



Medical University „Prof. Dr. Paraskev Stoyanov“ – Varna  
Faculty of Medicine, Department of psychiatry and medical psychology

**Dr. Svetla Milcheva Borisova**

# **SCREENING QUESTIONNAIRE APPLICATION IN THE ASSESSMENT OF ALCOHOL-USING PATIENTS IN A CLINICAL SAMPLE**

## **SUMMARY OF DISSERTATION**

For the award of educational and academic degree ”Doctor”

Specialty „Psychiatry“

Academic Jury:

Prof. Snezhana Zlateva Zlateva, MD, PhD

Prof. Mariana Dimitrova Arnaudova-Zhekova, MD, PhD

Assoc. Prof. Georgi Panov Panov MD, PhD

Assoc. Prof. Vesela Stoyanova Stoyanova, MD, PhD

Assoc. Prof. Pavlina Petkova Petkova, PhD

Assoc. Prof. Petar Milchev Petrov, MD, PhD, DSc

Prof. Dr. Georgi Neychev Onchev, MD, PhD

Varna, 2022

The dissertation contains 166 pages, includes 29 figures and 45 tables. The bibliography includes 156 sources- 16 in Bulgarian and 140 in English. The dissertation was discussed and directed for defense by the Department Council of the Department of Psychiatry and Medical Psychology at the Medical University "Prof. Dr. Paraskev Stoyanov"- Varna with protocol №7 / 27.04.2022

The defense of the dissertation will take place on..... 2022 from ..... at an open meeting of the Jury which will be held online. The defense materials are available in the library of Medical University-Varna, as well as on the official website of the university.

## CONTENTS

INTRODUCTION.....	4
I. AIM AND OBJECTIVES. RESEARCH HYPOTHESES.....	7
II. THE ALCOHOL USE DISORDERS IDENTIFICATION TEST SCREENING SIGNIFICANCE AND INTERVENTIONS.....	8
III. DATA ANALYSIS METHODOLOGY .....	9
IV. STUDY ORGANIZATION AND PROCEDURE .....	9
V. RESTRICTIONS AND LIMITATIONS.....	10
VI. RESULTS AND DISCUSSION.....	11
1. Alcohol-related questionnaires score results distribution.....	11
2. State - Trait anxiety inventory score results distribution.....	18
3. Reliability of the research study questionnaires.....	24
4. Correlation analysis.....	25
5. Factor analysis.....	27
6. ROC curves.....	32
VII. CONCLUSION.....	36
VIII. CONTRIBUTIONS.....	37
PUBLICATIONS RELATED TO THE DISSERTATION.....	38

# INTRODUCTION

According to one of the most ancient healing systems, the human body, like the universe, is made up of five fundamental elements: fire, water, earth, air, and space. We could consider the complex connection of alcohol with human existence as a reflection of the fact that it can be seen transcendently through the prism of these five elements as related to two of them - fire (to which the impulses - hunger, thirst, and sleep are related) and water because it is always a liquid. According to ancient sources, the use of the word alcohol is associated with the Arabs, who used it to refer to the powdered substance in the form of eyeliner and used in ancient times for religious purposes - in honor of the gods as well as magical purposes - to prevent disease and black magic. Later, the word alcohol has been related not only to chemically created powders or extracts but also used as a verb - for situation change and was brought to Europe with Arab traders. In parallel with the interesting etymology of the word alcohol, the intake of alcoholic beverages is present in human life, from a special means in rituals and religious events thousands of years ago to a routine part of the daily lives of millions of people around the world today. And while in the past, alcohol intake was associated with mystery and mystical beliefs due to changes in psychological state, later it became an integral part of the traditions and religious rituals of many people. Nowadays, alcohol consumption is widespread and daily for most of the people worldwide and in Bulgaria.

At the same time, alcohol consumption leads to health problems and this fact has been known for centuries. However, current trends are sharpening the focus on alcohol as a risk factor for more than 200 diseases at significant healthcare costs globally. At present, the reduction of alcohol-related harm is an important component of good health and is, therefore, an integral part of most of the United Nations' sustainable development goals for 2030. However, increasing attention to this topical and significant problem on a global scale contrast with the situation in Bulgaria. The existence of a national system for monitoring and fragmented measures (taxes on alcohol, restriction of purchases by persons under 18, legislative measures against drink and driving) cannot compensate for the damage caused

by the daily and mass consumption of alcohol by part of the population, including young people and even students. This problem is especially significant in Bulgaria considering the following factors - current trends where population growth is declining, the predominantly elderly population, and high levels of morbidity and mortality. Last but not the least, reports suggest that alcohol consumption during the COVID pandemic has increased, which carries the risk of an additional burden on the health care system, trying to address the increased levels of morbidity.

In this dissertation, the subject of the research is the use of alcohol, which is a current and medically significant problem and alcohol use is determined by the AUDIT screening questionnaire. The AUDIT questionnaire, which is the focus of this paper, was created decades ago and is used in many countries around the world to screen for alcohol-related problems. Detailed statistical analyzes of its factor structure and its screening value compared to other questionnaires in Bulgaria have not been performed. Moreover, the Bulgarian translation of the AUDIT questionnaire has been used in mass practice, but it has not been validated and its screening value is not confirmed either.

The aim of the dissertation is to validate of the AUDIT screening questionnaire for early identification of cases of harmful alcohol use and alcohol dependence. The set aim is related to the following objectives: to identify the factor structure of the AUDIT screening instrument for the Bulgarian population; to explore the psychometric characteristics of the Bulgarian version of the questionnaire - external and internal validity. Additional analyses are held to prove the screening value of the questionnaire in relation to other questionnaires for alcohol use/dependence.

The statistical methods used for data analyses are descriptive statistics; correlation analysis; internal consistency of the scale with Cronbach's alpha methodology; exploratory factor analysis; identifying the factor structure of the scale; analysis of sensitivity and specificity of the questionnaire (ROC curve) and analyzes to confirm the screening value of the scale compared to others screening tools. The described analyzes are used to identify the psychometric characteristics of the questionnaire and respectively - to prove its value as a screening tool in Bulgaria.

The development of this dissertation is an attempt to answer the question whether the Bulgarian version of the AUDIT scale is a valid questionnaire for screening alcohol use in Bulgaria. The included literature review is based on a critical analysis of the sources used to substantiate both the relevance and significance of the issue. Alcohol use is a growing issue and requires immediate attention considering many factors like increased alcohol use among young people and adolescents and high mortality levels in Bulgaria.

The significance of the issues described is based on cited data from national and international studies. According to the WHO, 2.3 billion people in the world consume alcohol, which includes more than half of Europe's population over the age of 15 in 2017. In the same year, alcohol consumption caused 3 million deaths worldwide which is 5.3% of the total number of deaths in the world. The risk of dying from alcohol-related diseases is seven times higher for people living in Eastern Europe than for those living in the Mediterranean. According to the national survey of risk factors related to lifestyle among the population, conducted by the National Center for Public Health and Analysis (Bulgaria) in 2014, 65.7% of the respondents use alcohol (beer, wine, concentrates) and a quarter of them (25.4%) the use is regular. Only 2.9% of users have received any form of advice to reduce alcohol intake.

Many patients admitted at different levels of the health care system have alcohol-related issues, however, most of these patients deny such a problem, which further complicates the process of diagnosis and treatment. The dissertation focuses on the screening for harmful alcohol use and a questionnaire to assess alcohol consumption is used, which can be used not only by doctors but also by other medical professionals. The validation of the AUDIT questionnaire for Bulgaria will allow for more accurate screening and comparability of results related to global standards. Moreover, the process of conducting brief intervention will be facilitated at the initial patient-physician contact.

## I. AIM AND OBJECTIVES. RESEARCH HYPOTHESES

The screening questionnaire AUDIT, used to screen for alcohol use-related conditions, is in the focus of this dissertation. The aim of the dissertation is to validate the questionnaire.

The objectives related to the above-mentioned goal are:

- to identify the factor structure of the AUDIT screening instrument for the Bulgarian population
- to explore the psychometric characteristics of the Bulgarian version of the questionnaire - external and internal validity. Additional analyses are held to prove the screening value of the questionnaire in relation to other questionnaires for alcohol use/dependence.

An analysis of the data obtained in this study will test the basic hypothesis regarding the factor structure of the alcohol use disorders identification questionnaire. There is evidence to support the existence of a three- and two-factor model of the Alcohol Use Disorders Identification Test.

- The basic hypothesis related to the present work assumes a three-factor structure of the alcohol use disorder identification test
- Associations between the alcohol use disorder identification test and other screening questionnaires are suggested
- High internal consistency of the alcohol use disorder identification test is suggested
- High sensitivity of the alcohol use disorder identification test is assumed

Data collection methods include a structured interview on demographic indicators - age and gender, as well as alcohol use disorder identification test, CAGE test, State-trait anxiety inventory.

## II.THE ALCOHOL USE DISORDERS IDENTIFICATION TEST SCREENING SIGNIFICANCE AND INTERVENTIONS

In a situation of demographic decline and increased health care costs, some of the most common health risks among the population are those due to alcohol intake. Conducting screening for conditions of risky and harmful alcohol use in Bulgaria provides many options in the field of prevention of these conditions, especially in the presence of a Bulgarian translation of a screening questionnaire. The lack of statistical analyses on the psychometric characteristics of the AUDIT questionnaire illustrates significant gaps in the past in terms of planning and organizing future strategies for alcohol-related problems. The AUDIT methodology validation for Bulgarian conditions would provide guidelines for more accurate screening and comparability of results related to global standards. The AUDIT screening procedure will provide an accurate assessment of alcohol-related conditions after validation study in a sample of the Bulgarian population. The accurate assessment of alcohol-related conditions is an important step before conducting case-specific interventions and the Alcohol use disorder identification test screening procedure provides opportunities for follow-up interventions. In cases of risky drinking, individuals can receive advice on low-risk drinking, as well as information on the health risks associated with their drinking. The conversation includes simple advice or an explanation of health risks with a recommendation on how to create new healthy habits. Brief intervention is needed in cases of harmful alcohol use. The key elements of brief intervention are the identification of risks and discussion about consequences based on the screening results to identify the goal – reduced drinking or abstinence. From short advice within minutes to short-term counseling within no more than a few sessions - these activities aim to solicit patient commitment associated with the identified goal.



### III. DATA ANALYSIS METHODOLOGY

The statistical methods used for data analysis are:

- Descriptive statistics - mean, standard deviation
- Assessment of the internal consistency of the Alcohol use disorder identification test- with the measure of Cronbach's alpha;
- exploratory factor analysis;
- identification of the factor structure of the Alcohol use disorder identification test;
- Analysis of sensitivity and specificity of the AUDIT scale (ROC curve) and the area above the curve (AUC);
- Assessment of the reliability and validity of the AUDIT questionnaire;
- Correlation analyses to confirm the screening value of the AUDIT scale compared to other screening instruments.

Based on the performed analyzes, the validation of the AUDIT methodology for Bulgarian conditions is discussed, which will allow for accurate screening and comparability of the results, related to global standards. The described analyses are used to derive the psychometric characteristics of the questionnaire and respectively - to prove its value as a screening tool in a sample of Bulgarian population.

The statistical processing of the results was carried out with the statistical package of programs SPSS - 19 and 21 - form for expert science.

### IV. STUDY ORGANIZATION AND PROCEDURE

The research study was conducted in the Department of Psychiatry (Second clinic) at the University Hospital "St. Marina" - Varna. There are two groups involved in the study- a group of patients with harmful alcohol use/dependence and a control group. The assessment of the hospital patients was performed after discharge (no withdrawal symptoms). Dehospitalized patients were randomly assigned and selected after

randomization procedure of hospitalized patients of the Psychiatry Department of the hospital during the period from August 2020 to December 2020. After filling in the form of informed consent about the procedure and about personal data, the subjects of the study completed self-assessment questionnaires AUDIT, CAGE, Spielberger (including demographic data). At the second stage of the study - in a period of 12 months, 22 of the 33 participants responded and were included.

The control group includes individuals randomly selected and randomised from a larger group of individuals who responded positively to a social media advert in 2020-2021. The main investigator initiates the contact, provides information about the study, an informed consent form and a consent about personal data. The participants in the control group were 128. Healthy volunteers were included in the second stage of the study and completed the self-assessment questionnaires.

## V RESTRICTIONS AND LIMITATIONS

The study has limitations in terms of space, time, the characteristics of the sample and the problem examined. The study covers a period of one year and 4 months, during COVID pandemic with no prior planning for such events. Therefore, collected data in two domains – alcohol use and anxiety is influenced by the diffuse spread on viral disease on a global scale. However, such data provide information related to alcohol use in global disasters and could contribute to comparability of results.

The surveyed persons live in Varna district, there is no representation for other districts of the country. The included subjects are 161 but the study findings are not generalizable due to the relatively small number of individuals included. The data obtained from the participants was based on self-assessment questionnaires. Therefore, the screening procedure of the control group shows the trends in alcohol use in the group.

The collected data provide information on the validity of the AUDIT test methodology for a sample of the Bulgarian population in relation to reliability and internal consistency. However, the study does not claim to be exhaustive in relation to the validation of a test

methodology for screening for alcohol-related conditions. Moreover, to conduct standardisation of the methodology, it is necessary to aggregate data from a larger nationally representative sample.

## VI. RESULTS AND DISCUSSION

### 1. Alcohol-related questionnaires score results distribution

➤ AUDIT score result distribution in the group of patients with harmful alcohol use/dependence

There are no individuals with a test score of 0-5; 3 individuals with a score of 10 to 15 (9.1%), and 5 with a score of 16 to 19 (15.1%) and the largest group - with a score of over 20 - are 25 individuals (75.8%). The AUDIT questionnaire scores ranged from 10 to 38 for individuals in the group of patients with harmful alcohol use/dependence (Table 1). The AUDIT test score distribution histogram in the harmful drinking/dependence group is presented in Figure 1. The distribution histogram in the group of patients with harmful alcohol use/dependence is skewed to the left with a predominance of individuals with high questionnaire scores above the mean of 27.12 (Fig. 1)

Table 1

AUDIT score distribution in the group with harmful alcohol use/dependence

AUDIT score	Frequency	Percent	Valid Percent	Cumulative Percent
10	1	3.0	3.0	3.0
13	1	3.0	3.0	6.1
14	1	3.0	3.0	9.1
16	3	9.1	9.1	18.2
18	1	3.0	3.0	21.2
19	1	3.0	3.0	24.2
21	1	3.0	3.0	27.3
23	1	3.0	3.0	30.3
25	1	3.0	3.0	33.3
27	3	9.1	9.1	42.4
28	3	9.1	9.1	51.5
29	1	3.0	3.0	54.5
30	1	3.0	3.0	57.6
31	1	3.0	3.0	60.6
33	4	12.1	12.1	72.7
34	3	9.1	9.1	81.8
35	4	12.1	12.1	93.9
37	1	3.0	3.0	97.0
38	1	3.0	3.0	100.0
Total	33	100.0	100.0	

Individuals with a score of 10 to 15 were a total of 3 persons all females, of which 2 were females with harmful use and one female had alcohol dependence. Persons with a score of 16 to 19 were 5, of whom 1 was male with harmful use and 3 others with dependence; 1 was

female with dependence (Table 1). Males with AUDIT test scores above 20 were more prevalent than females, i.e., higher AUDIT test score results were more common in males than females.

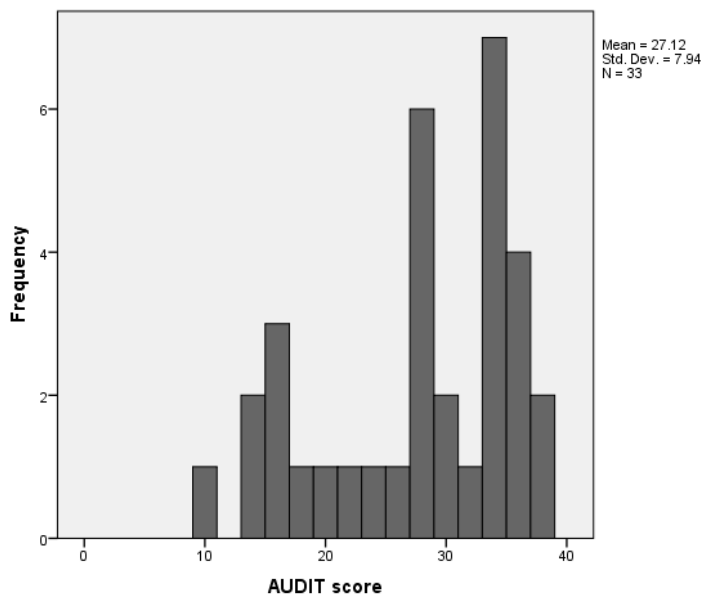


Fig. 1. AUDIT score distribution in group of patients with harmful alcohol use/dependence

➤ AUDIT score result distribution in the control group

The mean AUDIT score of the control group individuals was several times lower than the mean test score of the group of patients with harmful alcohol use/dependence. The AUDIT mean value of individuals in the control group was 4.40 with a standard deviation of 3.973 (minimum value of 0 and a maximum value of 20). Most of the participants in the control group receive a total AUDIT test score up to 5, accounting for 73,4% of the control group individuals (Table 2). While the distribution in harmful alcohol use and alcohol dependence group is skewed to the left and more individuals have a high total AUDIT score, the opposite

phenomenon is observed in the control group - individuals with a low total AUDIT score dominate and the distribution is skewed to the right.

The AUDIT score distribution in the control group is presented in table 2 and fig.2 In the control group, most individuals with a total AUDIT scale score up to 5 were 73.4% of all individuals examined. With the same score up to 7 are 84.4% of the examined individuals in the control group.

Table 2

AUDIT score distribution in the control group

AUDIT score	Frequency	Percent	Valid Percent	Cumulative Percent
0	10	7.8	7.8	7.8
1	20	15.6	15.6	23.4
2	16	12.5	12.5	35.9
3	22	17.2	17.2	53.1
4	12	9.4	9.4	62.5
5	14	10.9	10.9	73.4
6	8	6.3	6.3	79.7
7	6	4.7	4.7	84.4
8	3	2.3	2.3	86.7
9	4	3.1	3.1	89.8
10	4	3.1	3.1	93.0
12	2	1.6	1.6	94.5
13	1	0.8	0.8	95.3
14	2	1.6	1.6	96.9
15	1	0.8	0.8	97.7
18	1	0.8	0.8	98.4
19	1	0.8	0.8	99.2
20	1	0.8	0.8	100.0

The AUDIT score distribution histogram in the control group showed in fig.2:

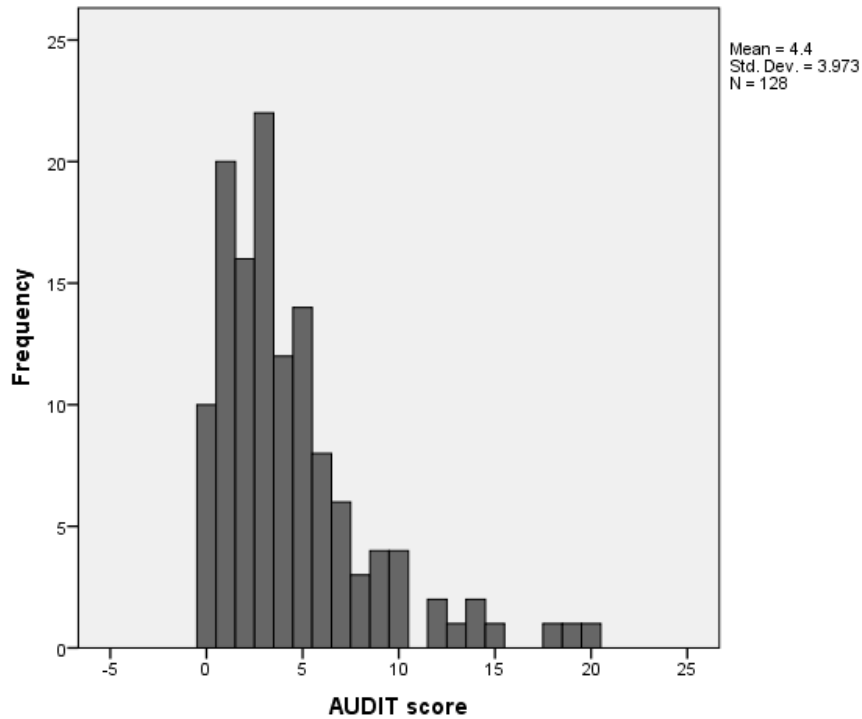


Fig.2 AUDIT test result distribution histogram in the control group

In summary, the control group was dominated by those with a total AUDIT scale score of up to 5, who accounted for 73.4% of all individuals tested. With the value of the same score up to 7 are 84.4% of the examined persons in the control group. The remaining individuals in the same group, or 15.6% in the control group (assuming a threshold AUDIT score of 8), appeared to have a problem that needs attention and can be defined as risky use, harmful use, or even alcohol dependence. The result of the AUDIT test provides a guideline for further testing of these individuals for risky drinking, harmful use or dependence.

- CAGE score distribution in the group of patients with harmful alcohol use/dependence

Individuals in the harmful drinking/dependence group score above 0 on the CAGE test. The distribution is shown in Table 3 and Figure 3:

Table 3

CAGE score distribution in the group of patients with harmful alcohol use/dependence

CAGE score	Frequency	Percent	Valid Percent	Cumulative Percent
2	8	24.2	24.2	24.2
3	10	30.3	30.3	54.5
4	15	45.5	45.5	100.0
Total	33	100.0	100.0	

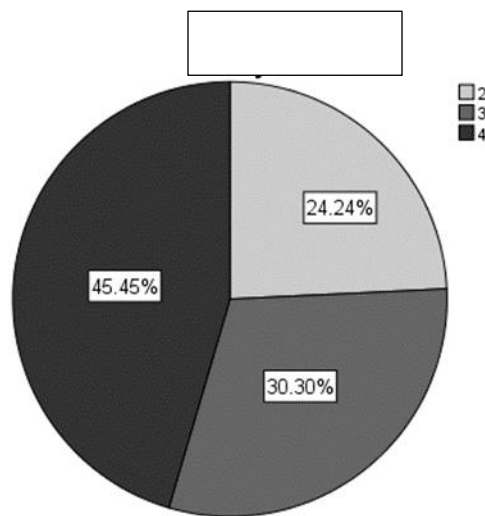


Fig.3. CAGE score distribution in the group of patients with harmful alcohol use/dependence



➤ CAGE score distribution in the control group

Those with a positive response and a need for follow-up were 16.4% of participants in the control group - results were similar for the AUDIT test. The distribution is shown in Table 4 and Figure 4:

Table 4

CAGE score distribution in the control group

CAGE	Frequency	Percent	Valid Percent	Cumulative Percent
0	107	83.6	83.6	83.6
1	11	8.6	8.6	92.2
2	5	3.9	3.9	96.1
3	5	3.9	3.9	100.0
Total	128	100.0	100.0	

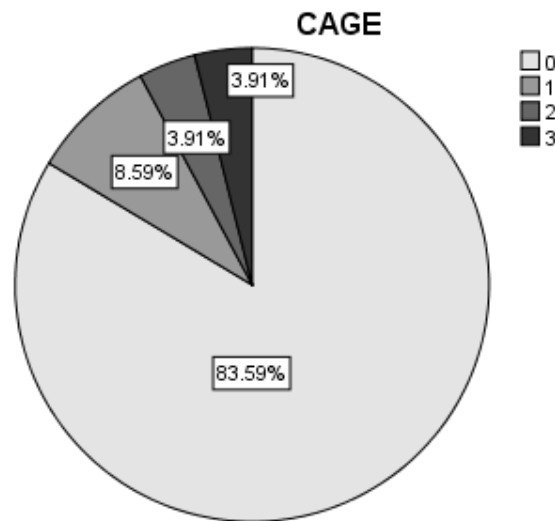


Fig.4. CAGE score distribution in the control group

## 2. State - Trait anxiety inventory score results distribution

### ➤ State anxiety in the group of patients with harmful alcohol use/dependence

Subjects in the group of patients with harmful alcohol use/dependence were 33, with a mean ST score of 44.82, a standard deviation of 13.540, a minimum of 25 and a maximum of 77(Fig.5).

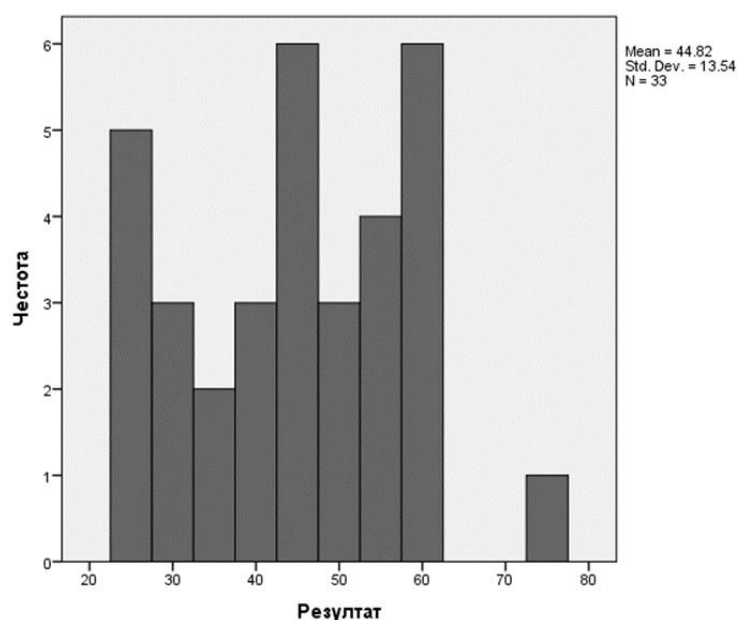


Fig.5. State anxiety score distribution Histogram in the group of patients with harmful alcohol use/dependence

### ➤ State anxiety score distribution in the control group

There are 86 tested individuals with a mean of 35.21, a standard deviation of 9.539 with a minimum of 20 and a maximum of 58. The data of the distribution in the control group according to the total score of situational anxiety are shown in the histogram - Fig. 6:

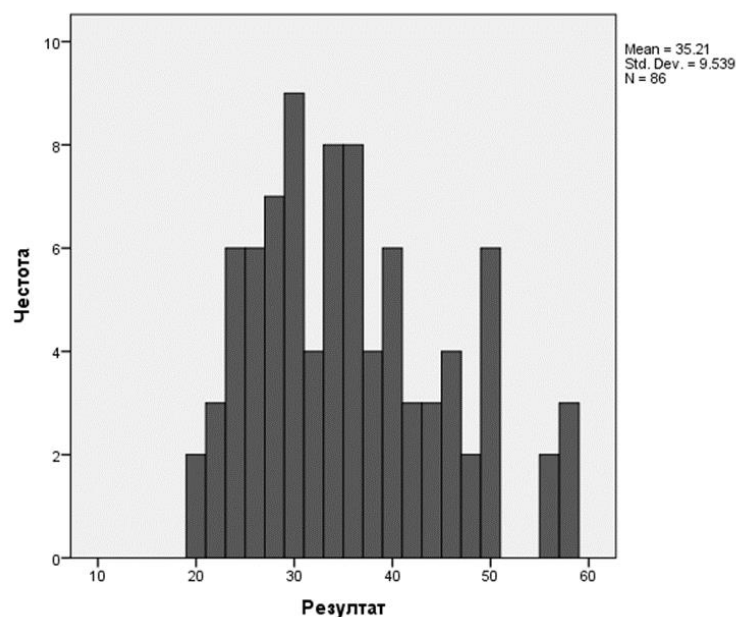


Fig.6. State anxiety score distribution in the control group

We can conclude that the mean of the test score of state anxiety for individuals in the harmful drinking/dependence group was higher than the mean for the control group. The state anxiety distribution in the two groups is different - in the group with harmful alcohol use/dependence predominate individuals with low and high scores, while in the control group there are more people with average scores.

- Trait anxiety score distribution in the group of patients with harmful alcohol use/dependence

According to the result obtained for trait anxiety, in the group of individuals with harmful use of alcohol/addiction the minimum test score is 29 and the maximum test score is 70, with a mean score of 48.73 and a standard deviation of 10.153 (Fig. 7):

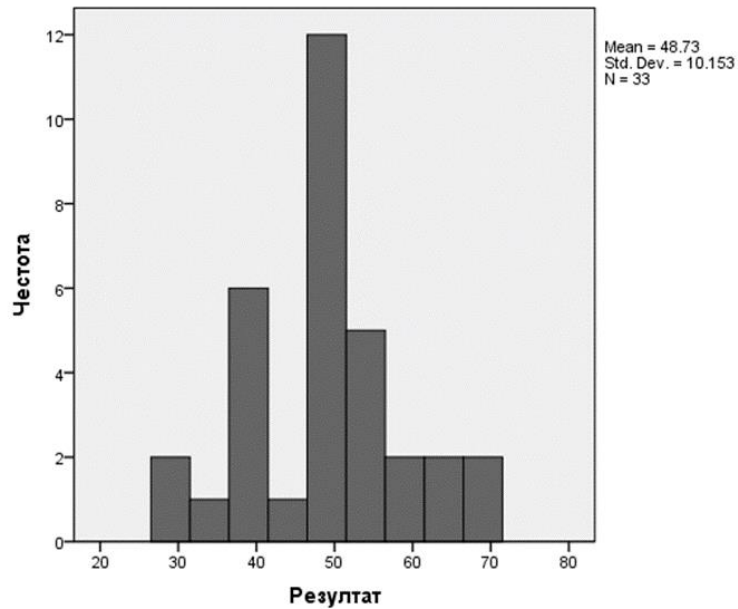


Fig.7. Trait anxiety score distribution in the group of patients with harmful alcohol use/dependence

➤ Trait anxiety score distribution in the control group

The trait anxiety score distribution is normal, the mean is 37.76 with a standard deviation of 9.448, the minimum is 20 and the maximum is 67. The distribution is close to normal with a dominance of individuals with low and medium scores on trait anxiety in the control group. The histogram of the distribution according to the test scores on trait anxiety in the control group is presented in Fig. 8:

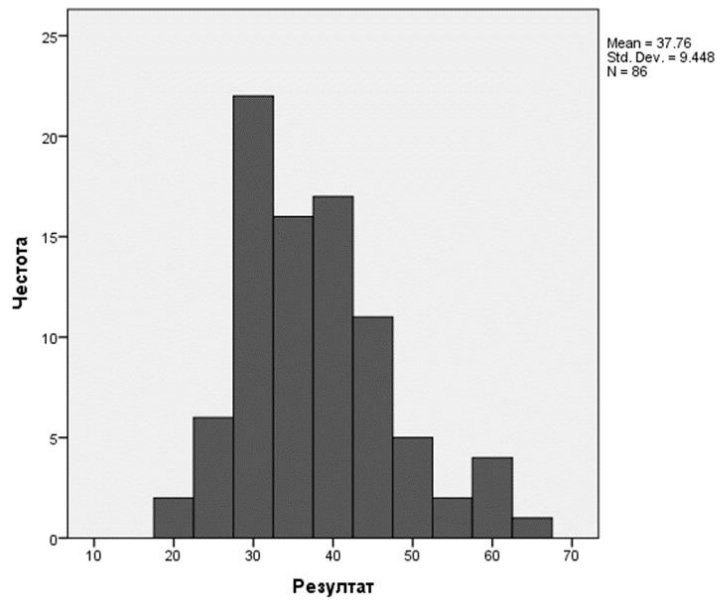


Fig.8. Trait anxiety score distribution histogram in the control group

The trait anxiety mean score for individuals in the harmful alcohol use/dependence group was much higher compared to individuals in the control group. There are significantly higher recorded trait anxiety score levels of alcohol-dependent individuals compared to individuals in the control group.

➤ Crosstabulations in the group of patients with harmful alcohol use/dependence

Crosstabulations in the group of patients with harmful alcohol use/dependence including their score on state and trait anxiety are presented in next two tables - 5 and 6:

Table 5

Crosstabulation State anxiety/ AUDIT in the group of patients with harmful alcohol use/dependence

STAI-Y1	AUDIT score			Total
	10-15	16-19	>20	
20-39	1	3	8	12
40-49	2	2	4	8
>50	0	0	13	13
Total	3	5	25	33

Table 6

Crosstabulation Trait anxiety/ AUDIT in the group of patients with harmful alcohol use/dependence

STAI-Y2	AUDIT score			Total
	10-15	16-19	>20	
20-39	1	3	2	6
40-49	1	1	11	13
>50	1	1	12	14
Total	3	5	25	33

There are more individuals with high AUDIT total test scores and higher state anxiety scores. Individuals with substance abuse and dependence have higher mean levels of anxiety, which is consistent with the data about the prevalence of anxiety disorders among individuals with addictions and the anxiety levels among such individuals. In contrast to the group of individuals with harmful alcohol use/dependence, the control

group had the highest number of individuals with low AUDIT total test scores that have at the same time low scores on the state anxiety test.

➤ Crosstabulations in the control group

Crosstabulations State and Trait anxiety/ AUDIT in the control group are presented below:

Table 7

Crosstabulation State anxiety/ AUDIT in the control group

STAI-Y1	AUDIT score			Total
	0-7	8-15	16-19	
20-39	51	8	1	60
40-49	17	1	1	19
>50	7	0	0	7
Total	75	9	2	86

Table 8

Crosstabulation Trait anxiety/ AUDIT in the control group

STAI-Y2	AUDIT score			Total
	0-7	8-15	16-19	
20-39	48	8	1	57
40-49	19	1	1	21
>50	8	0	0	8
Total	75	9	2	86

The test trait anxiety results are not identical. Individuals scoring below and above 40 on the trait anxiety test were approximately equally represented in the sample. Most individuals in the control group had a low total AUDIT test score and a low score on the trait anxiety assessment. While state anxiety appears to be higher in disorders due to alcohol intake, especially when completing an alcohol use questionnaire, no differences were observed in trait anxiety levels.

### 3. Reliability of the research study questionnaires

Cronbach's alpha coefficients for questionnaires used - AUDIT, AUDIT-C and Spielberger anxiety inventory show fair results (table 9):

Table 9

Questionnaires	Cronbach's Alpha	Item number
AUDIT (control group)	0,770	10
AUDIT (harmful alcohol use/dependence group)	0,848	10
AUDIT-C (control group)	0,692	3
AUDIT-C (harmful alcohol use/dependence group)	0,801	3
STAI-Y1 (control group)	0,831	20
STAI-Y1 (harmful alcohol use/dependence group)	0,935	20
STAI-Y2 (control group)	0,812	20
STAI-Y2 (harmful alcohol use/dependence group)	0,892	20

The lowest result measured in the control group is 0.692 shown for AUDIT-C questionnaire.

Cronbach's alpha results for the Alcohol use disorder identification test shows fairly good results – over 0.770. The Cronbach's alpha value obtained for the group of patients with harmful alcohol use/dependence is 0.848 and is close to the value obtained when the original



version of the AUDIT questionnaire for Bulgaria was tested at the initiation of the study in 1985. The results described here correspond with the results of other studies of the AUDIT questionnaire which show high internal consistency of the original version of the scale (Saunders et al, 1993; Allen et al., 1997).

The internal consistency coefficients of the Spielberger's scales showed high values.

Cronbach's alpha for the CAGE questionnaire could not be examined, not suggesting a normal distribution.

#### 4. Correlation analysis

##### ➤ Screening tests correlations in the control group

The AUDIT, AUDIT-C и CAGE tests results show high correlations in the control group (tabl.10).

Table 10

AUDIT, AUDIT-C and CAGE tests' correlations (control group)

Въпросник		AUDIT	AUDIT-C	CAGE
AUDIT	Pearson Correlation	1	0.881**	0.742**
	Sig. (2-tailed)		0.000	0.000
	N	128	128	128
AUDIT-C	Pearson Correlation	0.881**	1	0.500**
	Sig. (2-tailed)	0.000		0.000
	N	128	128	128
CAGE	Pearson Correlation	0.742**	0.500**	1
	Sig. (2-tailed)	0.000	0.000	
	N	128	128	128

To compare test scores completed by individuals in the harmful alcohol use/dependence group, correlation analyses were conducted comparing two test score values for 22 individuals. The repeat survey was conducted 12 months after the initial survey. The correlation analyses are reported in Tab. 11.

Score correlation is calculated between the tests to determine if the tests have good reliability. There is a high correlation between the two measurements of the AUDIT defining the high test-retest reliability of the questionnaire and therefore proves its value as a screening methodology.

Table 11

Screening tests correlations (2 measurements)

Въпросници		AUDIT-C	AUDIT	CAGE	AUDIT-C 2	AUDIT 2	CAGE 2
AUDIT-C	Pearson Correlation	1	0.897**	0.786**	0.793**	0.865**	0.630**
	Sig, (2-tailed)		0.000	0.000	0.000	0.000	0.002
	N	22	22	22	22	22	22
AUDIT	Pearson Correlation	0.897**	1	0.840**	0.633**	0.923**	0.579**
	Sig, (2-tailed)	0.000		0.000	0.002	0.000	0.005
	N	22	22	22	22	22	22
CAGE	Pearson Correlation	0.786**	0.840**	1	0.637**	0.860**	0.821**
	Sig, (2-tailed)	0.000	0.000		0.001	0.000	0.000
	N	22	22	22	22	22	22
AUDIT-C 2	Pearson Correlation	0.793**	0.633**	0.637**	1	0.775**	0.641**
	Sig, (2-tailed)	0.000	0.002	0.001		0.000	0.001
	N	22	22	22	22	22	22
AUDIT 2	Pearson Correlation	0.865**	0.923**	0.860**	0.775**	1	0.745**
	Sig, (2-tailed)	0.000	0.000	0.000	0.000		0.000
	N	22	22	22	22	22	22
CAGE 2	Pearson Correlation	0.630**	0.579**	0.821**	0.641**	0.745**	1
	Sig, (2-tailed)	0.002	0.005	0.000	0.001	0.000	
	N	22	22	22	22	22	22

AUDIT-test 1; AUDIT 2-test 2 (second test after 12 months)

AUDIT-C -test 1; AUDIT-C 2 -test 2 (second test after 12 months)

CAGE -test 1; CAGE 2-test 2 (second test after 12 months)

## 5. Factor analysis

Factor analysis is a statistical technique to transforming a set of correlated variables into a smaller number of uncorrelated variables (factors). The resulting factors from the analysis describe as much of the variability of the original data as possible. The number of initial variables is reduced to a smaller number of factors composed by grouping those variables that correlate with each other.

Factor analysis can be applied to generate hypotheses about causal relationships, to prepare data for further statistical analyses or for classifications. The main purpose of factor analysis is to properly interpret the resulting factors and to match the meaning of the data under study by grouping the factors appropriately. Mathematically, factor analysis is not a strictly formalized procedure and its results are applicable if the results have a real interpretation. Exploratory factor analysis is conducted during questionnaire validation. This analysis is based on the reproduced correlation matrix of original data. After obtaining the matrix F (extraction of the factor variables - initial solution), a so-called factor rotation is performed. The exploratory factor analysis in this study is performed based on principal components analysis to assess domains which can better explain observed variations in AUDIT score results.

In this dissertation study, all the general requirements for factor analysis are met:

- The data is random. If necessary, a random sampling procedure is performed;
- The available sample size is  $n \geq 50$  ;
- The variables included in the study are interval ;
- The studied parameters have close to normal distribution;
- The observations are independent.
- Measures of sampling adequacy are tested

Measures of sampling adequacy are tested: KMO (Kaiser-Meyer-Olkin) Measure of Sampling Adequacy, and Bartlett's test of sphericity; the variables and their significance levels; the

inverse and reciprocal correlation matrix; the anti-image matrix; and the factor solution and factor loadings. The KMO test of adequacy and Bartlett's test of specificity for the factor analysis of the AUDIT methodology are reported in Table 12:

Table 12

Kaiser-Meyer-Olkin Measure of Sampling Adequacy,		0.785
Bartlett's Test of Sphericity	Approx, Chi-Square	431.287
	df	45
	Sig,	0.000

KMO test is higher than 0,5 and Bartlett's test of sphericity significance level is below 0,05. These measures show that exploratory factor analysis can be conducted.

The factor variables included in the analysis and their high levels of significance are shown in the following table 13:

Table 13

Components	Initial	Extraction
Question 1	1.000	0.540
Question 2	1.000	0.613
Question 3	1.000	0.737
Question 4	1.000	0.747
Question 5	1.000	0.724
Question 6	1.000	0.631
Question 7	1.000	0.655
Question 8	1.000	0.716
Question 9	1.000	0.681
Question 10	1.000	0.412

The components and their relations with other variables in the correlation matrix also provide information on each item included in the factor solution - those variables that do not correlate with others with a correlation value above 0.3 should be excluded. It is clear from the table that all the variables in the correlation matrix have correlations with each other and can be included in the factor solution.

To compare the two- and three-factor model, we also monitor the factor loadings of each of the questions with respect to the factor loadings both before and after rotation. The initial solution is a three-factor solution. The three factors are: alcohol consumption (questions 1-3), dependence (questions 4-6) and harmful/risky use of alcohol (questions 7-10). The extracted factors with Eigenvalue  $> 1$  are reported in the following fig 9:

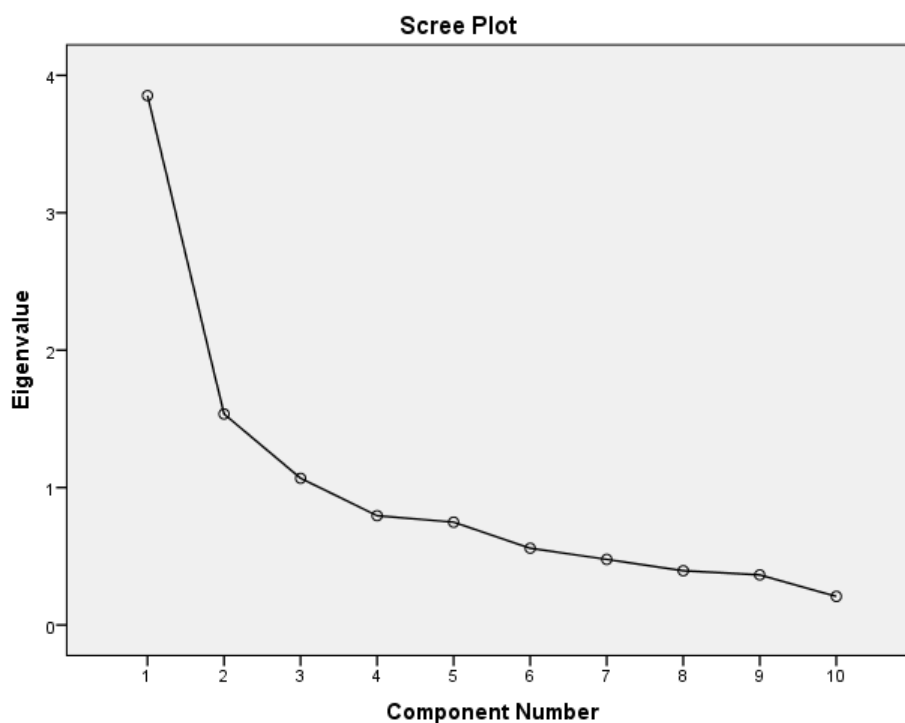


Fig. 9. Scree Plot Test with 3 extracted factors

The results show three main factors with Eigenvalue  $> 1$ . Such findings are confirmed by multiple studies replicating the original three-factor structure of the AUDIT questionnaire

(WHO, 2001; Schields et al., 2004). The first consumption factor includes the questions "How often do you drink alcohol?", "How many drinks containing alcohol do you have on a typical day when you drink alcohol?" and "How often do you have 6 or more drinks at a time on one occasion?". The second factor includes the questions "How often in the last year have you been unable to stop drinking once you have started?", "How often in the last year have you failed to do what is expected of you because of your drinking?", "How often in the last year have you needed a drink in the morning to recover after a heavy drinking episode?". The third factor includes the questions, "In the past year, how often have you felt guilt or remorse after drinking?", "In the past year, how often have you been unable to remember what happened the night before when you drank alcohol?", "Have you or anyone else ever been hurt (physically) as a result of your drinking?", and "Have a relative, friend, doctor, or other health professional ever been concerned about your drinking and suggested that you stop?".

After performing the initial solution, we perform factor rotation using the Varimax method. The factors are included into a rotation matrix, where each variable with a factor loading above 0.5 is included in one of the three extracted factors. In next tables the component matrix and rotated component matrix are shown (tables 14 and 16). The table of variations is presented in Tab. 15.

Table 14

Component Matrix

	Component		
	1	2	3
Question 1	0.556	-0.461	0.135
Question 2	0.674	-0.397	0.002
Question 3	0.777	-0.325	0.165
Question 4	0.768	-0.275	0.284
Question 5	0.612	0.307	-0.505
Question 6	0.487	0.581	0.238
Question 7	0.635	0.227	-0.448
Question 8	0.699	0.473	-0.057
Question 9	0.436	0.420	0.560
Question 10	0.448	-0.315	-0.335

Table 15

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.852	38.524	38.524	2.713	27.126	27.126
2	1.535	15.353	53.877	1.988	19.882	47.008
3	1.067	10.672	64.549	1.754	17.541	64.549

The three extracted factors explain over 64% of the variance in the original data. We group the factors into a rotation matrix, where each variable with a weight above 0.5 participates in the formation of one of the three extracted factors.

Table 16

	Component		
	1	2	3
Question 1	0.733	0.041	0.012
Question 2	0.748	0.230	0.020
Question 3	0.809	0.191	0.213
Question 4	0.796	0.115	0.317
Question 5	0.128	0.829	0.141
Question 6	0.018	0.302	0.735
Question 7	0.210	0.770	0.134
Question 8	0.178	0.602	0.567
Question 9	0.158	-0.026	0.809
Question 10	0.458	0.386	-0.231

## 6. ROC curves

The ROC curve (sensitivity/1-specificity) reflects data sensitivity and specificity or proportions of correctly classified cases with a condition due to alcohol intake to the proportions correctly classified as negative.

We use the data obtained from the completion of the AUDIT test by participants in the harmful alcohol use/dependence group and participants in the control group to assess the sensitivity and specificity of the AUDIT test methodology by ROC curves. ROC curves are assessed in three aspects – first three questions of the Alcohol Use disorders Identification test. The Alcohol Use disorders Identification test is a screening test and we calculate sensitivity in accordance with a condition of harmful alcohol use or dependence.

The ROC curve for the first question and AUC (Area under the curve) parameters are shown below:

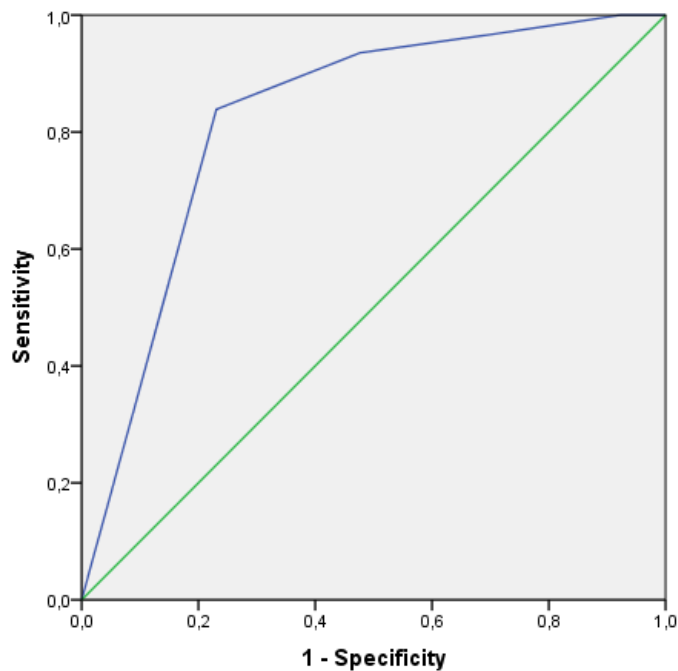


Fig.10. ROC curve AUDIT Question 1



### Area Under the Curve

Test Result Variable(s): AUDIT question 1

Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.824	0.038	0.000	0.749	0.898

The area under the curve shows good parameters for the first question of the Alcohol use disorders identification test in the assessment of a condition related to alcohol harmful use or dependence in the sample consisting of all participants in the study.

The ROC curve for AUDIT Question 2 and area under the curve are shown below:

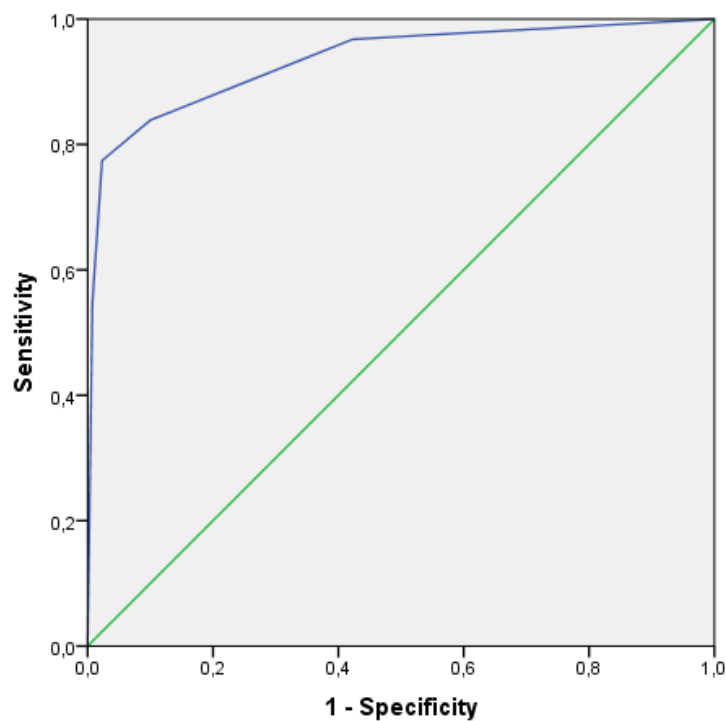


Fig.11. ROC curve AUDIT Question 2

### Area Under the Curve

Test Result Variable(s): AUDIT Question 2

Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.934	0.029	0.000	0.878	0.990

The second question parameters in the assessment of a condition related to alcohol harmful use or dependence in the sample consisting of all participants in the study using the Alcohol use disorders identification test are better and area under the curve is 0.934.

Parameters for the third AUDIT question are shown below:

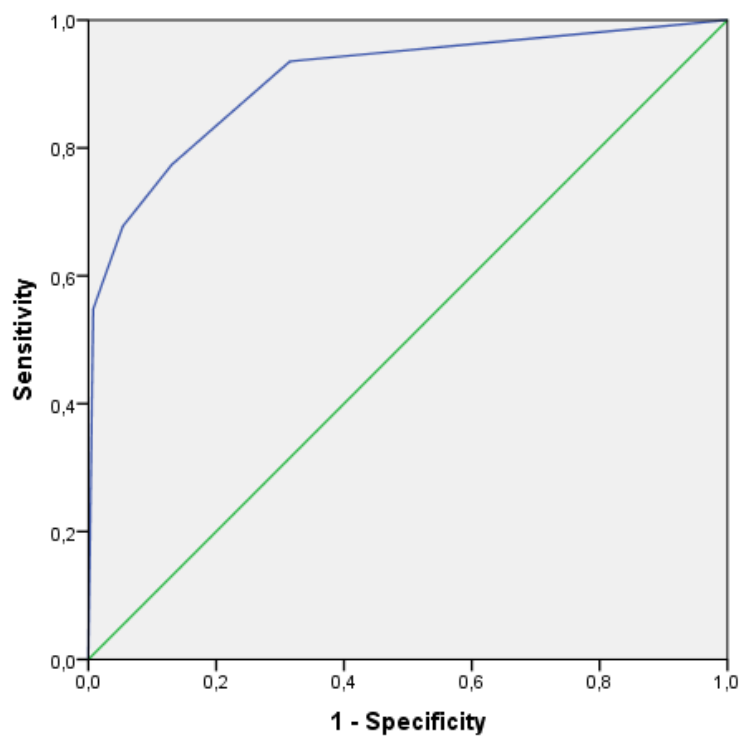


Fig.12. ROC curve AUDIT Question 3

Table 19

**Area Under the Curve**

Test Result Variable(s): AUDIT Question 3

Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.907	0.033	0.000	0.841	0.972

The ROC curve and area under the curve parameters for the third question show good values as well. The second question of the AUDIT test shows the best sensitivity, followed by the third and first question. The AUDIT-C questionnaire composed of first three questions shows good sensitivity in screening for harmful drinking/dependence states and therefore has the capacity to replace the administration of the entire questionnaire.

## VII. CONCLUSION

1. Descriptive statistics analyses show high percentage young patients in age 40-50 years. hospitalized with a diagnosis Alcohol use disorder.
2. AUDIT questionnaire data obtained from participants in the baseline group showed a large number of participants with higher overall test scores. consistent with the alcohol dependence status that these individuals have. Among the control group individuals. the predominance of individuals with a low total test score of up to 5 represented 73.4% of all individuals in the control group.
3. Analyses of Cronbach's alpha indicate the high internal consistency of the AUDIT questionnaire as well as for its short version AUDIT-C.
4. The high degree of correlation between the AUDIT and CAGE screening tests proves the value of the AUDIT methodology as a screenings tool in for alcohol-related conditions.
5. The high degree of correlation between the AUDIT and AUDIT-C screening tests demonstrates an option for interchangeability and short scale version use.
6. The three-factor model structure of the original version of the AUDIT questionnaire was replicated in a sample of the Bulgarian population with three domains – alcohol consumption. harmful use and dependence.
7. The first three questions of the AUDIT screening test methodology used exhibit high sensitivity for identifying cases requiring further diagnostic follow-up
8. In a sample of the control group 15.6% individuals need follow-up due to the received AUDIT test result.
9. Study pparticipants with harmful use of alcohol and addiction show higher anxiety levels.
10. The Bulgarian version of the AUDIT questionnaire shows high retest test reliability based on two AUDIT score results of the test.

## VIII. CONTRIBUTIONS

1. The Bulgarian version of the Alcohol Use Disorder Identification Test Screening Instrument was evaluated for its psychometric properties (AUDIT).
2. Validation of a Bulgarian version of the Alcohol use disorder identification test (AUDIT).
3. Assessment of the prevalence of risky and harmful alcohol use in a healthy individuals' sample in Bulgaria

## PUBLICATIONS RELATED TO THE DISSERTATION

1. *Milcheva. S.* (2022). COVID pandemic. anxiety and alcohol use. e-journal VFU  
<https://ejournal.vfu.bg/bg/psychology.html>
2. *Long. E., Milcheva. S., Psederska. E., Vasilev. G., Bozgunov. K., Nedelchev. D., Gillespie. N., Vassileva. J.* (2018) Validation of the SURPS with Bulgarian substance dependent individuals. *Frontiers in Psychology*.  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6275315/>
3. *Кожухаров. Хр., Александров. И., Милчева. Св.* (2015). Addictions. Alcohol use Disorders and disorders due to psychoactive substances. Nurse assessment and therapeutic activities. *Psychiatry for nurses*. Varna Medical University.