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Spatial regularity in suicides and alcohol psychoses in Belarus

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Objective. Epidemiological evidence suggests that rates of suicide mortality vary noticeably between the regions in Belarus with the regular spatial pattern in suicide distribution. The present study considers the effect of regional alcohol consumption as a factor responsible for regional variations in suicide rates.

Methods. The cross-sectional time series analysis of suicide and alcohol psychoses (as a proxy for alcohol consumption) rates by the regions of Belarus between 1990 and 2010 was made.

Results. In general, the regional variations of suicide and alcohol psychoses incidence rates have a similar spatial regularity, meaning that the regions with a high suicide rate also have a high alcohol psychoses incidence rate.

Conclusions. The findings on spatial relationship between suicide and alcohol psychoses incidence rates seem to support the hypothesis that considers the regional pattern of alcohol consumption as a factor responsible for suicide rate regional variations.

Key words: suicide, alcohol psychoses, spatial regularity, Belarus

INTRODUCTION

Suicide is one of the main causes of premature mortality in Belarus, bringing considerable loss of human lives (1). The alarming increase in the occurrence of suicide in Belarus in 1990s has resulted in the country having one of the highest suicide rates in the world (2). Epidemiological evidence suggests that rates of suicide vary noticeably between the regions in Belarus with the regular spatial pattern in suicide distribution (1, 3). On the map of the country the main gradient of suicide mortality is

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increased from the south to north of the country, which means that the four northern administrative regions (Vitebsk, Minsk, Hrodna and Mahiliou) regularly have a higher suicide rate than the two southern regions (Brest and Homel) (Fig. 1). The similar north-south suicide gradient is also visible between the districts of the Minsk Region situated in the center of the country (3).

Noteworthy, the north-south suicide gradient in Belarus repeats the same of other European countries: Italy, France, European Russia (4–7). Moreover, the polar points on the country's suicide map are the Brest Region on the south-west and the Vitebsk Region on the north-east, and such polarity repeats the general European gradient in suicide mortality directed from south-west to north-east (5).

It has been hypothesized that the phenomenon called as 'Yugoslavian paradox' (8) or 'Albanian paradox' (9) is true for other European territories including Belarus (3). In the original version, this phenomenon considers the existence of some protective health factors within socially and economically disadvantageous southern European nations. In the discussion on association between the anthropological composition and suicide variations in Eastern European territories Kandrychyn suggested that reasons of such variation might be rooted in the ethnic history, which follows Morselli's hypothesis about the role of the biological factor in suicide genesis (7).

Since the beginning of social statistics, at the end of XVIII – the first half of XIX century, the spatial regularity of suicide has been a matter for serious scientific discussion (10, 11). Among potentially responsible factors are geophysical, climatic, biological, anthropological, pathological, socioeconomic, cultural and some other factors (3). None of the listed hypotheses have gained proper scientific verification yet, and the multifactorial nature of suicide is considered as the main methodological obstacle (12, 13).

The level of alcohol consumption in Belarus is among the highest in the world (14). As a predominantly spirits drinking country, Belarus is characterized by infrequent, but heavy (binge) drinking leading to high rates of acute alcohol-related problems (14). Alcohol plays an important role in Belarussian suicide mortality crisis (15). A recent study based on the autopsy reports of the Bureau of Forensic Medicine revealed that 61% of males and 30.6% of females were BAC-positive at the time of death (16). The findings also suggest that in Belarus alcohol is an important determinant of suicide rate at the aggregate level (16–21). In line with this evidence, we assume that suicide rate variations between the regions of Belarus are connected with the regional pattern of alcohol-related problems. In this study we will test this hypothesis by analyzing regional time series of suicide and alcohol psychoses rates between 1990 and 2010.

Fig. 1. Belarus: administrative regions

MATERIALS AND METHODS

Data

Suicide data by the regions of Belarus obtained from the Ministry of Statistics and Analysis' annual reports and regional suicide rates by 100,000 of population were calculated. The cause-of-death classification has been subjected to several changes over the last decades. In 1989–2001 the Ministry of Statistics used the coding scheme based on ICD-9. In 2002 a new coding system based on ICD-10 has been introduced. The Belarusian coding system is claimed to be compatible with ICD-9 and ICD-10. For example, code 173 (1989–2001) "suicide and self-inflicted injury" corresponds with ICD-9 code E 950.0–E 959.9 and code 249 (since 2002) corresponds with ICD-10 code X 60.0–X 84.9.

In the present study we used the alcohol psychoses incidence rate as a proxy for the aggregate level of alcohol consumption. The alcohol psychoses incidence as an indicator of harmful drinking may capture more effectively the magnitude of alcohol-related problems among the population than official sales statistics and expert's estimation of the total level of alcohol consumption (Razvodovsky, 2012). We specified the number of persons, which were admitted for the first time for the treatment as incidence of alcohol psychoses: (ICD–10: F 10). The data on alcohol psychoses incidence rate (per 100,000 of the population) is taken from the Ministry of Statistics of Belarus annual reports for the years from 1990 to 2010.

Statistical analysis

Pooled matrix of data consisted of cross-sectional data on 7 regions of Belarus and time series on 21 years (from 1990 to 2010) to produce a data set of observations. The Spearman paired correlation and linear regression was used for the present analysis with the time series of alcohol psychoses incidence rate as an independent variable and the time series of suicide mortality rate as a dependent. In a general form the linear regression model looks as follows:

$$Y = a + \beta X,$$

where Y is the suicide mortality rate, a indicates the possible trend in suicide mortality due to other factors than those included in the model, X is the alcohol psychoses incidence rate (as a proxy for alcohol consumption), β is the estimated regression parameter. P-values less than 0.05 were considered statistically significant.

RESULTS

According to official statistics in the period from 1990 to 2010, the suicide rate in Belarus increased by 27.6% (Table 1). The suicide rate in Belarus has a range from the minimum of 20.3 per 100,000 in 1990 to the maximum of 35.0 per 100,000 in 1998. In this period the suicide rate in Brest Region increased by 47.0%; in Homel Region by 46.6%; in Vitebsk Region by 17.6%; in Mahiliou Region by 52.3%; in Hrodna Region by 27.1%; and in Minsk Region by 48.5%. At the same time, in Minsk City this indicator declined by 25.5% (Table 1). For the period 1990–2010 the mean suicide rate (per 100,000) by the regions of Belarus was the following: 24.5 ± 3.6 in Brest Region; 27.1 ± 4.8 in Homel Region; 41.2 ± 6.7 in Vitebsk Region; 34.0 ± 5.2 in Mahiliou Region; 32.0 ± 4.8 in Hrodna Region; 38.8 ± 7.8 in Minsk Region and 18.0 ± 4.9 in Minsk City (Table 1). Thus, for the studied period the lowest suicide rate was noted in Minsk City and

Table 1. Mean suicide rates (per 100,000 of population), with the minimal and maximal values in the regions of Belarus, 1990–2010

Region	Mean	Minimal	Maximal	1990	2010	%
Brest	24.5 ± 3.6	16.4	29.4	16.4	24.1	+47.0
Homel	27.1 ± 4.8	16.1	33.4	16.1	23.6	+46.6
Vitebsk	41.2 ± 6.7	26.7	51.3	26.7	31.4	+17.6
Mahiliou	34.0 ± 5.2	22.0	40.4	22.0	33.5	+52.3
Hrodna	32.0 ± 4.8	21.6	39.6	23.6	30.0	+27.1
Minsk	38.8 ± 7.8	23.2	47.9	23.7	35.2	+48.5
Minsk City	18.0 ± 4.9	11.7	26.2	15.7	11.7	–25.5
Belarus	30.1 ± 4.6	20.3	35.3	20.3	25.9	+27.6

Table 2. Mean alcohol psychoses incidence rates (per 100,000 of population), with the minimal and maximal values in the regions of Belarus, 1990–2010

Region	Mean	Minimal	Maximal	1990	2010	%
Brest	16.5 ± 7.3	4.8	24.8	4.5	24.2	+437.7
Homel	26.5 ± 8.7	9.6	39.9	11.0	30.3	+175.5
Vitebsk	25.6 ± 11.7	7.3	43.9	6.8	9.4	+38.2
Mahiliou	21.0 ± 8.1	7.9	28.1	7.5	9.9	+32.0
Hrodna	23.8 ± 10.9	6.9	42.1	5.9	13.4	+127.1
Minsk	21.7 ± 8.7	7.0	33.9	6.5	14.4	+121.5
Minsk City	25.5 ± 9.1	7.9	41.8	7.8	25.5	+226.9
Belarus	22.7 ± 7.8	6.4	34.7	6.4	19.9	+210.9

the highest rate was in the Vitebsk Region. The maximal increase of suicide rate was registered in Homel and Brest regions. During the studied period the suicide rates in the four northern regions of Belarus were constantly higher than the rates in two southern regions (25.8 vs 36.5). In contrast, the suicide rate increase has demonstrated the opposite tendency: it was higher just in the southern regions, then in four northern regions (46.8% and 36.4%, respectively).

Based on the data of the Ministry of Public Health in the period from 1990 to 2010, the alcohol psychoses incidence rate increased in Belarus by 210.9% (Table 2). In this period the alcohol psychoses incidence rate increased in Brest Region by 437.7%, in Homel Region by 175.5%, in Vitebsk Region by 38.3%, in Mahiliou Region by 32.0%, in Hrodna Region by 127.1%, in Minsk Region by 121.5%, and in Minsk City by 226.9% (Table 2).

The minimal value of the mean alcohol psychoses incidence rate in the studied period was in the Brest Region (16.5 ± 7.3) and the maximal rate was in the Homel Region (26.5 ± 8.7). The largest alcohol psychoses incidence rate increase in the given time was in the Brest Region, while the Hrodna Region has the smallest one. The values of the mean alcohol psychoses incidence rates by a region of Belarus are near about the average for all the country, with exception of the Brest Region where it was noticeably lower. The mean value of alcohol psychoses incidence rates is just below the same value in four northern and two southern regions (21.5 vs 23.0) and it is no possibility to suggest the existence of the spatial gradient. The mean value of increase rates, as in the case of suicide rates increase, was noticeably higher in the southern regions compared to the northern ones (306.6% and 79.7%, respectively) (Table 2).

In the studied period the general dynamic pattern for the both indices was similar in the most of regions: the rapid increase till the years 1997–1998, with the following stabilization and gradual decline (Figs. 2, 3). There were some differences in regional trends in suicide and alcohol psychoses incidence rates. For example, in the Hrodna Region the alcohol psychoses incidence rate has sharply decreased beginning from 1998, while the suicide rate began to decline only after the year 2003. In Minsk City, the suicide rate after the stage of rapid increase began to decline in 1996, while the alcohol psychoses incidence rate began to decline only three years after that (Figs. 2, 3).

The results of the Spearman paired correlation analysis indicate the significant positive association between suicide mortality and alcohol psychoses incidence time series in all regions, while in Minsk City it was statistically not significant (Table 3). The results of the linear regression analyses are presented in Table 4. As can be seen, the effects of alcohol psychoses incidence (as a proxy for alcohol consumption) on suicide rates were generally positive and significant; only Minsk City obtained a non-significant estimate. The largest estimates were found in the Minsk Region (0.68) and in the

Table 3. The association between alcohol psychoses incidence rates and suicide rates. The results of Spearman paired correlation analysis

Region	r	p
Brest	0.85	0.000
Homel	0.87	0.000
Vitebsk	0.74	0.000
Mahiliou	0.81	0.000
Hrodna	0.60	0.015
Minsk	0.82	0.000
Minsk City	0.12	0.658

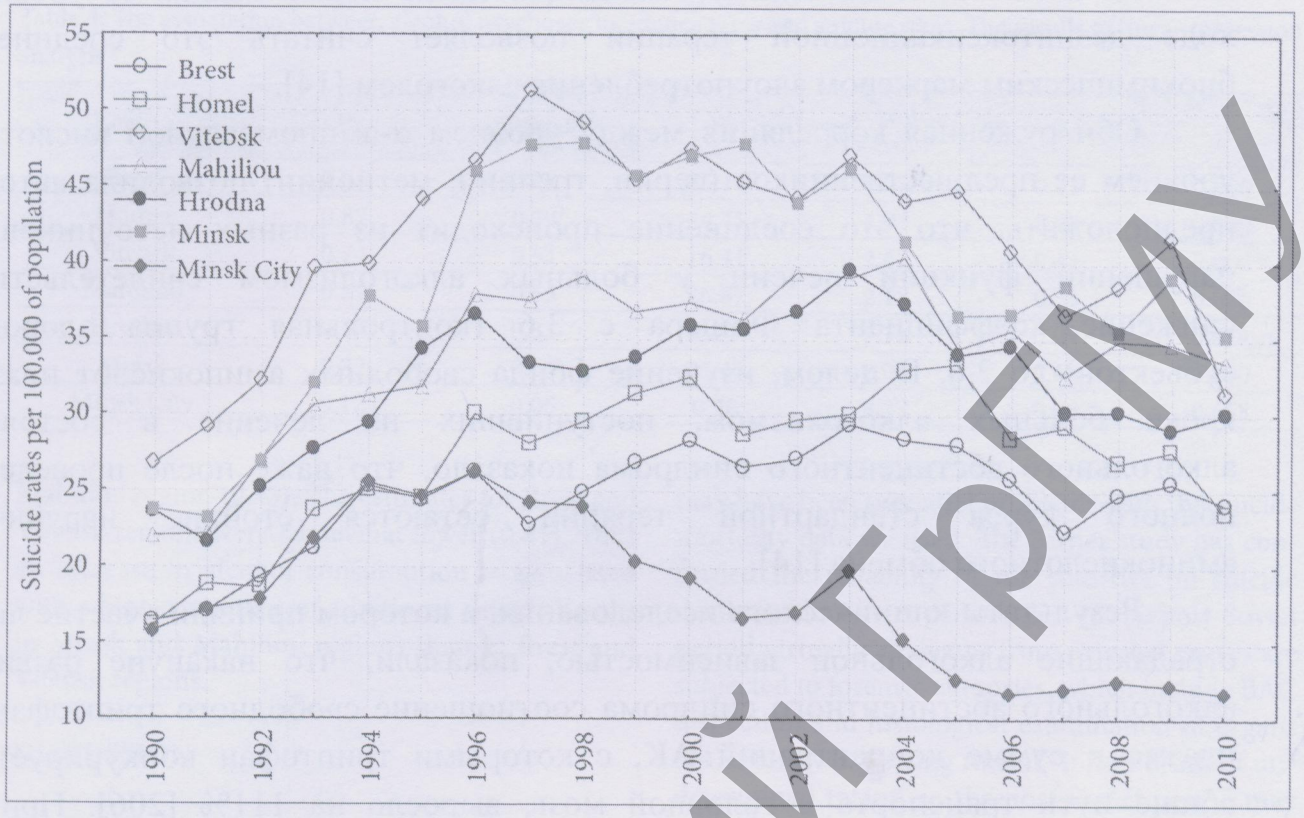

Fig. 2. Trends in suicide rates in the regions of Belarus between 1990 and 2010

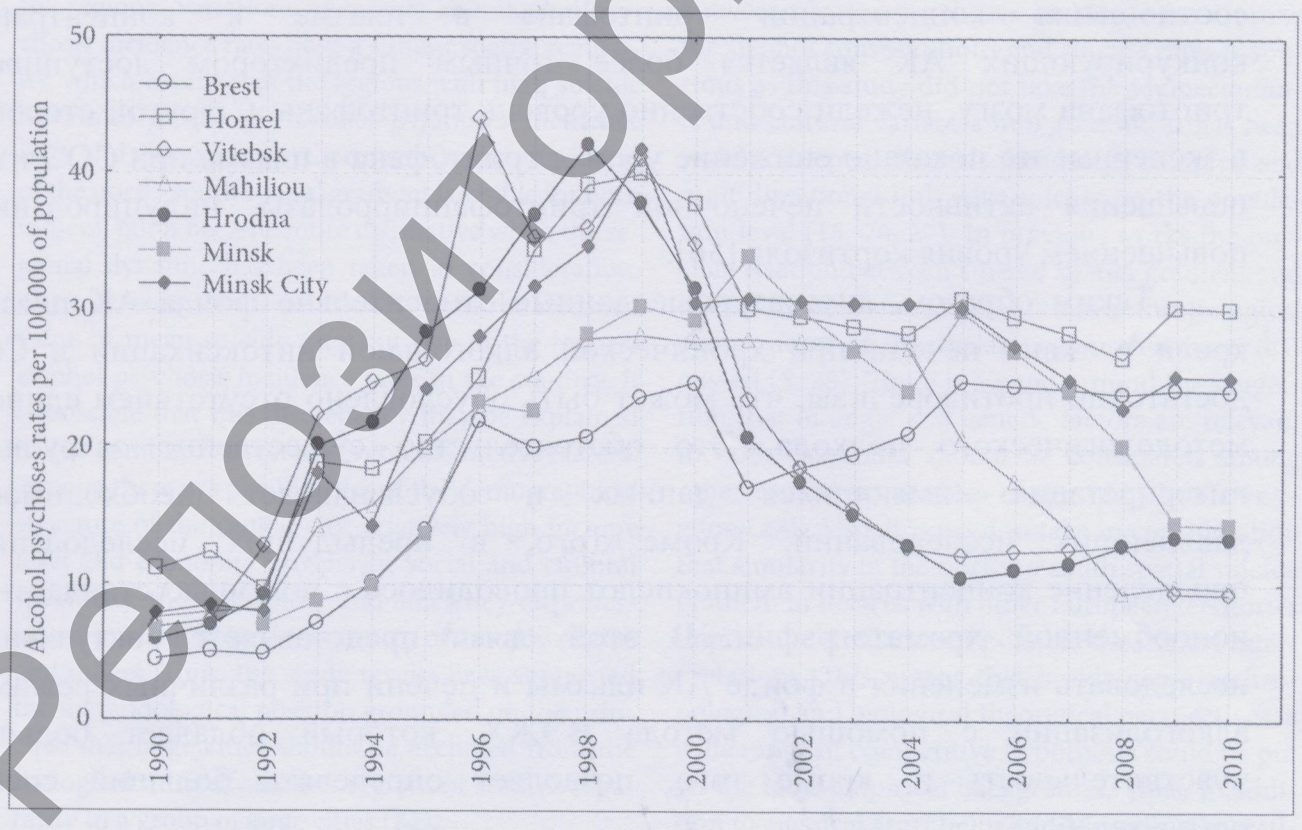

Fig. 3. Trends in alcohol psychoses incidence rates in the regions of Belarus between 1990 and 2010

Table 4. The association between alcohol psychoses incidence rates and suicide rates. The results of linear regression analysis

Region	R	Adjusted R^2	F	Stand. Error	β	p
Brest	0.85	0.70	36.14	1.25	0.41	0.000
Homel	0.87	0.74	44.41	1.93	0.49	0.000
Vitebsk	0.74	0.51	16.41	2.62	0.41	0.000
Mahiliou	0.81	0.63	26.87	2.18	0.55	0.000
Hrodna	0.60	0.31	7.71	2.11	0.09	0.014
Minsk	0.82	0.65	25.46	2.90	0.68	0.000
Minsk City	0.12	0.05	0.20	3.27	0.06	0.658

Mahiliou region (0.55). The estimates for Brest and Vitebsk regions were somewhat lower (0.41). Thus an increase in alcohol consumption is associated with a higher number of additional suicide deaths in Minsk and Mahiliou regions than in Brest and Vitebsk regions.

DISCUSSION

The finding from the present study indicates that alcohol consumption and suicide mortality rates are positively related phenomena in Belarus. In general, the regional variations of suicide and alcohol psychosis incidence rates have a similar spatial regularity, which means that the regions with high suicide rates also have high alcohol psychoses incidence rates and vice versa. Furthermore, the manifestation of the north-south spatial gradient is visible for both indices, but it became more distinctive when the regional dynamic has been taken in consideration. The sole exception is Minsk City with the minimal value of mean suicide rate, but one of the highest alcohol psychosis incidence rates in the country. It is possible that this discrepancy may be explained by the combined effect of several distinctive factors. Among them are peculiarities of the demographical structure of the capital city, relatively high income level and economic prosperity, social and cultural specificity, the availability and efficiency of professional medical help, the accuracy of autopsy results and others. Thus, the study results have supported the methodological position grounded on the principle that large cities should be excluded from the ecological study of all other regions or studied separately in a group of large cities (22).

Before concluding, several potential limitations of this study must be mentioned. In particular, there may have been potential problems with the suicide mortality data we used. The earlier study has confirmed the reliability of the statistics on suicide death for the Soviet period (23). In the post-Soviet period virtually all deaths from external causes are subjected to forensic autopsies, which include BAC inspection and histological examination of organs (24). However, a rising rate of "injury death of undetermined intent" in the post-Soviet period may indicate declining quality in suicides mortality statistics (25).

Further, it may be argued that the association between alcohol psychoses incidence (as a proxy for alcohol consumption) and suicide rates is spurious as this study did not take the socioeconomic and cultural variables into account. It has been widely accepted that alcohol has a complex and multidirectional link with suicide on the population level (15, 26, 27). In previous works the possible relation between suicide spatial gradient and historical differences in ethnic and anthropological composition of Belarusian regions has been discussed (3, 28). There is a good ground for suggestion that biologic and genetic factors are relevant in both cases and should be considered among other causative variables of the spatial differentiation (28). Also, it is need to take in consideration that similarity of the north to south spatial suicide gradient in Belarus with other European territories implies the similarity of possible theoretical interpretations. This means that beside some anthropological and biological theoretical perspectives, a wide range of competitive hypothesis could be put on the local empirical background. Thus, in addition to classical Durkheim and Morselli's theoretical positions which try to explain suicide regional variations in XIX century Europe, the Belarusian

example is fit to the number of modern hypothesis operating with climatic (29, 30), sociocultural and behavioral factors (31–33). Simultaneously, the question is raised about the projection of the same factors effect in genesis of alcohol psychosis regional differences.

It is important to note that variations in suicides and alcohol psychoses rates between the north and south regions in Belarus correspond to the complex regional differences in rates and patterns of medical, biological and demographical indicators (3). Furthermore, taking into consideration that psychopathology mediates suicides and alcohol abuse (12) and the fact that northern regions of Belarus usually have higher rates of mental disorders (psychosis, schizophrenia, mental retardation) (28), the alcohol-suicide relationship needs a projection on the general mental background of the population. Finally, several scholars have argued that the dramatic increase in suicide rates in the first half of 1990s may reflect the rise in stress experienced by the population during the transition period (34). Therefore, other important contextual factors should be considered in further researches.

CONCLUSIONS

In conclusion, the findings on spatial relationship between suicide and alcohol psychoses incidence rates seem to support the hypothesis that considers the regional pattern of alcohol-related problems as a factor responsible for suicide rate regional variations. However, until principle problem with methodological differentiation of various causative factors in suicide genesis is unsolved, this hypothesis remains provisional and should be considered as an impetus for further research.

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SAVIŽUDYBIŲ IR ALKOHOLIO PSICHOZIŲ ERDVINIS REGULIARUMAS BALTARUSIJOJE

Santrauka

Tikslas. Epidemiologinių tyrimų duomenimis, mirtingumo dėl savižudybių dažniai Baltarusijos regionuose gali smarkiai skirtis. Šis tyrimas rodo, kad regioninės alkoholio vartojimo ypatybės turi įtakos savižudybių dažnio skirtumams regionuose.

Metodai. Buvo atlikta savižudybių ir alkoholio psichozės analizė Baltarusijos regionuose 1990 ir 2010 metais.

Rezultatai. Apskritai savižudybių ir alkoholio psichozių dažnio skirtumai skirtinguose regionuose turi panašų erdvinį reguliarumą, tai reiškia, kad regionuose, kuriuose yra didelis savižudybių skaičius, taip pat dažnos ir alkoholio psichozės.

Išvados. Santykio tarp savižudybių ir alkoholio psichozių dažnio nustatymas patvirtina hipotezę, kad regioninis alkoholio vartojimo modelis yra savižudybių skirtumus regionuose lemiantis veiksnys.

Raktažodžiai: savižudybė, alkoholio psichozės, erdvinis reguliarumas, Baltarusija