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**THE STATISTIC MODEL OF SUICIDE RISK AMONG RUSSIAN  
STUDENTS**

J.V. Borisenko (a)\*, E.V. Evseenkova (a), I.S. Morozova (a), K.N. Belogai (a), E.S. Kagan (b),  
S.G. Gutova (b)

\*Corresponding author

(a) Kemerovo State University, Institute of Education, Krasnaya st., 6, Kemerovo, 650000, Russian Federation, e-mail: laboratory\_cno@mail.ru

(b) Kemerovo State University, Institute of fundamental sciences, Krasnaya st., 6, Kemerovo, 650000, Russian Federation, e-mail: kaganes@mail.ru

***Abstract***

In this paper we analyze the modern world tendencies in theoretical and empirical studies of the risk factors for suicidal behavior among adolescents and youth. Developing a model of suicide risk among adolescents considering the inner and external factors determinating suicidal risk, we conducted an empirical research. 276 pupils (151 male и 125 female) were assessed on a number of measures such as The hopelessness scale for children, Beck Depression Inventory (BDI), The Reasons for Living Inventory», Zung Self-Rating Depression Scale) Nemchin's Questionnaire, Kulikov's Questionnaire, Amirkchan's Questionnaire, Orel's Questionnaire to obtain inner risks and our specially developed measure: Hopeless Situation Inventory to find situational external risks. In our model we consider inner determinants of suicidal risk to be hierarchic and on the first level to be united into three components: Emotional and regulative component, Cognitive and evaluation component and Behavioral component. Our fussy model of suicide risk also considers external determinants to be the triggers of suicide attempt when inner risk is high. Using our model we could predict the risk of suicidal behaviour among our adolescents' sample.

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**Keywords:** Suicidal risk, suicidal prevention, fussy model.



## 1. Introduction

Modern studies of suicidal risks (Jobes et al., 2004) as well as classical (Linehan, Goodstein, Nielsen, & Chiles, 1983; Kazdin, Rodgers, & Colbus, 1986) demonstrate the relevance of the issue. The problem concerns the revealing and forecasting difficulties among all the age and gender groups (Kene, Yee, & Gimmetstad, 2018). The special risks of the adolescences and adults are studied (Yong-Chun, Seon-Kyeong, Kee-Hong Ch, & Seung-Hwan, 2017; Abrutyn & Mueller, 2018; Kene et al., 2018; McCusker, 2019), but still the detailed study of suicide risk factors and the development of suicide risk model for adolescents is an issue of great need in psychology and related sciences (Schechter, Herbstman, Ronningstam, & Goldblatt, 2018).

### 1.1. The state of arts in Russia

In Russia this is a particular relevant issue. Russian suicide prevention is being developed by many researchers, such as T.S. Aparchina, A.YU. Barhatova, N.V. Basalaeva, P.V. Bezmenov, I.Y. Vyalceva, O.A. Grebennikova, T.V. Zaharova, N.V. Karpova, A.A. Mazurenko, O.F. Pankova, O.F. Romanova, O.V. Serebrovskaya, I.I. Smirnov, A.A. Tacij, E.L. Usacheva studying suicide risk factors, A.F. Minullina, E.I. Murtazina, T.F. Rudzinskaya, A.A. Sharov concentrating on family factors of suicide, A.A. Volochkov, A.V. Melekhin conceptualizing bullying as a factor of suicide, T.S. Pavlova elaborating suicide risk measures and S.A. Alieva, M.V. Vasilchenko, N.V. Vlasova, T.A. Guseva, I.EH. Esaulenko, YU.V. Migunova, A.S. Rahimkulova, V.A. Rozanov, E.A. Semenova, A.N. Cybulevskaya, M.I. Cherepanova, S.A. Cherkasova, K.S. Shalaginova developing suicidal prevention among adolescents (Belogai, Evseenkova, Borisenko, Morozova, & Kagan, 2018). The problem concerns the revealing and forecasting difficulties among all the age and gender groups but especially among adolescents.

According Myasishev (2011) the person's attitude towards something includes emotional, cognitive and behavioral components. And this approach could be useful as a basis for the suicidal risk study. In the light of it we could understand the complex of attitudes towards suicide in the relation with the attitudes towards such related phenomena as autodestructive behavior (as long as the suicide is considered to be an autoaggressive murder), the complex of attitudes towards death, the religiosity of the person (Francis, 2005), reasons for life, self image as well as emotional problems and disorders of any kind (depression, hopelessness, loneliness and other).

### 1.2. Risk factors of suicide

The issue of risk factors and determinants has been studied by M. D. Rudd, A. L. Berman, T. E. Joiner, M. K. Nock, M. M. Silverman, M. Mandrusiak, K. Van Orden, T. Witte, C. Perlman, E. Neufeld, L. Martin, M. Goy, J. P. Hirdes D. A. Jobes, E. M. Peterson, R. F. DeVellis, G. Groth-Marnat, K. N. Nelson, D. Pentiu, V. Downing, K. Francini K. Michel, J. T. Maltzberger, D. A. Jobes, A. A. Leenaars, I. Orbach, K. Stadler. Basing on their works K. M. Harris, J. J. Syu, O. D. Lello, Y. L. Chew, C. H. Willcox and R. H. Ho (Harris et al., 2015) elaborated a model of suicidal barometer. Generally among risk factors are usually named:

- Previous Suicide Attempt,
- History of a Prior or Ongoing Psychiatric Disorder,

- History of Sexual or Physical Abuse,
- Family factors (Family History of Suicidal Behavior or Mood Disorders),
- Male Sex,
- Sexual Orientation.

• **Additional Risk Factors are:**

- Substance abuse,
- Access to firearms or other means,
- Social stress,
- Emotional factors.

In the light of risk factors studies we may assume as suicide risk predictors: health problems (depression, health problems, received treatment, genetics, neurological status), social disorientation (family risks, conflicts, social status, deviant behaviour) and personal risks (addiction, stress, crisis, values and senses, coping strategies).

## 2. Problem Statement

Now we are elaborating the model of suicide risk among adolescents considering the inner and external factors determinating suicidal risk. In our model we consider inner determinants of suicidal risk to be hierarchic and on the first level to be united into three components: Emotional and regulative component, Cognitive and evaluation component and Behavioral component.

Each component has its own constituents which represent the second level of model. Table 01 represents the structure of Suicidal risk components.

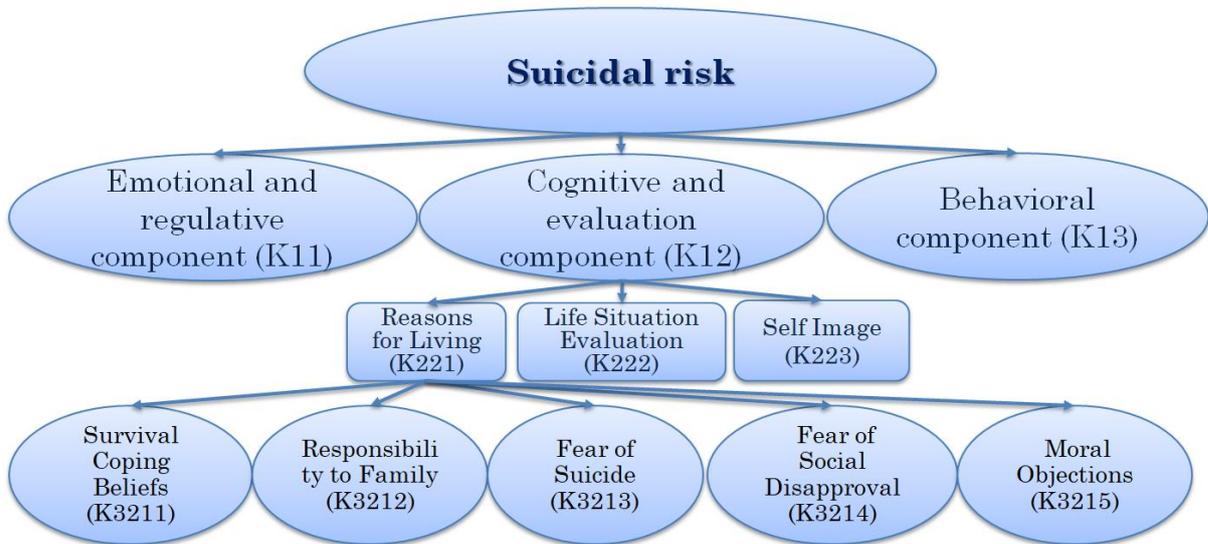
**Table 01.** Suicidal risk components

<b>Emotional and regulative component (K11)</b>	<b>Cognitive and evaluation component (K12)</b>	<b>Behavioural component (K13)</b>
Depression (K121)	Reasons for Living (K221)	Autodestructive behaviour (K321)
Hopelessness (K122)	Life Situation Evaluation (K222)	Suicide attempts (K322)
Loneliness (K123)	Self Image (K223)	Risk (K323)
Self regulation (K124)		Addiction (K324)

As we see in the table 01, Emotional and regulative component (K11) is compiled by Depression (K121), Hopelessness (K122), Loneliness (K123), Self regulation (K124). Behavioral component (K13) consists of Autodestructive behavior (K321), Suicide attempts (K322), Risk (K323), Addiction (K324).

Cognitive and evaluation component (K12) is compiled by Reasons for Living (K221) Life Situation Evaluation (K222) Self Image (K223), while K221 consists of Survival Coping Beliefs (K3211), Responsibility to Family (K3212), Fear of Suicide (K3213), Fear of Social Disapproval (K3214) and Moral Objections (K3215) on the third level of model.

The example of the hierarchy is provided in the figure 01.



**Figure 01.** Hierarchy of Cognitive and evaluation component

However the research problem of the study lays in the reckoning of suicide risk factors among adolescents considering the inner and external factors determinating suicidal risk.

### 3. Research Questions

The research question of the study is how we can use the statistic model of suicide risk among adolescents for attribution to risk group for the special case. We consider the monitoring measure instrument for suicide risk to be necessary in the modern suicide risk research.

### 4. Purpose of the Study

Our goal was to develop a model of suicide risk among adolescents. Considering the inner and external factors determinating suicidal risk we tried to perform such a model and to elaborate a research instrument for assessment of suicide risk among adolescent.

### 5. Research Methods

We used the combination of measures such as

- The hopelessness scale for children (Kazdin et al., 1986),
- Beck Depression Inventory (BDI),
- The Reasons for Living Inventory» (Linehan et al., 1983),
- Zung Self-Rating Depression Scale),
- Nemchin's Questionnaire,
- Kulikov's Questionnaire,

- Amirkchan’s Questionnaire,
- Orel’s Questionnaire to obtain inner risks
- Hopeless Situation Inventory (Belogai et al., 2018) – our specially developed measure to find out situational external risks. .

### 5.1. Statistic methods

We use the membership functions of linguistic variables terms to provide scale values fuzzification for our model. Our fuzzy model of suicide risk also considers external determinants to be the triggers of suicide attempt when inner risk is high.

### 5.2. Sample

276 participants (151 male и 125 female) formed the sample of our study. All the participants were Russian school students from 6-th to 11-th grades. Adolescent participants aged 13-17 years old were recruited and compensated through the local Research community through the written permission from at least one parent.

## 6. Findings

When we represent of suicidal risk in a hierarchical model, we can obtain its integral complex assessment. Also basing on fuzzy complex assessments of the components of the first level of the model, we use the apparatus of fuzzy conclusions to carry out fuzzy typology of our participants.

Each component of the model has a degree of importance and has a degree of severity. Expert assessments were used to assess the importance of the components, which were presented as weight coefficients after processing. We used fuzzy approach to assess the degree of expression of the indicators corresponding to the final vertices of the hierarchical model. So, each of these indicators was presented as a linguistic variable (LP) with a term set: T1-low, T2 – medium, T3 – high. Each clear value of the indicator is put in accordance with the value of the membership function (FP), characterizing how it corresponds to this term. As the membership functions (FP) of terms, we used triangular and trapezoidal functions. For instance, knowing the range of the concrete scale and higher/lower scores indicates, we coded our data for further analysis.

In the stage of fuzzification we translated clear values of indicators into values of FP terms. The fragment of fuzzification of values of two scales, FP of which are described in table 2, for two pupils is presented in table 02.

**Table 02.** The fragment of fuzzification for values of two scales

Number	Component	Clear value	Values of FP terms		
			T 1 Low	T 2 Medium	T 3 High
1	K223	58 (0,16)	0,4	0,6	0
	K3212	4,91	0,86	0,14	0
2	K223	39 (0,22)	0	0,8	0,2
	K3211	2,3	0	0	1

The next step was the procedure of fuzzy aggregation of conditions. For this purpose we used the weighted addition operation. We determined the values of the FP terms of the output (for example) LP (cognitive-evaluative component) at the stage of accumulation.

Then we performed the procedure of defuzzification (bringing to clarity) by the centroid method in order to obtain a clear comprehensive assessment. Also we normalized the values of a clear integrated assessment in order for the values of the integral index to be in the range [0;1].

The example of this calculation of fuzzy and clear estimates of the cognitive-evaluative component for a particular participant is presented in Table 03.

**Table 03.** The example of this calculation of fuzzy and clear estimates of the cognitive-evaluative component

Component	Clear value of the component	Weighting factor	Values of FP terms		
			T 1 Low	T 2 Medium	T 3 High
K223	60 (0,2)	0,2	0	1	0
Fuzzy evaluation of cognitive-evaluative component			0	0,46	0,54
The centroids of the terms			0,172	0,5	0,828
Normalized clear assessment of cognitive-evaluative component			0,77		

Analyzing the result presented in the last line of table 3 we can conclude if this participant should be classified as belonging to a risk group according to the level of cognitive-evaluative component. When we analyze all three components of the model for this participant we will be able to find out if this person belongs to a risk group for suicide.

## 7. Conclusion

A comprehensive assessment of the suicide risk is one of the most important tasks if the field of suicide prevention. The clinical methods of suicide risk assessment are difficult in mass monitoring (Patry & Magaletta, 2015; Tempier, 2016; Miklin, Mueller, Abrutyn, & Ordonez, 2019; McCusker, 2019).

Bearing in mind the practice of the components of suicide risk measurement in different scales, we used a fuzzy approach to assess the severity of its components. Suicidal risk can be represented as a hierarchical model. The first level of the model consists of three components: emotional-regulatory; cognitive-evaluative; behavioural. This approach will allow us to obtain an integral indicator of suicidal risk, but also to make the typology of our participants, and therefore to predict the risk of suicidal behaviour among our adolescents' sample. Now we are working on the approbation of our method on the more extensive sampling. According to these findings we are now developing prevention strategy for adolescents which includes: prevention of suicidal attempts, reducing self-harm consequences, improving the quality of life, improving social and school functioning, supporting mental health and physical symptoms treatment.

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