VIOLENT DEATHS AMONG ADOLESCENTS IN SERBIA: PAST, PRESENT AND FUTURE

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SUMMARY

Objectives: The aim of the study was to determine the trend and methods of violent deaths (suicide and homicide) in adolescents aged 15–19 years in Serbia.

Methods: Mortality database was drawn from the Statistical Office of Serbia from the 1997–2019 period. To calculate the annual percentage change (APC) of mortality rate (MR) with corresponding 95% confidence interval we used join point regression analysis. Statistical analyses were also performed using the chi-square test and Spearman's rho correlation.

Results: The average suicide rate was 3.65 per 100,000 and homicide rate was 1.36 per 100,000 adolescents. The boys to girls ratio was 4.2 for suicides and 2.7 for homicides. Among girls, suicide rate significantly decreased (APC −20.7%; 95% CI −32.5 to −6.8) and homicide rate insignificantly decreased (APC −19.3%; 95% CI −37.8 to 5.1). Among boys, suicide rate significantly decreased (APC −4.6%; 95% CI −7.0 to −2.0) as well as homicide rate (APC −7.7%; 95% CI −11.5 to −4.3). The most common method of suicide was hanging (195, 44.3%) and nearly one third (198, 32.6%) of violent deaths were caused by firearms. Significantly negative correlation was observed between the Human Development Index (HDI), gross domestic product (GDP) per capita and MR due to suicides and homicides among both genders (p < 0.05).

Conclusions: Increase of GDP and HDI, national preventive intervention and strict application of the provisions of the law regarding the possession and storage of weapons must be implemented in order to continue reducing violent deaths among adolescents.

INTRODUCTION

Globally, starting from the 21th century, the rate of total adolescent mortality for the 15–19 years age group was reduced from 120.96 per 100,000 in the year 2000 to 80.17 per 100,000 adolescents in the year 2019. However, mortality due to injury among adolescents of this age group was still an important world public health issue. Therefore, road injury (11.98 per 100,000), self-harm (5.88 per 100,000), and interpersonal violence (7.58 per 100,000) are among the leading four causes of death among 15–19 years old adolescents in the year 2019 (1).

Worldwide, every 7 minutes one adolescent is killed. Adolescents aged 15–19 years are three times more likely to be killed than younger adolescents aged 10–14 years. Two out of three killed adolescents in the world are victims of interpersonal violence, the rest are killed in wars and civil unrests (2). In 2019, the highest mortality of interpersonal violence among adolescents aged 15–19 years was in the WHO Region Americas (27.49 per 100,000) and the lowest in the WHO Region Western Pacific (1.40 per 100,000) (1). According to the United Nations Office on Drugs and Crime (UNODC), boys in the age group of 18–19 years have the greatest risk of homicide, both in Europe and the Americas (3).

In 2019, suicide rates among adolescents varied between regions – the highest were in the WHO Region South East Asia

(8.34 per 100,000) and the lowest were in the WHO Region Western Pacific (3.45 per 100,000) (1). More than two thirds of suicides occurred in low- and middle-income countries and most of these deaths occurred in adolescents (90%) (4). According to WHO data, suicide was the second leading cause of deaths among adolescents aged 15–19 years in Serbia in 2019 (1).

The Republic of Serbia is an upper middle-income Eastern European country (5). Starting from the last decade of the 20th century Serbia has passed through extreme political, social and economic changes: the dissolution of the Federative Republic of Yugoslavia, civil war, the sanctions of the United Nations, hyperinflation, democratic changes in 2001, and global financial and economic crisis.

All this led to an increased migration of young people to other countries which significantly changed the demographic composition of the country. While in the year 2000 adolescents aged 15–19 years comprised 6.7% of the population, in 2019 they comprised no more than 5.2 % (6).

However, concerns about the occurrence of suicide or interpersonal violence in adolescents in Serbia still exist, given the results of a recent survey of 1,000 adolescents aged 16–17 years (7). The feelings of anxiety caused by various matters were reported by 45% of students, while 7% of students say that they sometimes think about ending their lives. As many as 27% of students report

having committed at least some form of violent behaviour more than twice in 2013 and every fourth student reports that he or she has been a victim of violence (7).

There were no studies analysing the mortality due to suicide and homicide in adolescents in Serbia. The aim of this study was to analyse the violent mortality trend (suicides and homicides) among adolescents aged 15–19 years in Serbia from 1997 to 2019.

MATERIALS AND METHODS

Study included adolescents 15–19 years old from the territory of Central Serbia and the Province of Vojvodina excluding the Province of Kosovo and Metohija (data not available since 1998). Data on the number and type of intentional injuries-related deaths for the 1997–2019 period were retrieved from the Statistical Office of the Republic of Serbia.

Causes of death due to violence-related injuries were classified according to the World Health Organization International Classification of Diseases, 10th Revision for self-harm (suicide) (X60–X84, Y87.0) and assault (homicide) (X85–Y09). Deaths due to event of undetermined intent were coded as Y10–Y34, Y87.2, Y89.9.

According to the method of suicide the data were grouped as intentional self-poisoning (X60–X69); hanging, strangulation and suffocation (X70); firearm injury (X72–X74); jumping from a high place (X80); and other intentional self-harm (X71; X75–79; X81–84).

According to the method of homicide data were allocated as firearm injury (X 93–95); sharp object injury (X99); and other injury due to homicide (X85–X92; X96–X98; Y00–Y09).

Data of gross domestic product (GDP) per capita (current LCU) in Serbia were taken from the World Bank Serbia (5), and data of the Human Development Index (HDI) from the United Nations Development Programme (8).

Chi-square test was used to compare methods of death. P-value < 0.05 was taken as significant. The Spearman's rho correlation was performed to calculate correlation coefficient for adolescent mortality due to suicide and homicide and GDP and HDI.

Based on the obtained information on the number of deaths, cause of intentional death and death due to event of undetermined intent according to gender, we calculated mean annual mortality rates (MR) per 100,000 population aged 15–19 years. To compute sex and age group specific mortality rates, population data were obtained from the 1991, 2002 and 2011 national censuses by interpolation (9).

To estimate the annual percentage change (APC) in mortality rates and corresponding 95% confidence interval, we applied Joinpoint Regression Program software (version 4.8.0.1, Statistical Methodology and Applications Branch, Surveillance Research Program, US National Cancer Institute*). P-values < 0.05 were considered significant (10).

RESULTS

Over the 23-year study period there were 608 violent deaths among adolescents aged 15–19 years of whom 440 (72.4%) were suicides and 168 (27.6%) homicides. Out of 440 persons who committed suicide, 340 (77.3%) were boys, while 100 (22.7%) were girls. Out of 168 killed adolescents, 124 (73.8%) were boys, while 44 (26.2%) were girls.

Table 1 shows mortality rates per 100,000 for suicide, homicide and events of undetermined intent between 1997 and 2019 according to gender.

Suicide rate was 4.2 time higher among boys than girls (5.81 vs. 1.39 per 100,000) while homicide rate was 2.7 time higher among boys compared to girls (1.97 vs. 0.73 per 100,000). Mortality rate due to event of undetermined intent was nearly 3.5 times higher among boys than girls (3.02 vs. 0.87 per 100,000) (Table 1).

In both boys and girls, the most common method of suicide was hanging, followed by suicide by firearms while the leading method of homicide was death by firearms, followed by homicide by a sharp object. In girls, intentional self-poisoning was more common than in boys as a method of suicide, and boys more often than girls used hanging as a way of suicide. Also, girls were more often killed by firearms than boys (Table 2).

Mortality rates due to suicide among both adolescent boys and girls showed a significant downward trend (by −4.6% vs. −20.7% per year). Although the declining trend of the mortality rate due to homicide was noted among boys by −7.7% yearly and girls by −19.3% yearly, this decline was significant only among boys while for girls it was not significant (p=0.106). The significant decreasing trend of adolescent MR due to events of undetermined intent was observed to be −6.7% per year among boys. At the same time, among girls we noted a non-significant decreasing trend for deaths due to events of undetermined intent by −10.8% per year (p=0.320) (Table 3).

According to the comparability test, mortality trends from both suicides and assault/homicide among boys and girls were not parallel, and the final selected model rejected parallelism (p<0.01).

Table 1. *Mortality rates per 100,000 population (95% CI) from suicides, homicide and event of undetermined intent in Serbian adolescents aged 15–19 years according to sex, 1997–2019*

Causes of death (ICD 10 classification)	Males	Females	Total
Intentional self-harm (suicides) (X60–X84, Y87.0)	5.81 (4.69 to 6.92)	1.39 (0.97 to 1.82)	3.65 (2.97 to 4.34)
Homicide (X85–Y09)	1.97 (1.40 to 2.55)	0.73 (0.48 to 0.97)	1.36 (1.02 to 1.70)
Event of undetermined intent (Y10–Y34, Y87.2, Y89.9)	3.02 (2.11 to 3.92)	0.87 (0.57 to 1.17)	1.95 (1.34 to 2.55)

*https://surveillance.cancer.gov/joinpoint/

Table 2. *Number and distribution of suicide and homicide methods among Serbian adolescents by gender, 1997–2019 (N = 608)*

Method of death (ICD-10 classification)	Total n (%)	Males n (%)	Females n (%)	p-value
Suicide				
Intentional self-poisoning (X60–X69)	32 (7.3)	18 (5.3)	14 (14.0)	0.032*
Hanging, strangulation and suffocation (X70)	195 (44.3)	160 (47.1)	35 (35.0)	0.033*
Firearm injury (X72–X74)	127 (28.9)	98 (28.8)	29 (29.0)	0.972
Jumping from a high place (X80)	22 (5.0)	14 (4.1)	8 (8.0)	0.117
Other intentional self-harm (X71; X75–79; X81–84)	64 (14.5)	50 (14.7)	14 (14.0)	0.860
Homicide				
Firearm injury (X93–X95)	71 (42.3)	46 (37.1)	25 (56.8)	0.022*
Sharp object injury (X99)	54 (32.1)	45 (36.3)	9 (20.5)	0.053
Other assault injury (X85–X92; X96–X98; Y00–Y09)	43 (25.6)	33 (26.6)	10 (22.7)	0.611

Chi-square test, *statistically significant at p < 0.05

Table 3. *Annual percent change of mortality rates per 100,000 population from suicides, homicides and event of undetermined intent in the age group 15–19 years in Serbia from 1997 to 2019*

Causes of death ICD 10 classification	Gender	Mortality rate		APC (95% CI)	p-value
		1997	2019		
Suicide (X60–X84, Y87.0)	Boys	11.48	3.30	−4.6 (−7.0 to −2.0)	0.001**
	Girls	5.95	0.00	−20.7 (−32.5 to −6.8)	0.007**
Homicide (X85–Y09)	Boys	4.59	2.75	−7.7 (−11.5 to −4.3)	<0.001***
	Girls	2.78	1.16	−19.3 (−37.8 to 5.1)	0.106
Event of undetermined intent (Y10–Y34, Y87.2, Y89.9)	Boys	4.59	2.20	−6.7 (−9.8 to −3.5)	<0.001***
	Girls	0.40	0.58	−10.8 (−29.3 to 12.6)	0.320

Join point regression analysis; APC – annual percentage change; **p < 0.01; ***p < 0.001

Table 4. *Correlation coefficients of HDI, GDP per capita and mortality rate (per 100,000) for suicide and homicide in adolescents aged 15–19 years in Serbia*

Variable	Suicide		Homicide		Intentional injuries	
	Males	Females	Males	Females	Males	Females
GDP per capita	−0.669*	−0.778*	−0.685*	−0.415*	−0.828*	−0.847*
HDI	−0.681*	−0.770*	−0.668*	−0.437*	−0.830*	−0.845*

HDI – Human Development Index; GDP – gross domestic product; *Spearman's rho correlation; p < 0.05

Significant negative correlation was observed between GDP per capita and MR due to suicide and homicide (p < 0.05) (Table 4).

DISCUSSION

WHO data show the reduction of the suicide mortality in the age group of 15–19 years in the WHO European region from 12.78 in 2000 to 6.17 per 100,000 in 2019 (1). According to the latest EUROSTAT data, the Republic of Serbia has a relatively low mortality rate due to suicides in adolescent aged 15–19 years (3.13 per 100,000 in 2018) compared to most European countries. In 2018, the highest adolescent mortality rates due to suicides were recorded in Iceland, Estonia, Lithuania, and Finland (more than 10 per 100,000) while the lowest were in Portugal, Greece, Cyprus, and Italy (less than 2.5 per 100,000) (11).

Data from 29 European countries showed a correlation between cold temperature, some economic variables and suicide for both genders (12). Junker et al. have reported more frequent adolescent suicides in Norway (13) as a result of sleeping difficulties often

present in Nordic countries (14), which may have an impact on increased adolescent suicidal behaviour.

In the first decade of the 21st century, adolescent suicide rates in the former Soviet Union were among the highest globally. The dissolution of the Soviet Union led to political, social and economic changes which produced stress and endangered the health of the population leading to these high rates of suicides (15). According to the data from 81 countries for the period 2000–2009, adolescent boys aged 15–19 years in the Russian Federation, Kazakhstan and Lithuania had the highest rates of suicide (higher than 30/100,000), while adolescent girls in Kazakhstan and the Russian Federation were among the top 10 countries (16). Unfortunately, self-harm is still the leading cause of death among adolescent aged 15–19 years in the Russian Federation, Kazakhstan, Lithuania, and Estonia in 2019 (1).

Suicidal thought patterns and behaviours occurred more often among adolescents in low- or middle-income countries, as shown by the results of a study conducted in 59 countries (17). In Brazil, unemployment and social inequality influenced the rate of suicides among 15–19 years old adolescents. The correlation of suicides with economic parameters was relevant only in girls (18). In high-income countries, income inequality and reduction in GDP during 2008 caused an increase in suicide rates among adolescents and young people aged 15–24 years (19). On the contrary, the number of adolescent hospitalizations in Denmark due to self-injury remained unchanged during the economic recession (20).

Miranda-Mendizabal et al. research based on the analysis of the results of 67 studies recommend that future researches consider the influence of socioeconomic factors and ethnicity on suicides of adolescents and young persons in order to reduce suicide mortality (21).

In our study, suicide rate was 4 times higher among boys. Results from 90 countries of the world show that the rates of suicides were higher in almost all countries for boys compared to girls. The exceptions were China, Cuba, Ecuador, El Salvador, and Sri Lanka, where the suicide rate of girls is higher than that of boys (22). The reasons for this ratio were mainly of cultural nature associated with the status of women in these countries. Furthermore, economic inequality was correlated with a higher ratio of male/female suicides (23).

In most of the studies, like in our study, the most common method of suicides for children and adolescents of both sexes was hanging/suffocation. The reason for that is easy accessibility to the means needed for hanging. Usually, the second most common method of suicides among children and adolescents was poisoning by pesticides for girls and firearms for boys (24).

Also, an easy access to firearms increases the risk of dying from violent causes (25). The easy access to firearms that had been left over after wars in Serbia in the nineties of the last century may have led to the fact that almost a third of adolescent deaths due to violence-related injuries were caused by firearms (198, 32.6%).

The rate of death due to interpersonal violence in the WHO European region in the 2000–2019 period is in decline for adolescents (15–19 years). For boy adolescents this decline started from 7.12 in 2000 to 2.40 per 100,000 in 2019. For girls the rate of death due to homicide was reduced from 2.42 in 2000 to 0.89 per 100,000 in 2019 (1).

The latest Eurostat data showed that highest homicide rate among girls aged 15–19 years was observed in Estonia (3.38/100,000 in 2018 and 3.44 in 2017) (26). Further, drug use disorders were the second leading cause of deaths among Estonian adolescents aged 15–19 years in 2017 and 2018 (1). It is important to note that in case of Estonia key factors seem to be culture values and tradition, especially concerning the use of alcohol (27). Resnick et al. found that adolescent's involvement in violence perpetration is caused by the frequent use of alcohol and drugs (28).

In 2017, more than half (58%) of all girl victims were killed by their intimate partners or family members (2). Adhia et al. state that a frequent cause of female adolescent homicide is a break-up or jealousy involving a partner with access to firearms (29). These homicides occur usually impulsively and on a spur of the moment, and if firearms had not been available at that time, it is doubtful whether the homicide would have occurred (30). We should also point out that more than one half of girl adolescent deaths were caused by firearms.

In order to reduce firearms-related violence, Serbia revised the Law on Weapons and Ammunition (in 2019 and 2020) in order to promote the safe keeping of firearms and prevent the access to firearms, especially by children and adolescents.

Evidence from 130 studies in 10 countries suggests that the implementation of laws restricting the purchase and access to firearms results in the reduction of rates of intimate partner homicides and firearm unintentional deaths in children (31).

Study Limitations

The rate due to events of undetermined intent in our study is very high, especially in men (3.0 per 100,000) which certainly may influence the rate of violence-related deaths.

CONCLUSION

The rate of suicide- and homicide-related deaths in the researched period shows a decline for boys and girls in the 15–19 age group. One of possible reasons may be a better economic situation and better quality of life in Serbia. The changes in the Serbian legislation concerning the possession and protection of firearms, which are involved in the third of intentional deaths, should bring about the reduction in suicide- and homicide-related deaths.

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