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**Komparativna analiza socio-demografskih i hemijsko-toksikoloških karakteristika u slučajevima ubistava i samoubistava**

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**Comparative evaluation of toxicology and sociodemographic characteristics in homicide and suicide victims**

Komparativna analiza socio-demografskih i hemijsko-toksikoloških karakteristika u slučajevima ubistava i samoubistava

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## **Abstract**

**Background/Aim.** Suicide and homicide are very important social problem, especially frequent among the population younger than 40 years old. The aim of this study was to assess the influence of different sociodemographic factors and relevant psychoactive substances on the difference between homicide and suicide victims. **Methods.** A cross-sectional study analysed autopsy reports of 714 suicide cases and 166 homicide cases, autopsied in a five-year period (2011-2016). Out of these, 666 suicide cases and 127 homicide cases met the inclusion criteria for this study. Blood-ethanol concentration was determined by headspace gas chromatography with flame ionisation detection (HS-GC-FID). Analysis of substances other than ethanol was accomplished by gas chromatography-mass spectrometry (GC-MS) and liquid chromatography tandem-mass spectrometry (LC-MS/MS). **Results.** There was a significant difference in age, level of education and employment rate between suicide and homicide cases ( $p < 0.05$ ). The distribution of suicide and homicide cases differed significantly on weekdays in comparison to weekends (OR=1.5; 95 % CI=1 – 2.3;  $p < 0.05$ ). Presence of a psychoactive substance remained a non-significant predictor of whether a person would become a homicide or suicide victim ( $p > 0.05$ ). Homicide victims were more likely to have significantly higher blood alcohol concentration (0.2 – 0.3 g/dL) than suicide victims (OR=2.2; 95 % CI=1 - 5;  $p < 0.05$ ). **Conclusion.** Victim's age, level of education, employment status and high blood alcohol concentration (0.2 – 0.3 g/dL) are significantly different between suicide and homicide cases.

## **Key words:**

**suicide; homicide; sociodemographic characteristics; toxicological findings.**

## **Apstrakt**

**Uvod/Cilj.** Samoubistva i ubistva značajno doprinose mortalitetu populacije, naročito kod osoba mlađih od 40 godina. Cilj istraživanja bio je da se proceni uticaj sociodemografskih i toksikoloških karakteristika na razliku između slučajeva samoubistva i ubistava. **Metode.** Ovom studijom preseka obuhvaćeno je 714 slučajeva samoubistava i 166 slučajeva ubistava, obdukovanih u petogodišnjem periodu (2011-2016). Nakon selekcije, u studiju je uključeno 666 samoubistava i 127 ubistava. Prisutvo alkohola u krvi određena je metodom gasne hromatografije sa detekcijom plamene jonizacije (HS-GC-FID). Analiza drugih supstanci osim etanola određivana je metodom gasne hromatografije sa masenom spektrometrijom (GC-MS) i tečnom hromatografijom tandem-masenom spektrometrijom (LC-MS/MS).

**Rezultati.** Starosna dob, nivo obrazovanja i zaposlenost su statistički značajno uticali na razlike u karakteristikama ubistava i samoubistava ( $p < 0,05$ ). Distribucija slučajeva samoubistava i ubistava značajno se razlikovala radnim danima u odnosu na vikende (OR=1,5; 95 % CI=1 - 2,3;  $p < 0,05$ ). Na verovatnoću da će osoba pre biti žrtva ubistva u odnosu na verovatnoću da će izvršiti samoubistvo nije statistički značajno uticalo prisustvo psihoaktivnih supstanci ( $p > 0,05$ ). Žrtve ubistava su češće imale značajno veću koncentraciju alkohola u krvi (0,2 - 0,3 g/dl) nego žrtve samoubistva (OR=2,2; 95 % CI=1 - 5;  $p < 0,05$ ). **Zaključak.** Starost žrtve, nivo obrazovanja, status zaposlenja i visoka koncentracija alkohola u krvi (0,2 - 0,3 g/dL) značajno su se razlikovali među žrtvama samoubistava i ubistava.

### **Ključne reči:**

**samoubistvo; ubistvo; socio-demografske karakteristike; hemijsko-toksikološki nalaz.**

## **Introduction**

Suicide and homicide as forms of violent death represent conscious and intentional destruction of own or others' life. The frequency of these forms is constantly declined in the period 2000 – 2015 on the global level <sup>1,2</sup>. Different factors are associated with variations in homicide and suicide mortality rate. During previous decades the influence of many social, economic, geographic and demographic factors on the frequency of appropriate violent death types was particularly studied <sup>3-10</sup>. Also, very important determinants connected with violence generally are consumption of alcohol, different narcotics and some psychoactive drugs <sup>11-15</sup>. Namely, previous studies showed that more than half of suicide and homicide victims had positive toxicological findings on psychoactive substances in blood <sup>11,12,16,17</sup>. However, presented results vary in different world regions and many other factors such as gender, age, cause of death and methodological procedures on data collection could affect the distribution of substance presence in suicide and homicide victims <sup>14,15,18,19</sup>.

The number of death cases due to injuries, poisoning and other external causes shows a decreasing trend in Serbia <sup>20</sup>. Although distribution data of different forms of violent death exist, a relatively small number of studies examined the association between certain sociodemographic factors and the incidence of homicide and suicide in our region <sup>2,7</sup>.

Additionally, the connection of psychoactive substance usage with these forms of violent death was analyzed insufficiently. Until now only the influence of alcohol consumption on homicide and suicide rates was extensively studied <sup>5,21</sup>.

The aim of this study was to assess the influence of different sociodemographic factors and relevant psychoactive substances on the difference between homicide and suicide victims.

## **Methods**

### *Case identification*

This study was designed as a cross-sectional. All homicide and suicide cases autopsied at the Institute of forensic medicine "Milovan Milovanović" in Belgrade in the period from 1<sup>st</sup> January 2011, to 31<sup>st</sup> December 2016, were included. From a total of 880 autopsy cases, 127 homicide cases and 666 suicide cases were found to fulfill the selection criteria.

Considering that the aim of our study was to examine the indirect influence of psychoactive substances on suicide and homicide frequency, all cases in which the cause of death was

deliberate or accidental drug overdose were excluded. All cases of death in a hospital where a victim was treated for more than 24 hours and did not undergo toxicological analysis were excluded as well. After the selection, 793 cases (127 homicides and 666 suicides) remained in our study. For this type of study, formal consent was not required.

### *Toxicological analysis*

Toxicological analyses were performed in the Laboratory of Toxicology of the Institute of Forensic Medicine “Milovan Milovanović“. The presence and concentration of ethanol were determined in all cases, however not all suicide and homicide victims were examined for the presence of other psychoactive substances. Hence, the influence of psychoactive drugs besides ethanol on homicide and suicide rates and their other features was analyzed only in cases with complete toxicological findings (47 cases of homicide and 129 cases of suicide).

Blood–alcohol concentration (BAC) was determined by head-space gas chromatography with flame-ionization detection (HS–GC–FID). The limit of ethanol detection was set at 0.0001 g/dL, and the limit of quantification was 0.0003 g/dL. In this study cut-off concentration was of 0.03 g/dL to report positive alcohol results because lower values can be the result of endogenous postmortem alcohol production.<sup>22</sup>

Analysis of other psychoactive substances was performed by gas chromatography with mass spectrometry (GC–MS) and liquid chromatography with tandem-mass spectrometry (LC-MS/MS).

### *Case categorization*

All included cases of homicide and suicide were divided into categories according to the victim’s gender, age, marital status, level of education, employment status, day of death, suicidal or homicidal method and toxicological analysis findings. To simplify our analysis, we defined age groups as: <40, 40-65 and >65 years of age. According to the education level subjects were divided into two categories, those with a high level of education (if the victim had a university degree) and those with lower levels of education (finished elementary and/or high school). The day of death was categorized into a weekend (Friday, Saturday and Sunday) or workday accordingly. Psychoactive substances were categorized as alcohol (ethanol), methadone and opioids (heroin, 6-monoacetylmorphine, codeine,

morphine, and/or tramadol), cannabinoids (D-9-tetrahydrocannabinol (THC) and/or THC acid), psychostimulants (cocaine, benzoylecgonine and/or 3,4-methylenedioxymethamphetamine (MDMA)) and psychoactive drugs (benzodiazepines, antidepressants, antipsychotics and/or anticonvulsants). The heavy alcohol intoxication was defined as the presence of BAC of 0.2-0.3 g/dL.

### *Statistical analysis*

Statistical analysis was conducted through the use of the commercial statistical package SPSS (*Statistical Package for the Social Sciences software - IBM Statistics*) version 20.0. The evaluation of differences between variables was performed by Student's t test and Mann-Whitney U depending on the normality of data distribution. In order to define the influence of a psychoactive substances and concordant social demographic factors on homicide or suicide risk odds ratio and 95% confidence interval were estimated using logistic regression. P value below 0.05 was considered significant, and below 0.01 was highly significant.

### **Results**

The victim's demographic characteristics are shown in Table 1. There was no statistically significant difference in gender distribution between suicide and homicide cases ( $p=0.062$ ). Out of 127 homicide victims, 85 (66.9%) were men and 42 women. Out of suicide victims, 499 (74.9%) were men and 167 women. The mean age of homicide victims was  $45.2 \pm 17.34$  years compared with  $57.3 \pm 17.39$  years in suicide cases, and the difference was statistically significant ( $p < 0.001$ ).

The distribution of homicide and suicide victims according to age groups, is shown in Figure 1. Persons aged under 40 years were significantly more frequent among homicide victims compared to suicide victims (OR=3.8 95% CI=2.5 – 5.6  $p < 0.01$ ). Marital status in homicide cases was not significantly different from suicide cases ( $p = 0.854$ ). There were significantly more victims with the higher level of education in the suicide group (15.9%) compared to homicide group (7.8%) Better educated persons had a smaller risk to be killed than to commit suicide (OR=0.4 95% CI 0.2 – 0.9  $p = 0.029$ ).

Among homicide cases, more victims were employed compared with the suicide cases (32.5% in relation to 23.2% OR=1.6 95% CI=1–2.4  $p = 0.032$ ). The most common

homicidal method was gunshot (55.6%), whereas in the suicide group that was hanging (42.3%). The distribution of cases in dependence to the day of death is shown in Figure 2. The persons that died on workdays were more often victims of homicide in relation to those killed on weekends (OR=1.5; 95% CI=1–2.3;  $p = 0.049$ ).

The relationship between toxicological findings and the distribution of homicide and suicide cases is presented in Table 2. There were no statistically significant differences in the presence of opioids and methadone, psychostimulants and psychoactive drugs between the group of homicide and suicide cases. As cannabis was not detected in any of the suicide cases, its influence could not be examined.

Alcohol (ethanol) was present in 15.5% of all cases (18.1% of homicide and 15% of suicide cases) but its presence did not affect the distribution of victims owing to appropriate forms of violent death (OR=1.3; 95% CI=0.8 – 2.1;  $p = 0.378$ ). The median of blood–ethanol concentration of homicide victims was 0.19 g/dl (ratio 0.04–0.48 g/dl) while in the population of suicide victims, it was 0.14 g/dl (ratio 0.04–0.51 g/dl), and the difference was not significant ( $U=909.000$ ,  $p = 0.118$ ). However, the blood–ethanol concentration corresponding to heavy alcohol intoxication (0.2–0.3 g/dl) was significantly more frequent in homicide victims (7.1% to 3.3% OR=2.2; 95% CI=1–5;  $p = 0.049$ ).

## Discussion

In particular world regions like India, USA and Japan, the incidence of homicide and suicide is stagnant or rising<sup>2,23,24</sup>. On the other side, in some countries these forms of lethal violence are considered as the most common causes of death in the population under 40 years of age<sup>25</sup>. The effect of these forms of violent death on overall mortality rates will likely become more notable in the future following numerous societal and technological changes worldwide. Socio-demographic characteristics of the population and the abuse of psychoactive substances probably play an important role in the cases of suicide and homicide, but their influence is still insufficiently estimated.

Our study examined the influence of different sociodemographic factors and relevant psychoactive substances on the difference between homicide and suicide victims. It was shown that certain sociodemographic characteristics (e.g. gender, educational level, marital status etc.) could increase or decrease a person's risk to become a victim of homicide or suicide. On the other hand, it was shown that there was no significant difference between

homicide and suicide cases in term of the usage and type of abused psychoactive substances.

In our study there was a significant age difference between the homicide and suicide populations. Younger persons were more prevalent in the group of murdered victims, while the older more often committed suicide. These results could to some extent explain the differences in homicide and suicide rates between younger and older persons. Our results are in concordance with numerous studies that showed that most of the population of suicide victims are persons older than 65 years, whereas victims of murder were most often persons under 40 years of age<sup>5,18,25-27</sup>. The older population is prone to develop different organic diseases connected with certain psychiatric disorders<sup>27</sup>. Also, the cumulative effect of stress increases with age and it can negatively affect mental health and contribute to suicidal behavior<sup>27</sup>. On the contrary, the population younger than 40 years is more exposed to various circumstances associated with interpersonal violence<sup>4,28</sup>.

The previous studies also showed male predominance in homicide and suicide cases, and our study showed that the distribution of males and females did not differ significantly between homicide and suicide victims, which is consistent with the results of Molina et al.<sup>16</sup> In contrast, Darke et al.<sup>11</sup> found that males are more prone to suicide, three times as often as women. This difference could be explained by the fact that in some parts of the world females primarily choose methods to commit suicide that do not result in immediate death. That could lead to an underestimate of the number of suicide cases, even though there is an equal or higher prevalence of suicide attempts in females in comparison to males<sup>7,29</sup>.

Like in other studies<sup>9,29</sup>, our results showed that there was no significant association between marital status and type of violent death. Obtained results also pointed out that suicide and homicide cases did not differ significantly in terms of the victim's marital status. On the other side, our results indicated that level of education and employment status could have a certain influence on homicide and suicide rates. Highly educated and unemployed persons had lower risk to become murder victims than to commit suicide. In contrast, the employed had bigger risk of being killed. Our results are in concordance with data of Bando et al.<sup>9</sup> and Milner et al.<sup>30</sup>. It is considered that population of highly educated individuals is more likely to avoid engaging in dangerous behavior. Also, these people are less exposed to social environment where interpersonal violence plays an important role in dealing with misery and unhappiness

<sup>9</sup>. Highly educated persons in most cases have a better quality of life, and thus often have no clear external source to blame for their misery. This could lead to depression and certain auto-aggressive behavior. On the contrary, persons with a lower quality of life mainly represent the poorly educated people who solve their conflicts with violence that could result in murder.<sup>31</sup> Prolonged unemployment is usually followed by a sense of underachievement and self-deprecation that could result in vulnerability to suicide<sup>30</sup>.

In the presented report more murders were observed on workdays in comparison to suicides. The possible explanation could be careful planning of the murder as well as knowledge of the daily routine of the victim. Opposite to these, suicides were more frequent on weekends. Although there are no many studies that have analyzed the association between the day of death and suicide and homicide rates. Kattimani et al.<sup>32</sup> reported in their study that Sunday is the day with the highest number of suicide attempts. In agreement with several previous studies<sup>11,12,16,17</sup>, more than a half of included homicide and suicide victims were positive for a psychoactive substance. These drugs have direct psychopharmacological effects on the user, making him more prone to endanger his own or others' health. The consumer is also often forced to use violence (through robbery or burglary) to obtain money for drugs. Finally, illicit drugs cause systemic violence as a result of activities on illicit drug markets, where conflicts are regularly solved using violent behavior<sup>12</sup>. Regardless to obtained results, the influence of psychoactive substances use on violence in general can not be ignored.

Ethanol was detected in 15.5% out of all analyzed suicide and homicide cases. Results of our study showed that the presence of ethanol in the blood did not differ significantly between suicide and homicide victims. This finding was in accordance with results obtained by Darke et al.<sup>11</sup> Despite this finding, the fact that 4.7% of the population in Serbia consumes alcohol daily<sup>20</sup>, emphasizes the importance of alcohol in the expression of lethal violence. Darke et al.<sup>11</sup> also found that the concentration of ethanol was significantly higher in murdered persons than that among suicide victims', however our study did not show similar difference between homicide and suicide cases. In the present study, a significantly higher number of murder victims were in the state of heavy alcohol intoxication (0.2-0.3 g/dl) in comparison to suicide victims. This can imply that high blood-ethanol concentrations have a certain influence on differences between homicide and suicide rates. Additionally, a possible explanation of this finding could be that victims with

heavy alcohol intoxication are more vulnerable, and they are less competent to perform a complicated forms of suicide such as hanging.

In our study, there was no significant difference between homicide and suicide cases in terms of the presence of opioids, psychostimulants and psychoactive drugs. On the contrary, other studies<sup>11,16</sup> showed that the presence of opioids and psychostimulants was more prevalent among murdered than among suicide victims, while certain psychoactive drugs were more often detected in the victims of suicide. The insufficient number of complete toxicological analyses directly affects the size of the sample in our study on one side, and unjustified and uncontrolled usage of certain psychotropic drugs in the general population on the other side could explain our result.

### **Conclusion**

The results of our study pointed out that some sociodemographic characteristics, primarily age, level of education and employment status could affect the differences between the victims of homicide and suicide. Additionally, murders were more prevalent on workdays, while suicides occurred more frequently on weekends. The presence of a psychoactive substance was not associated with differences between homicide and suicide rates. Heavy alcohol intoxication could increase the chances of becoming a murdered victim in comparison to committing suicide.

Considering that some of the toxicological findings could be predictors of homicide and suicide, it should be advised to perform the complete toxicological analysis not only in the herein discussed but also in all others forms of violent death in the future.

## REFERENCES

1. World health statistics 2017: monitoring health for the SDGs, Sustainable Development Goals. Geneva: World Health Organization; 2017.
2. *Ilic M, Ilic I.* Suicide in Serbia. *J Affect Disord.* 2016;193:187–93.
3. *Fountoulakis KN, Chatzikosta I, Pasiadis K, Zanis P, Kawohl W, Kerkhof AJ, et al.* Relationship of suicide rates with climate and economic variables in Europe during 2000–2012. *Ann Gen Psychiatry.* 2016;15:19.
4. *Mundia L, Matzin R, Mahalle S, Hamid MH, Osman RS.* Contributions of sociodemographic factors to criminal behavior *Psychol Res Behav Manag.* 2016;9:147-56.
5. *Rancic N, Erceg M, Radojevic N, Savic S.* Medicolegal characteristics of firearm homicides in Belgrade, Serbia: before, during, and after the war in the former Yugoslavia. *J Forensic Sci.* 2013;58:1549–53.
6. *Kovacevic D, Zarkovic-Palijan T, Radeljak S, Marinovic D, Dadic Hero E, Ljubin Golub T.* Forensic aspects in domestic homicide. *Coll Antropol.* 2010;34:29-37.
7. *Dedic G.* Gender differences in suicide in Serbia within the period 2006-2010. *Vojnosanit Pregl.* 2014;71:265–70.
8. *Santric Milicevic M, Bjegovic V, Terzic Z, Vukovic D, Kocev N, Marinkovic J, et al.* Serbia within the European context: An analysis of premature mortality. *Popul Health Metr.* 2009;7:12.
9. *Bando DH, Lester D.* An ecological study on suicide and homicide in Brazil. *Cien Saude Colet,* 2014;19:1179-89.
10. *Kalediene R, Starkuviene S, Petrauskiene J.* Seasonal patterns of suicides over the period of socio-economic transition in Lithuania. *BMC Public Health.* 2006;6:40.
11. *Darke S, Duflou J, Torok M.* Drugs and violent death: comparative toxicology of homicide and non-substance toxicity suicide victims. *Addiction.* 2009;104:1000–5.
12. *Hedlund J, Ahlner J, Kristiansson M, Sturup J.* A population-based study on toxicological findings in Swedish homicide victims and offenders from 2007 to 2009. *Forensic Sci Int.* 2014;244,25–9.
13. *Kuhns JB, Maguire ER.* Drug and alcohol use by homicide victims in Trinidad and Tobago, 2001-2007. *Forensic Sci Med Pathol.* 2012;8:243-51.

14. *Delaveris GJ, Teige B, Rogde S.* Non-natural manners of death among users of illicit drugs: Substance findings. *Forensic Sci Int* 2014;238:16-21.
15. *Kuhns JB, Wilson DB, Clodfelter TA, Maguire ER, Ainsworth SA.* A meta-analysis of alcohol toxicology study findings among homicide victims. *Addiction.* 2010;106:62–72.
16. *Molina DK, Hargrove VM.* Can intoxication status be used as a prediction tool for manner of death: A comparison of the intoxication status in violent suicides and homicides. *Am J Forensic Med Pathol.* 2017;38:69-73.
17. *Darke S.* The toxicology of homicide offenders and victims: a review. *Drug Alcohol Rev.* 2010;29:202–15.
18. *Cros J, Alvarez JC, Sbidian E, Charlier P, Lorin de la Grandmaison G.* Homicidal deaths in the Western suburbs of Paris: a 15-year-study. *Am J Forensic Med Pathol.* 2012;33:404-9.
19. *Skibin L, Bilban M, Balazic J.* Harmful alcohol use of those who died a violent death (the extended region of Ljubljana 1995–1999) *Forensic Sci Int.* 2005;17:49–52.
20. Institute of Public Health of Serbia. Health statistical yearbook of Republic of Serbia 2016; 2017.
21. *Cvetkovic D, Zivkovic V, Lukic V, Nikolic S.* Unnatural and Violent Death in Cases with High Blood Alcohol Concentration – Autopsy Study. *J Forensic Sci.* 2017;62:1506-11.
22. *Kugelberg FC, Jones AW.* Interpreting results of ethanol analysis in postmortem specimens: a review of the literature. *Forensic Sci Int.* 2007;165:10–29.
23. *Rockett IR, Regier MD, Kapusta ND, Coben JH, Miller TR, Hanzlick RL, et al.* Leading Causes of Unintentional and Intentional Injury Mortality: United States, 2000–2009. *Am J Public Health.* 2012;102:e84-e92.
24. *Reddy MS.* Suicide incidence and epidemiology. *Indian J Psychol Med.* 2010;32:77-82.
25. *Richardson EG, Hemenway D.* Homicide, suicide, and unintentional firearm fatality: comparing the United States with other high-income countries, 2003. *J Trauma Acute Care Surg* 2011;70:238–43.
26. *Fässberg MM, van Orden KA, Duberstein P, Erlangsen A, Lapierre S, Bodner E, et al.,* A Systematic review of social factors and suicidal behavior in older adulthood. *Int J Environ Res Public Health.* 2012 Mar;9(3):722-45.
27. *Draper BM.* Suicidal behaviour and suicide prevention in later life. *Maturitas.* 2014;79:179–83.

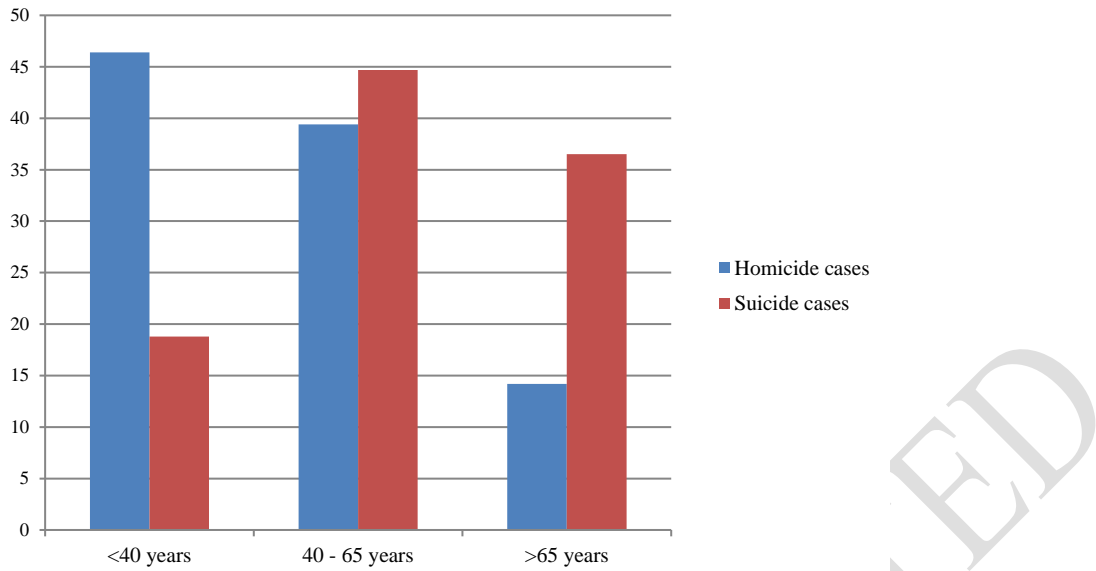
28. *Lachaud J, Donnelly PD, Henry D, Kornas K, Calzavara A, Bornbaum C, et al.* A population-based study of homicide deaths in Ontario, Canada using linked death records. *Int J Equity Health.* 2017 Jul 24;16(1):133.
29. *Ambade VN, Godbole HV, Kukde HG.* Suicidal and homicidal deaths: a comparative and circumstantial approach. *J Forensic Leg Med.* 2007;14:253–60.
30. *Milner A, Page A, LaMontagne AD.* Long-Term Unemployment and Suicide: A Systematic Review and Meta-Analysis. Baradaran HR, ed. *PLoS ONE.* 2013;8:e51333.
31. *Fountoulakis KN, Gonda X.* Differential correlation of suicide and homicide rates according to geographical areas: A study with population-level data. *Psychiatry Res.* 2017;249:167-71.
32. *Kattimani S, Penchilaiya V, Sarkar S, Muthukrishnan V.* Temporal variations in suicide attempt rates: A hospital-based study from India. *J Family Med Prim Care.* 2016;5:357-61.

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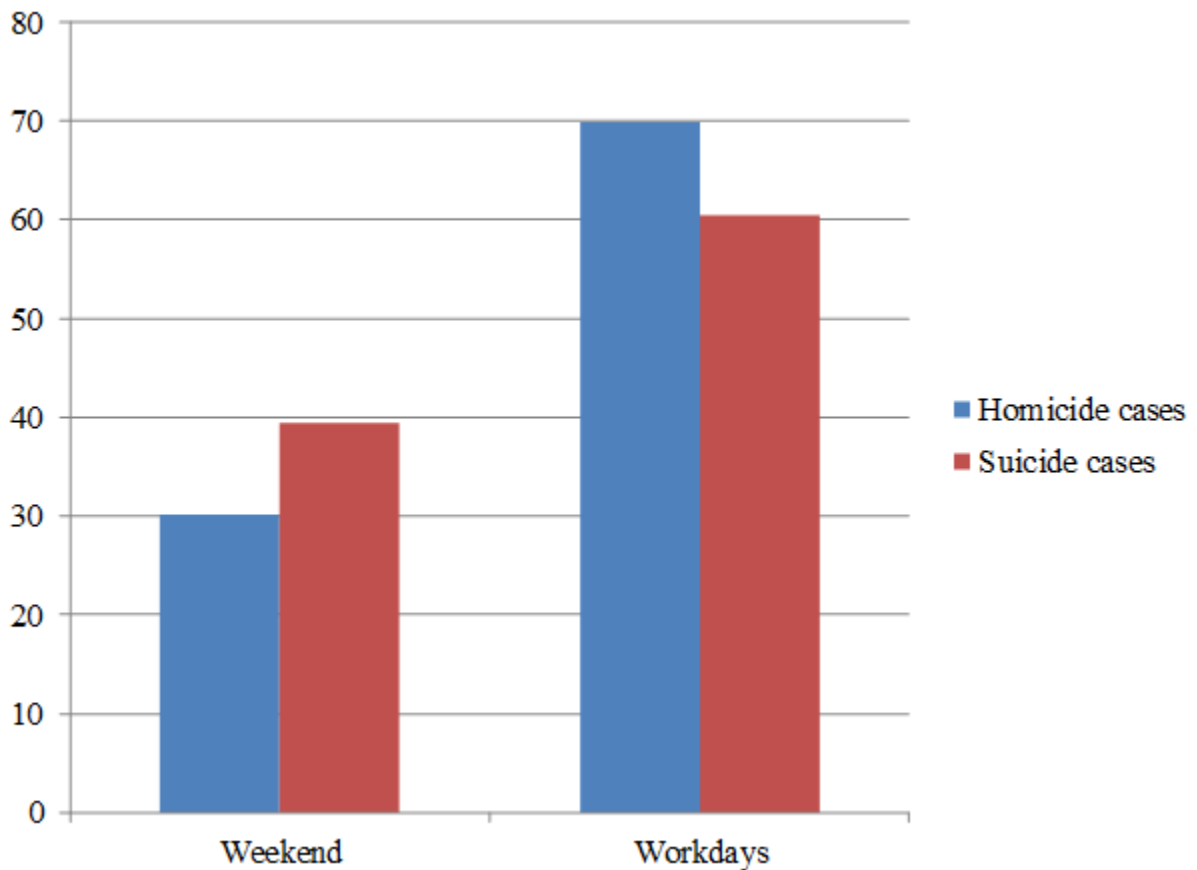
**Table 1 Demographic and forensic characteristics of homicide and suicide cases**

<b>Variable</b>	<b>Homicide n (%)</b>	<b>Suicide n (%)</b>	<b>OR (95% CI)<sup>b</sup></b>	<b>p</b>
<b>Age<sup>a</sup></b>	45.2 ± 17.34	57.3 ± 17.4		<0.001
<b>Gender</b>				
Male	85 (66.9)	499 (74.9)	1.0	
Female	42 (33.1)	167 (25.1)	1.5 (1 – 2.2)	0.062
<b>Married</b>				
No	68 (56.2)	370 (57.1)	1.0	
Yes	53 (43.8)	278 (42.9)	1.0 (0.7 – 1.5)	0.854
<b>Education (higher level)</b>				
No	106 (92.2)	499 (84.1)	1.0	
Yes	9 (7.8)	94 (15.9)	0.4 (0.2 – 0.9)	0.029
<b>Employed</b>				
No	81 (67.5)	489 (76.8)	1.0	
Yes	39 (32.5)	148 (23.2)	1.6 (1 – 2.4)	0.032
<b>Method</b>				
Gunshot	70 (55.6)	170 (25.5)		
Cuts / stabbing	29 (23)	29 (4.4)		
Fall from height	0	122 (18.3)		
Hanging	0	282 (42.3)		
Blunt force injury	18 (14.3)	0		
Drowning	0	33 (5)		
Poisoning	0	9 (1.4)		
Vehicle injury	0	10 (1.5)		
Strangulation / asphyxia	7 (5.6)	2 (0.3)		
Other	2 (1.6)	9 (1.4)		

<sup>a</sup> Values are presented as mean ± SD; <sup>b</sup> OR- Odds ratio, CI 95%- Confidence interval 95%



**Fig. 1 – Distribution of suicide and homicide cases according to age groups (the y-axis represents a percentage)**



**Fig. 2 – Distribution of suicide and homicide cases according to the day of death (the y-axis represents a percentage)**

**Table 2 Toxicology results of homicide and suicide cases**

<sup>b</sup> OR- Odds ratio, CI 95%- Confidence interval 95%

Variable	Homicide <i>n</i> (%)	Suicide <i>n</i> (%)	OR (95% CI) <sup>b</sup>	<i>p</i>
<b>Alcohol</b>				
No	104 (81.9)	566 (85)		
Yes	23 (18.1)	100 (15)	1.3 (0.8 – 2.1)	0.38
<b>Blood – ethanol concentration (g/dl)<sup>a</sup></b>	0.19 (0.04 – 0.48)	0.14 (0.04 – 0.51)		0.12
<b>High level of alcohol intoxication (0.2 – 0.3 g/dl)</b>				
No	118 (92.9)	644 (96.7)		
Yes	9 (7.1)	22 (3.3)	2.2 (1 – 5)	0.04
<b>Opioids and methadone</b>				
No	42 (89.4)	111 (86)		
Yes	5 (10.6)	18 (14)	0.7 (0.3 – 2.1)	0.56
<b>Cannabis</b>				
No	44 (93.6)	129 (100)		
Yes	3 (6.4)	0		
<b>Psychostimulants</b>				
No	45 (95.7)	128 (98.5)		
Yes	2 (4.3)	2 (1.5)	2.8 (0.4 – 20.8)	0.30
<b>Psychoactive drugs</b>				
No	41 (87.2)	96 (74.4)		
Yes	6 (12.8)	33 (25.6)	0.4 (0.2 – 1.1)	0.07
<b>Illicit substances</b>				
	39 (83)	113 (87.6)		
	8 (17)	16 (12.4)	1.4 (0.6 – 3.6)	0.43

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