in the frequency of traffic accidents and the severity of their consequences, including the specific features of accident and mortality rates in the city of Almaty.

Domestic studies have also examined the socio-demographic aspects of road traffic injuries, albeit in a more limited territorial and temporal context. For example, Buleshova et al. (2016) analyzed the epidemiological characteristics of injuries, including the distribution of victims by gender and age, based on data from medical institutions in Shymkent for 2012–2014. Igissinov et al. (2020), using statistical data from 1999–2018, applied regression analysis and exponential modeling to assess and predict mortality from road traffic accidents, paying attention to age and gender differences.

Thus, an analysis of international and domestic scientific literature shows that road traffic injuries are characterized by pronounced territorial and socio-demographic differentiation. International studies examine how a territory's socio-economic characteristics, transport infrastructure, gender, age, and behavioral factors affect injury and mortality rates. Kazakhstani studies have provided an important empirical basis for studying this problem; however, many of the reviewed works rely on earlier statistical periods, are limited to specific territories, or analyze only specific aspects of mortality and injury.

In this regard, there remains a need for an updated comprehensive assessment of road traffic injuries, which would make it possible to compare regional differences in the frequency of traffic accidents simultaneously, the structure of victims by gender, age, and role as a road user, as well as the severity of the recorded consequences. This study aims to fill this analytical gap based on official statistical data from Kazakhstan for 2015–2025. The results may broaden understanding of road traffic injuries as a socio-economic problem related to preserving human capital, territorial differences, and the need for targeted resource allocation in road safety.

3 | RESEARCH METHODS

The study is based on secondary official statistical data from the Committee for Legal Statistics and Special Records of the General Prosecutor’s Office of the Republic of Kazakhstan and the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan.

The analysis was carried out at two levels. At the national level, the dynamics of road traffic accidents (RTAs), the number of fatalities and injuries over the period 2015–2025 were examined. To assess regional and socio-demographic differences, data from 2025 were used, covering 20 administrative-territorial units of Kazakhstan (17 regions and three cities of republican significance), as well as categories of victims by gender, age, and role as a road user.

The study’s methodological basis included descriptive statistics, comparative analysis, time-series indexing, and indicator normalization. To assess the severity of the recorded consequences of traffic accidents, the study also calculated the proportion of fatal outcomes among victims. Table 1 presents the indicator system used in the study.

Table 1. Indicators and measurement units used in the study

Variable	Measurement	Unit	Period	Data source
Road traffic accidents	Absolute count	Accidents	2015–2025	Committee on Legal Statistics and Special Accounts
Injured persons	Absolute count	Persons	2015–2025	Committee on Legal Statistics and Special Accounts
Fatalities	Absolute count	Persons	2015–2025	Committee on Legal Statistics and Special Accounts
Total victims	Injured + fatalities	Persons	2025	Authors’ calculations
Accidents per 100,000 population	Normalized rate	Per 100,000 population	2025	Committee on Legal Statistics and Special Accounts
Regional fatality proportion	Percentage	%	2025	Authors’ calculations
Victims by sex	Count and share	Persons, %	2025	Committee on Legal Statistics and Special Accounts
Victims by age group	Count and share	Persons, %	2025	Committee on Legal Statistics and Special Accounts
Victims by road-user category	Count and share	Persons, %	2025	Committee on Legal Statistics and Special Accounts
Fatality proportion by socio-demographic group	Percentage	%	2025	Authors’ calculations

Note: compiled by the authors based on Committee on Legal Statistics and Special Accounts (2026)

The dynamics of three key indicators – the number of traffic accidents, fatalities, and injuries were analyzed for the period 2015–2025. To assess the overall direction and scale of the changes, the percentage change between the initial (2015) and final (2025) years of the study period was calculated by formula (1):

$$Change\ (%) = \frac{Value_t - Value_0}{Value_0} \times 100$$

(1)

where:

$Value_t$ – the value of the indicator in the base year;

$Value_0$ – the value of the indicator in the final year of the study period.

Since the absolute values of the number of traffic accidents, fatalities, and injuries vary significantly in scale, a time series indexing method with a fixed base year (2015 = 100) was used to ensure their comparability. The index for each indicator was calculated using the formula (2):

$$Index_t = \frac{X_t}{X_{2015}} \times 100 \quad (2)$$

where:

X_t – the value of the corresponding indicator in year t ;

X_{2015} – the value of this indicator in the base year.

Thus, the obtained indices were used to graphically compare the relative dynamics of the three indicators over the study period. Furthermore, to assess regional differences, absolute and normalized indicators of traffic accidents for 2025 were used. Because the administrative-territorial units of Kazakhstan differ significantly in population size, the absolute number of accidents does not allow for accurate comparison. For this reason, the number of registered accidents per 100,000 inhabitants was additionally calculated. The normalized accident rate for a specific region was calculated using formula (3):

$$Accident\ Rate_i = \frac{Accidents_i}{Population_i} \times 100,000 \quad (3)$$

where:

$Accidents_i$ – the number of traffic accidents registered in the region;

$Population_i$ – the population of the region.

This indicator was used to compare the recorded frequency of traffic accidents, adjusted for regional population. In addition, the severity of the recorded consequences of traffic accidents was assessed through the proportion of fatal outcomes among all victims in the respective region, calculated using formula (4):

$$Severity_i = \frac{Deaths_i}{Deaths_i + Injured_i} \times 100 \quad (4)$$

where:

$Deaths_i$ – the number of fatalities and injuries recorded in the region;

$Injured_i$ – the number of injuries recorded in the region; the number of fatalities and injuries recorded in the region.

The indicator reflects the proportion of fatalities among all registered fatalities and injuries and allows comparison across regions regardless of the absolute number of traffic accidents. However, it does not characterize the clinical severity of the injuries sustained.

To identify socio-demographic differences, the structure of the injured was analysed by gender, age, status as a minor, and role as a road user. For each group, the share in the total number of injured was calculated, and for men and women,

the severity of the consequences of traffic accidents was additionally assessed. This approach identifies differences in the structure and severity of consequences between individual socio-demographic groups without interpreting the obtained indicators as the individual probability of being involved in a traffic accident.

For each group, the structural share of injured was calculated using formula (5):

$$\text{Group Share} = \frac{\text{Victims in group}}{\text{Total victims}} \times 100 \quad (5)$$

where:

Victims in group – the number of dead and injured persons belonging to group

g;

Total victims – the total number of dead and injured in road traffic accidents.

Using this formula, the proportion of minors (under 18 years of age) in the overall structure of victims was also calculated. In addition, to compare the severity of the recorded consequences of traffic accidents between socio-demographic groups, the proportion of fatal outcomes was calculated separately. The severity of the consequences was calculated separately for men and women using formula (5):

$$\text{Gender Severity}_g = \frac{\text{Deaths}_g}{\text{Deaths}_g + \text{Injured}_g} \times 100 \quad (6)$$

where:

Deaths_g – the number of fatalities in the corresponding socio-demographic group;

Injured_g – the category of victims by gender, age or role.

The calculated indicators were used to identify regional and socio-demographic differences in the structure of victims and the proportion of fatal outcomes. The obtained results were interpreted as characteristics of registered road traffic injuries, rather than as an individual probability of being involved in a traffic accident, since the study does not include data on the intensity of participation of individual population groups in road traffic.

4 | RESULTS

In the first stage of the study, we analyzed the dynamics of road traffic accidents in Kazakhstan for 2015–2025. The main focus was on changes in three key indicators: the number of registered traffic accidents, fatalities, and injured persons. Comparing these indicators makes it possible to assess not only the general trends in accident rates but also the scale of the consequences of road traffic injuries, which are important for preserving human capital and the socio-economic well-being of the population.

To ensure comparability across indicators with different absolute values, we used an indexing method with a fixed base year (2015 = 100). Figure 1 presents the resulting dynamics.

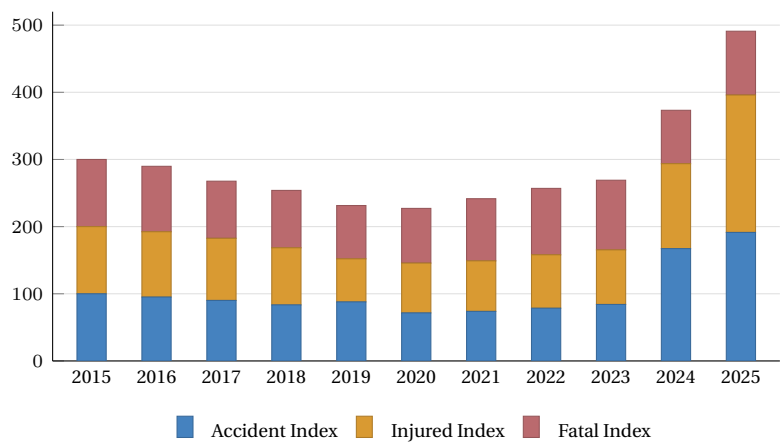


Figure 1. Dynamics of road traffic accidents, fatalities, and injuries in Kazakhstan for 2015–2025 (2015 = 100)

An analysis of the data presented in Figure 1 indicates divergent trends in the main road safety indicators. Over the study period, the number of registered road traffic accidents increased from 18,890 to 36,146 cases, representing a growth of 91.4%. Initially, the number of accidents declined, followed by a subsequent upward trend. The most pronounced increase was in 2024, when the number of registered accidents almost doubled from the previous year.

A similar upward trend was observed in the number of injured people. Between 2015 and 2025, this indicator increased from 24,055 to 49,220 people, representing a growth of 104.6%. During 2015–2019, the number of injured persons initially declined to 15,420 (by 35.9%), then rose substantially in subsequent years, reaching its highest recorded value in 2025.

Unlike the first two indicators, the number of fatalities showed a relatively small overall change between the study’s initial and final years. From 2015 to 2025, fatalities decreased from 2,453 to 2,330 persons (by 5.0%). However, fatalities fluctuated considerably during this period. Between 2015 and 2019, the number of fatalities declined by 20.6%, reaching 1,947 people. Subsequently, the figure rose to 2,544 in 2023 (up 30.7% from 2019). In 2024, fatalities fell to 1,950 (down 23.3%), then rose to 2,330 in 2025 (up 19.5%).

Overall, the findings reveal divergent patterns in the dynamics of registered accidents, injuries, and fatalities. Despite a slight reduction in fatalities between 2015 and 2025, the substantial increase in road traffic accidents and injuries indicates that road traffic injuries remain a significant public safety concern. From a socio-economic perspective, these trends highlight the importance of preserving human capital, preventing potential losses of working capacity, and reducing the burden of road traffic injuries on the healthcare and social protection systems.

An analysis of the regional structure of traffic accidents in 2025 revealed significant territorial differences in registered incidents, fatalities, and injuries (Table 2).

Table 2. Regional differences in road traffic risk in Kazakhstan in 2025

Region	Accidents	Accidents per 100,000 population	Injured	Deaths	Fatality proportion among victims, %
Abai	1,134	188	1,632	95	5.5
Akmola	1,079	137	1,716	104	5.7
Aktobe	2,007	211	2,919	134	4.4
Almaty	3,708	238	5,613	374	6.2
Atyrau	1,880	264	2,689	96	3.4
West Kazakhstan	1,260	181	1,980	81	3.9
Zhambyl	2,042	167	3,071	205	6.3
Zhetisu	1,114	160	1,842	137	6.9
Karaganda	1,347	119	1,682	160	8.7
Kostanay	1,359	165	1,853	79	4.1
Kyzylorda	1,446	171	1,932	109	5.3
Mangystau	1,672	208	2,394	91	3.7
Pavlodar	1,151	153	1,663	81	4.6
North Kazakhstan	593	114	793	47	5.6
Turkistan	1,274	59	1,602	274	14.6
Ulytau	293	132	426	27	6.0
East Kazakhstan	1,271	176	1,843	61	3.2
Astana city	2,074	136	2,573	36	1.4
Almaty city	7,620	332	8,881	73	0.8
Shymkent city	1,822	145	2,116	66	3.0

Note: compiled by the authors

The largest absolute number of accidents was recorded in Almaty city (7,620 cases), Almaty region (3,708) and Astana city (2,074). The minimum values were observed in Ulytau (293), North Kazakhstan (593), and Akmola (1,079) regions. In terms of the number of deaths, the highest rates were registered in Almaty (374 people), Turkestan (274) and Zhambyl (205) regions. The lowest numbers of deaths were recorded in Ulytau region (27), Astana city (36), and North Kazakhstan region (47). Similar territorial differences are observed in the number of injured. The maximum values were registered in Almaty city (8,881 people), Almaty (5,613) and Zhambyl (3,071) regions. The minimum figures were recorded in the Ulytau (426), North Kazakhstan (793), and Turkestan (1,602) regions.

Thus, a high frequency of road accidents does not necessarily accompany a high proportion of deaths. This is most clearly shown when comparing Almaty city and the Turkestan region: Almaty city is characterized by the maximum frequency of registered road accidents (332 per 100,000 population), but the minimum proportion of deaths (0.8%), whereas in the Turkestan region, with the minimum frequency of accidents (59 per 100,000), this indicator reaches 14.6%.

These differences are socio-economically important, since road accidents can affect not only the healthcare system but also regional labor resources and business activities. A high frequency of accidents can lead to temporary disability, worker absences, additional costs for households and organizations, and an increased burden on transport and medical infrastructure. For businesses, road safety is especially important in industries related to road transportation, logistics, trade, construction, and employee mobility, where traffic accidents can cause downtime, delivery delays, and higher operating costs.

An analysis of the socio-demographic structure of the victims revealed marked

differences in gender, age, and the role of a road user. In 2025, men accounted for 54.0% of all road accident victims, while women accounted for 46.0%. However, the differences are significantly magnified when considering deaths: men accounted for 71.7% of all deaths, while women accounted for 28.3%. The proportion of deaths among male victims was 6.0%, which is more than twice as high as the corresponding figure among women (see Table 3).

Table 3. Gender differences in road traffic injury outcomes in 2025

Sex	Total victims	Injured	Deaths
Men	27843	26172	1671
Women	23707	23048	659

Note: compiled by the authors

The identified gender differences are of socio-economic importance, since a higher proportion of deaths among men potentially affects labor and human capital. However, the available data do not allow us to directly assess the loss of employment or labor productivity, since the study does not include information on the labor status, profession, or economic activity of those affected.

The age structure also shows significant differences (Table 4).

Table 4. Age and road-user profile of road traffic victims in Kazakhstan in 2025

Category	Total victims	Injured	Deaths	Share of total victims, %	Fatality proportion among victims, %
Age group					
0–17 years	12,732	12,446	286	24.7	2.2
18–20 years	4,085	3,975	110	7.9	2.7
21–29 years	9,117	8,763	354	17.7	3.9
30–39 years	9,365	8,951	414	18.2	4.4
40–49 years	6,489	6,092	397	12.6	6.1
50–59 years	4,777	4,429	348	9.3	7.3
60 years and older	4,985	4,564	421	9.7	8.4
Road-user category					
Drivers	10,602	9,907	695	20.6	6.6
Pedestrians	21,481	20,719	762	41.7	3.5
Passengers	19,478	18,604	874	37.8	4.5

Note: compiled by the authors

The largest proportion of victims are children aged 0-17 years (24.7%), as well as groups aged 30-39 years (18.2%) and 21-29 years (17.7%). At the same time, the proportion of deaths increases consistently with age: from 2.2% among children under 18 to 7.3% in the 50-59 age group and 8.4% among people aged 60 and older. At the same time, people aged 60+ account for only 9.7% of all victims, but 18.1% of all deaths, which indicates more severe consequences of road accidents for the older age group.

Collectively, the 18-59 age groups account for about 65.6% of all victims and 69.7% of deaths. Because this age range largely covers the economically active part

of the population, the high concentration of severe road-accident consequences in these ages can have broader effects on human capital, labor supply, and household economic well-being. At the same time, these indicators should not be interpreted as a direct assessment of labor losses, since the statistics used do not include victims' labor status.

An analysis of road-accident victims by gender and road-user role revealed additional differences in the structure and severity of the consequences (Table 5).

Table 5. Sex and road-user profile of road traffic victims in Kazakhstan in 2025

Road-user category	Men				Women			
	total victims	injured	deaths	fatality proportion, %	total victims	injured	deaths	fatality proportion, %
Drivers	8,674	8,025	649	7.5	1,928	1,882	46	2.4
Passengers	7,359	6,902	457	6.2	12,119	11,702	417	3.4
Pedestrians	11,820	11,254	566	4.8	9,661	9,465	196	2.0
Total	27,853	26,181	1,672	6.0	23,708	23,049	659	2.8

Note: compiled by the authors

The most pronounced gender differences are observed among drivers. Men make up about 82% of injured drivers, and the proportion of deaths among them reaches 7.5% compared to 2.4% among women. Among pedestrians, the numerical advantage of men is much weaker, but the proportion of deaths among men (4.8%) is more than twice as high as the corresponding figure among women (2.0%). On the contrary, among passengers, many victims are women (about 62%), however, in this category, the proportion of deaths among men is higher – 6.2% versus 3.4%.

These results are important from the perspective of preserving human capital and labor potential. The concentration of more severe consequences among male drivers is especially noticeable and may be significant for areas related to road transport, logistics, and passenger and cargo transportation. However, the data used does not allow us to distinguish between professional and personal trips, so direct conclusions about business losses require additional information.

5 | DISCUSSION

The results indicate a significant increase in registered accidents and injuries, with a relatively stable long-term mortality rate. This indicates the need for a comprehensive assessment of road safety that considers not only the number of accidents, but also the victim profile and the severity of their consequences.

International studies show that mortality due to road accidents may vary between urban and rural areas, including due to differences in speed, distance to medical care, and transport infrastructure (Ryb et al., 2012). However, the results of this study do not allow this conclusion to be extended directly to Kazakhstan, since the statistics do not include a separate distribution of victims by urban and rural areas.. Therefore, this factor should be considered a possible direction for further analysis.

The data also show pronounced gender differences. Men make up 54.0% of all victims, but they account for 71.7% of all deaths. The gender gap among drivers is particularly noticeable: about 82% of affected drivers are men, and the death rate among them is 7.5% versus 2.4% among women. These results align with international studies linking more severe road-accident outcomes among men to differences in road behavior, including a higher propensity for speeding and other risky driving (Granić et al., 2025; Grdinić-Rakonjac & Pajković, 2026).

Age analysis also revealed marked differences. The largest proportion of victims is among children under 18 years of age, while the proportion of deaths increases consistently with age and reaches its maximum among people 60 years and older. This pattern aligns with findings showing that older road users are more vulnerable to the severe consequences of collisions (Niebuhr et al., 2016). Behavioral factors and the ability to assess traffic conditions can play an important role for children, especially pedestrians and cyclists (Swedler et al., 2024).

The results confirm the need for a differentiated approach to road safety policy. In regions with a high frequency of accidents, accident prevention, traffic flow management, and infrastructure improvement may be a priority. In regions with a relatively low frequency of accidents but a high proportion of deaths, special attention should focus on reducing the severity of consequences, improving access to emergency medical care, and reducing response time. This approach can support more targeted allocation of public resources and reduce socio-economic losses associated with road injuries.

The study's main limitation is its reliance on aggregated official statistical data. The available database does not include information on injury severity, the intensity of participation of various population groups in traffic, victims' labor status, trip purpose, the state of road infrastructure, or the timing of emergency medical care. In addition, the analysis is descriptive and does not allow establishing causal relationships between socio-demographic characteristics and accident outcomes. Further research should supplement the analysis with indicators of transport exposure, road infrastructure characteristics, accessibility of medical care, and regional socio-economic parameters.

6 | CONCLUSION

The study aimed to assess regional and socio-demographic differences in road traffic injuries in Kazakhstan based on indicators of accident frequency, victim composition, and severity of consequences, and to identify territories and population groups with the most unfavorable characteristics. An analysis of official statistical data for 2015-2025 showed that, despite an overall increase in registered accidents and injuries, mortality dynamics were significantly less pronounced. This confirms the need to consider road safety not only through the number of accidents, but also through the severity of their consequences.

The regional analysis revealed significant differences between the territories. A high proportion of deaths did not always accompany the high frequency of reported accidents. The most noticeable contrast was between Almaty and the

Turkestan region: Almaty had the highest frequency of road accidents per 100,000 population but one of the lowest proportions of deaths, whereas the Turkestan region had a relatively low accident frequency but significantly higher severity of consequences. This indicates the need for a differentiated approach to road safety measures that consider regional specifics.

Socio-demographic analysis also showed marked differences. Men accounted for slightly more than half of all the victims, but they accounted for a significantly larger proportion of the dead. With age, the severity of the consequences increased consistently, reaching maximum values among people 60 years and older. At the same time, a significant proportion of the injured and dead were in age groups, largely covering the economically active population. According to the role of road users, pedestrians were the most numerous category, while the highest proportion of deaths was observed among drivers.

The results allow us to consider road traffic injuries not only as a transport safety problem, but also as a factor affecting the preservation of human capital, labor potential, and the socio-economic sustainability of regions. To improve the effectiveness of preventive measures, it is necessary to consider not only the accident rate but also the victims' demographic structure, the severity of the consequences, and regional differences. However, the study is limited to aggregated statistical data, which does not include information on injury severity, victims' employment status, traffic conditions, or the availability of emergency medical care. Further research may focus on these factors.

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REFERENCES

- Abdrakhmanova, Z. B., Buleshov, M. A., Moldaliyev, I. S., Buleshova, A. M., Ivanov, S. V., & Grjibovski, A. M. (2017). Epidemiology of traffic accidents in Kazakhstan in 2013-2015. *Ekologiya Cheloveka (Human Ecology)*, 24(5), 14–20. <https://doi.org/10.33396/1728-0869-2017-5-14-20>
- Amarasingha, N., & Dissanayake, S. (2014). Gender differences of young drivers on injury severity outcome of highway crashes. *Journal of Safety Research*, 49, 113.e1-120. <https://doi.org/10.1016/j.jsr.2014.03.004>
- Aubakirova, A., Kossumov, A., & Igissinov, N. (2013). Road traffic accidents in Kazakhstan. *Iranian Journal of Public Health*, 42(3), 231–239.
- Buleshova, A. M., Buleshov, M. A., Kudryavtsev, A. V., Kuandykova, A. K., Buleshov, D. M., Buleshova, R. M., Sultanbekov, K. A., Yemberdiyev, A. U., & Grjibovski, A. M. (2016). Epidemiology of injuries in Shymkent, Southern Kazakhstan: Justification for the need for establishment of municipal injury registry. *Ekologiya Cheloveka (Human Ecology)*, 23(6), 55–61. <https://doi.org/10.33396/1728-0869-2016-6-55-61>
- Committee on Legal Statistics and Special Accounts. (2026). *Road traffic accident statistics*. Qamqor. Retrieved September 10, 2026 from <https://qamqor.gov.kz/crimestat/kz/indicators/accide>

- nt
- Cordellieri, P., Piccardi, L., Giancola, M., Giannini, A. M., & Nori, R. (2024). On the Road Safety: Gender Differences in Risk-Taking Driving Behaviors Among Seniors Aged 65 and Older. *Geriatrics*, 9(5), 136. <https://doi.org/10.3390/geriatrics9050136>
- Cubbin, C., & Smith, G. S. (2002). Socioeconomic Inequalities in Injury: Critical Issues in Design and Analysis. *Annual Review of Public Health*, 23(1), 349–375. <https://doi.org/10.1146/annurev.publhealth.23.100901.140548>
- DiMaggio, C. J. (2015). Small-Area Spatiotemporal Analysis of Pedestrian and Bicyclist Injuries in New York City. *Epidemiology*, 26(2), 247–254. <https://doi.org/10.1097/EDE.0000000000000222>
- Doroudgar, S., Chuang, H. M., Perry, P. J., Thomas, K., Bohnert, K., & Canedo, J. (2017). Driving performance comparing older versus younger drivers. *Traffic Injury Prevention*, 18(1), 41–46. <https://doi.org/10.1080/15389588.2016.1194980>
- González-Sánchez, G., Olmo-Sánchez, M. I., Maeso-González, E., Gutiérrez-Bedmar, M., & García-Rodríguez, A. (2021). Traffic Injury Risk Based on Mobility Patterns by Gender, Age, Mode of Transport and Type of Road. *Sustainability*, 13(18), 10112. <https://doi.org/10.3390/su131810112>
- Granié, M.-A., Devif, J., Moreau, N., & Delannoy, S. (2025). Gender differences in drivers' road risks and gender equality policies: A gender paradox? Comparative analysis of 39 countries. *IATSS Research*, 49(3), 291–304. <https://doi.org/10.1016/j.iatssr.2025.06.004>
- Grđinić-Rakonjac, M., & Pajković, V. (2026). Differences in traffic safety behaviours between male and female drivers across road categories in a developing country: A case study. *PLOS One*, 21(8), e0355724. <https://doi.org/10.1371/journal.pone.0355724>
- Hanna, C. L., Taylor, D. M., Sheppard, M. A., & Laflamme, L. (2006). Fatal crashes involving young unlicensed drivers in the U.S. *Journal of Safety Research*, 37(4), 385–393. <https://doi.org/10.1016/j.jsr.2006.05.007>
- Holland, C., & Hill, R. (2010). Gender differences in factors predicting unsafe crossing decisions in adult pedestrians across the lifespan: A simulation study. *Accident Analysis & Prevention*, 42(4), 1097–1106. <https://doi.org/10.1016/j.aap.2009.12.023>
- Hosking, J., Ameratunga, S., Exeter, D., Stewart, J., & Bell, A. (2013). Ethnic, socioeconomic and geographical inequalities in road traffic injury rates in the Auckland region. *Australian and New Zealand Journal of Public Health*, 37(2), 162–167. <https://doi.org/10.1111/1753-6405.12034>
- Ibrayev, K., Ibrayev, A., Kapskiy, D., Kot, Y., Rybinskiy, A., & Bogdanovich, S. (2019). Analysis of the state of the road traffic safety in the Republic of Kazakhstan. *Science and Technique*, 18(6), 482–489. <https://doi.org/10.21122/2227-1031-2019-18-6-482-489>
- Igissinov, N., Aubakirova, A., Orazova, G., Akpolatova, G., Urazova, S., Tarzhanova, D., Zhantureyeva, A., & Kuandykov, Y. (2020). Prediction Mortality Rate Due to the Road-Traffic Accidents in Kazakhstan. *Iranian Journal of Public Health*, 49(1), 68–76. <https://doi.org/10.18502/ijph.v49i1.3053>
- James, S. L., Lucchesi, L. R., Bisignano, C., Castle, C. D., Dingels, Z. V., Fox, J. T., Hamilton, E. B., Liu, Z., McCracken, D., Nixon, M. R., Sylte, D. O., Roberts, N. L. S., Adebayo, O. M., Aghamolaei, T., Alghnam, S. A., Aljunid, S. M., Almasi-Hashiani, A., Badawi, A., Behzadifar, M., ... Mokdad, A. H. (2020). Morbidity and mortality from road injuries: Results from the Global Burden of Disease Study 2017. *Injury Prevention*, 26(Suppl 2), i46–i56. <https://doi.org/10.1136/injuryprev-2019-043302>
- Karimov, E. (2025). *Kazakhstan b'yt rekordy po DTP: Prichiny i resheniya* [Kazakhstan breaks road traffic accident records: Causes and solutions]. EC[ON]OMY. <https://economykz.org/kazakhstan-byot-rekordy-po-dtp-prichiny/>
- Laflamme, L., & Diderichsen, F. (2000). Social differences in traffic injury risks in childhood and youth—A literature review and a research agenda. *Injury Prevention*, 6(4), 293–298. <https://doi.org/10.1136/ip.6.4.293>
- Marmot, M. (2005). Social determinants of health inequalities. *The Lancet*, 365(9464), 1099–1104. [https://doi.org/10.1016/S0140-6736\(05\)71146-6](https://doi.org/10.1016/S0140-6736(05)71146-6)
- Morency, P., Gauvin, L., Plante, C., Fournier, M., & Morency, C. (2012). Neighborhood social inequalities in road traffic injuries: The influence of traffic volume and road design. *American Journal of Public Health*, 102(6), 1112–1119. <https://doi.org/10.2105/AJPH.2011.300528>
- Myssayev, A., Meirmanov, S., Rakhypbekov, T., Bulegenov, T., & Semenova, Y. (2014). The Characteristics of Road Traffic Fatalities in Kazakhstan's Semey Region, 2006–2010: A Descriptive Retrospective Study. *Iranian Journal of Public Health*, 43(6), 760–768

- Nantulya, V. M., & Reich, M. R. (2003). Equity dimensions of road traffic injuries in low- and middle-income countries. *Injury Control and Safety Promotion*, 10(1–2), 13–20. <https://doi.org/10.1076/icsp.10.1.13.14116>
- Niebuhr, T., Junge, M., & Rosén, E. (2016). Pedestrian injury risk and the effect of age. *Accident Analysis & Prevention*, 86, 121–128. <https://doi.org/10.1016/j.aap.2015.10.026>
- Noland, R. B., Klein, N. J., & Tulach, N. K. (2013). Do lower income areas have more pedestrian casualties? *Accident Analysis & Prevention*, 59, 337–345. <https://doi.org/10.1016/j.aap.2013.06.009>
- Oviedo-Trespalacios, O., & Scott-Parker, B. (2018). The sex disparity in risky driving: A survey of Colombian young drivers. *Traffic Injury Prevention*, 19(1), 9–17. <https://doi.org/10.1080/15389588.2017.1333606>
- Rhodes, N., & Pivik, K. (2011). Age and gender differences in risky driving: The roles of positive affect and risk perception. *Accident Analysis & Prevention*, 43(3), 923–931. <https://doi.org/10.1016/j.aap.2010.11.015>
- Road traffic injuries. (2026). Retrieved 10 September 2026 from <https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>
- Ryb, G. E., Dischinger, P. C., McGwin, G., & Griffin, R. L. (2012). Degree of urbanization and mortality from motor vehicular crashes. *Annals of Advances in Automotive Medicine*, 56, 183–190.
- Sorenson, S. B. (2011). Gender Disparities in Injury Mortality: Consistent, Persistent, and Larger Than You'd Think. *American Journal of Public Health*, 101(S1), S353–S358. <https://doi.org/10.2105/AJPH.2010.300029>
- Swedler, D. I., Ali, B., Hoffman, R., Leonardo, J., Romano, E., & Miller, T. R. (2024). Injury and fatality risks for child pedestrians and cyclists on public roads. *Injury Epidemiology*, 11(1), 15. <https://doi.org/10.1186/s40621-024-00497-2>
- Tom, A., & Granié, M.-A. (2011). Gender differences in pedestrian rule compliance and visual search at signalized and unsignalized crossroads. *Accident Analysis & Prevention*, 43(5), 1794–1801. <https://doi.org/10.1016/j.aap.2011.04.012>
- World Health Organization. (2026). *Road traffic injuries*. 10 September 2026 from <https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>
- Zabihi, F., Davoodi, S. R., & Nordfjærn, T. (2019). The role of perceived risk, reasons for non-seat belt use and demographic characteristics for seat belt use on urban and rural roads. *International Journal of Injury Control and Safety Promotion*, 26(4), 431–441. <https://doi.org/10.1080/17457300.2019.1660377>
- Zverling, C., Peek-Asa, C., Whitten, P. S., Choi, S. W., Sprince, N. L., & Jones, M. P. (2005). Fatal motor vehicle crashes in rural and urban areas: Decomposing rates into contributing factors. *Injury Prevention*, 11(1), 24–28. <https://doi.org/10.1136/ip.2004.005959>

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