

Acute use of alcohol before suicide in Kazakhstan: A population-wide study

Introduction

Alcohol consumption and suicide

Suicide is a significant global public health concern accounting for 1.3% of all deaths, which is 700 000 lives each year (WHO, 2021). According to the World Health Organization, more people die from suicide than malaria, HIV/AIDS, breast cancer, or homicide. Given the importance of the problem, it is critical to identify proximal factors increasing the risk of suicide. Acute use of alcohol (AUA) is a well-known risk factor for suicidal behavior and suicide attempts (G. Borges et al., 2017; Conner and Bagge, 2019). AUA has been defined as the use of alcohol within 3-6 hours of suicidal behavior, or as the presence of any alcohol in the blood of an individual who attempted suicide or died by suicide (Conner and Bagge, 2019).

Many studies document the importance of this risk factor. The blood alcohol positivity of suicide decedents varied from 32% to 36% across a range of studies (Choi et al., 2018; Hayward et al., 1992; Kaplan et al., 2014). A recent meta-analysis using cohort studies has found that alcohol use increases the risk of suicidal ideation, suicidal attempts, and suicide death by up to 65% (Amiri and Behnezhad, 2020). The same study highlighted that alcohol consumption has a more negative effect on suicidal behavior of males than females. While another meta-analysis, including 33 studies, concluded that alcohol use is associated with a 94% increase in the risk of death by suicide (Isaacs et al., 2022). Another study, involving 272 suicide attempters hospitalized to the emergency departments within 6 hours of the suicide attempt, found the dose-response relationship between AUA and suicide risk, showing specifically that every drink increased the risk of a suicide attempt by 30% (Guilherme Borges et al., 2017). The same study explored that the removing of alcohol would reduce suicide attempts by about 35%. AUA during 24 hours before a suicide attempt significantly increases the suicidal ideation (Bagge et al., 2014) and even facilitates the transition from a suicidal impulse to real suicidal action (Bryan et al., 2016). These findings suggest that the use of alcohol before the event intensifies the risk of suicide.

Several studies have established the association between chronic use of alcohol and suicide (Boenisch et al., 2010; Flensburg-Madsen et al., 2009; Kőlves et al., 2017; Morin et al., 2013; Schneider, 2009). Alcohol use disorder (AUD) was the second most common mental health disorder among individuals who died by suicide (Conner and Bagge, 2019). However, the psychological autopsy study found that alcohol dependency among suicide decedents is associated with other psychological conditions, including mood disorders (Kőlves et al., 2017). Patients with diagnosed depression often struggle with alcohol dependency (Brière et al., 2014; Currie et al., 2005; Mchugh & Weiss, 2019). Considering the difference between chronic and acute alcohol use, as well as the established dose-response relationship between the level of alcohol in the blood and suicide risk (Guilherme Borges et al., 2017), individuals who drank heavily before a suicide attempt can be at the different risk level to suicide compared the ones with AUD.

Alcohol use and suicide in Kazakhstan

Because of the high level of alcohol consumption in Kazakhstan, it is essential to examine the impact of alcohol use on suicide mortality. The Kazakhstani population consumes the equivalent of 7.7 liters of pure alcohol per capita, which is considerably higher than the world average of 6.4 liters (WHO, 2018). The rates of alcohol consumption also vary within Kazakhstan, with the highest levels found in the country's Northern, Eastern and Central regions (Schulte et al., 2020). The Northern and Central Kazakhstan regions also have one of the highest suicide rates in the country. Overall, Kazakhstan has the seventeenth-highest age-adjusted suicide rate, with 18.1 suicides per 100 000 population out of 183 countries, two times higher than the world's average (WHO, 2019). The suicide rate among males was 30.9 per 100 000 individuals in 2019, nearly five times higher than females (6.9 per 100 000) (WHO, 2019).

Kazakhstan is a post-Soviet Union country. Many former Soviet Union republics have both high rates of suicides (Zetzsche et al., 2007) and alcohol consumption (Pomerleau et al., 2008). A recent study in Lithuania, a former Soviet Union country, revealed that introducing of an alcohol control policy can decrease suicide mortality among males and concluded that the policies related to alcohol pricing could be a cost-effective indirect suicide prevention method (Lange et al., 2021). Another study in the United States also showed that increased tax on alcohol is associated with decreased suicides among men (Markowitz et al., 2003; Xuan et al., 2016).

There is growing evidence that public health measures targeting a reduction of alcohol consumption might potentially reduce suicide mortality; thus, it is especially important to identify the role of AUA in relation to suicide. The current study examines the association between AUA and suicide mortality in Kazakhstan. To our knowledge, this is the first study to address the link between AUA and suicide in Kazakhstan.

Methods

This study used open-source aggregate data for suicide decedents from 2015 to 2021 from the official webpage of the Committee on Legal Statistics and Special Accounts of the General Prosecutor's Office of the Republic of Kazakhstan (CLSnSA, 2022). The statistical report №1-M containing information on violent deaths, including suicides, was obtained for seven years. The report includes pooled data by gender and age groups. The following information was extracted from the reports: incident years, sex, age groups, toxicology results, known psychiatric condition during the suicide, and methods of suicide. The data on suicide cases were not available for the years before 2015; thus, the current study used only the accessible data.

A suicide case in Kazakhstan is considered as a violent death and investigated as a criminal case by the prosecutor's office. Therefore, the information on the suicide decedents becomes a part of the statistical report №1-M "The registered criminal cases". According to the order of the General Prosecutor of the Republic of Kazakhstan this report is developed and updated monthly (The order of the General Prosecutor of the RoK, 2019). The report collects and pools the data from the Unified Register of Pre-Trial Investigations, an automated database containing information about the reasons for initiating a pre-trial investigation and the progress of criminal investigations, including suicide inquiries (The General Prosecutor of the RoK, 2014). According to the Order of the Minister of Justice of the Republic of Kazakhstan on approval of the rules for

the organization and production of forensic examinations and research in forensic examination bodies, the coroner's postmortem examination is conducted in cases of violent deaths (Minister of Justice of RoK, 2017).

The main outcome measure was the blood alcohol content (BAC) of suicide cases. The statistical report №1-M includes the variable on substance use before suicide. This variable contains information on individuals who used alcohol or drugs before suicide. As suicide is considered a criminal case the toxicological examination is administered to explore a person's exposure to specific substances as part of the case death investigation. According to the Methodology of forensic examination of a corpse, biological fluids are collected from the body for laboratory examination. Blood and urine samples are required to be collected and sent for laboratory examination to determine the presence and amount of alcohol in the samples (except cases of death of adults who have been in hospital for a long time and young children) (Imanaliyev, 2016). The available data provided only aggregate data on alcohol and drug-positive cases. The acute use of alcohol (AUA) was based on positive alcohol cases. As the exact blood alcohol concentration was not provided, the AUA was coded either "yes" or "no".

The known psychiatric condition during the suicide variable in the statistical report №1-M did not specify the mental disorder, thus the presence of any psychiatric condition was coded "yes" or "no". The known psychiatric condition during the suicide was defined as a disturbance in an individual's mental health (The order of the General Prosecutor of the RoK, 2019).

Demographic characteristics were summarized using counts and frequencies. Logistic regression models were used to test unadjusted (OR) and adjusted (AOR) odds ratios controlling for the effects of other important variables (age categories, gender, suicide method, and known psychiatric condition). Regression modeling was used to identify significant predictors of alcohol use among suicide decedents and obtain unbiased estimates by performing adjustment for potential confounding factors. The age group between 18-24 y.o. was chosen a reference group as the youngest ages were considered more different compared to other age groups. Significance level for all statistical tests was set at $p < 0.05$ and 95% confidence levels (CI).

Results

A total of 25,797 suicide deaths were registered in Kazakhstan between 2015 and 2021 (*Figure 1*). During the study period the majority of suicides (40.2%) were conducted by middle-aged individuals between 35-54 y.o., and males accounted for 84.3% of suicides. The suicide proportion was notably high for young female adults aged 18-24 y.o. (15%) being the second most common age group among females after the 35-44 y.o. group, while among males this group had a low suicide proportion (9.1%) and ranked only 6th among other age groups. From the total suicides conducted in the country during seven years, 20.7% ($n = 5,330$) involved recognized acute use of alcohol before the suicide event. The results showed that 22.5% of male and 13.4% of female suicide decedents tested positive for alcohol.

[Figure 1 about Here]

Table 1 summarizes the overall characteristics of all suicide cases and characteristics of suicide cases with AUA. Both male and female suicide decedents between the ages 30-44 years were more likely to drink alcohol before suicide compared to other age groups (*Table 1*). The overall alcohol consumption proportion for both sexes remained stable during the study period, with minor fluctuations between years. However, the recognized alcohol use considerably increased among female suicide decedents in 2021 compared to other years, while among males, it decreased.

[Table 1 about here]

The most frequent suicide method for both genders was hanging or suffocation (79.9%). However, as shown in Table 1, hanging was more prevalent among males (83.2%) compared to females (66.9%), who also commonly used other suicide methods such as poisoning (10.5%) and jumping (8.2%). Although hanging is the most common method in the general population, it is the suicide method with the lowest involvement of alcohol. Only 10.6% of individuals using hanging as a suicide method had a recognized positive BAC. The proportion of alcohol consumption was highest among individuals who died by immolation (84.9%), shooting (80%), and self-stabbing (75.2%). The sex difference was identified for suicide methods with AUA involvement. AUA was common among males using suicide methods of high lethality (SMHL), such as immolation (97%) and drowning (94.3%), while among females, the proportion was highest for poisoning (58.1%) belonging to suicide methods of low lethality (SMLL).

According to the available data, only 3% of all suicide decedents had known psychiatric conditions, and among these decedents, only 1% had recognized positive BACs.

[Table 2 about here]

Table 2 summarizes the logistic regression models comparing suicide deaths with and without AUA not adjusted and adjusted for sex, age categories, suicide method, and known psychiatric condition. Before the adjustment, it was shown that individuals between 25 and 44 years old are at a higher risk of conducting suicide with AUA. Immolation, firearm use, stabbing, and drowning were identified as suicide methods associated with acute alcohol use. However, after the adjustment, the association was stronger for poisoning (AOR: 3.45, $p < 0.001$), burning (AOR: 2.91, $p < 0.05$), and drowning (AOR: 2.41, $p < 0.05$). The OR for the risk of suicide with alcohol involvement using a firearm was high compared to other methods before the adjustment; but after the adjustment this association was negative.

Discussion

This is the first study exploring AUA among suicide decedents in Kazakhstan. Overall, the analysis showed that being a male younger than 45 and using suicide methods such as poisoning, immolation, and drowning increases the odds of acute use of alcohol among suicide decedents.

Nearly 21% of all suicides over the study period involved recognized AUA. This is somewhat lower than in a recent meta-analysis finding that the prevalence of alcohol use among suicide cases range between 26.5% to 44.4% in different international studies (G. Borges et al., 2017). Recent studies in Australia and New Zealand found that roughly 27% of individuals use alcohol before suicide; however, both included only the population over 15 years old (Chong et al., 2020; Crossin

et al., 2022). Several studies have established the high proportion of AUA among suicide attempts where the prevalence of alcohol consumption before suicide varied between 32-40% (Boenisch et al., 2010; Lejoyeux et al., 2008). Considering the high alcohol consumption rates among suicide decedents, it is important to explore the association between AUA and suicide attempts in Kazakhstan and compare completed suicides and suicide attempts.

The proportion of suicides involving recognized AUA remained stable during the study period in Kazakhstan and was between 19-21%. The proportion of women consuming alcohol before suicide notably increased in 2021 (15.1%), which was the highest level over the study period. Several studies concluded that the current COVID-19 pandemic has negatively impacted the population's mental health by causing stress, anxiety, and depression (Necho et al., 2021; Salari et al., 2020). Thus, further studies are required to explore the potential effect of the pandemic on the rate of suicides with AUA.

The proportion of suicides involving AUA peaked between 35-44 years old in Kazakhstan, which is consistent with findings of the study in the US (Kaplan et al., 2013). The unadjusted OR of suicide risk with alcohol involvement was also highest for individuals between 35-44 years, and this result is consistent with the Australian study showing that being middle-aged between 35-44 years is associated with a higher risk of alcohol use prior to suicide (Chong et al., 2020). However, after the adjustment, the risk of suicide with alcohol involvement was higher for the age group between 30-34 years (AOR: 8.06, $p < 0.001$). Overall, the study revealed that being a male under 45 years is associated with an increased odds of suicide with AUA, which is consistent with the results of other studies conducted in the US and Australia (Chong et al., 2020; Giesbrecht et al., 2015; Kaplan et al., 2014).

Poisoning and self-stabbing (using sharp objects) are classified as SMLL. In contrast, other methods, including hanging/suffocation, jumping, drowning, use of a firearm, and immolation, are defined as SMHL (Park et al., 2017). Hanging was the most prevalent suicide method among the Kazakhstani population; approximately 80% of all suicides were conducted using this method. The suicide methods greatly vary between countries. The study using suicide data from 16 European countries revealed that hanging was the most frequent suicide method among the European population (Värnik et al., 2008), which is consistent with our results and the results of the studies conducted in South Korea, Japan, and Brazil (Gonçalves et al., 2018; Kim et al., 2011). However, using a firearm is the most prevalent suicide method in the US, followed by hanging/suffocation (CDC, 2020), and shooting accounted for nearly half of all suicides in the US (Houtsma et al., 2018). Firearm use was also ranked first among males in Switzerland (Värnik et al., 2008). The high prevalence of firearm use as a suicide method in these countries can be due to firearm access and availability. A study in the US identified that one-third of US residents are gun owners (Kalesan et al., 2016). Gun ownership due to military reasons is also prevalent in Switzerland, where one-third of households have firearms (Nina et al., 2018).

Suicides by firearm use were registered rarely in Kazakhstan (1.6%) and ranked only 6th among all other causes. It is consistent with findings of the study in South Korea and Japan, where suicides by shooting accounted only for 0.0~0.2% (Kim et al., 2011).

The study in the US found an association between violent suicide methods such as firearm and hanging and acute alcohol drinking (Conner et al., 2014). However, our study showed contradictory results regarding hanging, which was also the rarest type of suicide involving AUA.

Strength and Limitations

This was the first study examining suicide death in Kazakhstan, considering age, sex, and suicide methods in relation to alcohol consumption. This study has several limitations. Using the pooled data on exposure and outcome variables did not allow us to examine the association between alcohol use and suicide on the individual level. The alcohol use in this dataset included information only on individuals with positive alcohol toxicology tests; thus, the outcome was classified as either yes or no. But there was no information about individuals not tested for BAC, which does not exclude the possibility of missing data. Another limitation is the absence of information on the exact BAC level of suicide decedents, which cannot allow us to identify the dose-response relationship between alcohol consumption and suicide.

The study also showed that only 3.2% of all suicide decedents had any known psychiatric condition without specifying the mental disease; such a low proportion is likely due to underreporting or missing data. According to WHO, the incidence of mental disorders was 139 per 100,000 population in Kazakhstan in 2019 and this number decreased about four times since 2009 (505 per 100,000 population) (WHO, 2020). The country has a high shortage of mental health specialists with 4.33 psychiatrists and 1.41 psychologists per 100,000 population in 2020 (WHO: Mental Health Atlas 2020, 2020), which is considerably low compared to developed countries, and substantially decreases the access to mental health services especially in rural regions. For instance, the recent report on the distribution of the U.S. psychiatric workforce explored that the national average was 12.9 psychiatrists per 100,000 state population with a high difference in psychiatrists' ratio between states from 5 to 50 per 100,000 state population (Beck et al., 2018). The same study highlighted that the rural counties have a significantly lower proportion of mental health professionals. The overall high shortage of mental health specialists in Kazakhstan as well as the probable unequal distribution of the workforce between urban and rural areas can impact the diagnosis of mental diseases among the population. Previous studies have also established that most suicides are related to psychiatric diseases such as mood disorders and substance abuse (Brådvik, 2018). Many individuals with suicidal intentions can remain undiagnosed. Males have the highest suicide rate in the Kazakhstani population, but the proportion of males diagnosed with psychiatric conditions is considerably lower than females. This contradiction can be explained by cultural masculinity when men have to behave in ways that the culture defines as gender-appropriate or avoid behaviors that are culturally defined as feminine (Kilmartin, 2005). At the same time, it does not fully explain the underreporting of the presence of known psychiatric conditions in the suicide decedents; thus, further research is required to identify the rates and types of mental disorders among suicide cases in Kazakhstan.

Conclusion

The current study shows the important role of alcohol in suicide mortality in Kazakhstan. Thus, further studies exploring alcohol consumption and suicide risks, especially among middle-aged males, are required.

The absence of a country-based surveillance system collecting anonymous information for each suicide case makes it problematic to establish any causal relationships related to suicides. It is recommended to create a database containing information on violent deaths from multiple data sources. For example, the US National Violent Death Reporting System (NVDRS) collects extensive information from multiple sources on suicide decedents and can be a useful model for other countries (CDC, 2022).

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