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MEDICAL PSYCHOLOGY**

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**DIGITAL FOLLOW-UP OF PATIENTS WITH
SUBSTANCE USE DISORDERS**

DISSERTATION SUMMARY

**FOR THE ACQUISITION OF THE EDUCATIONAL AND
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SCIENTIFIC SUPERVISOR:

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The dissertation consists of 127 pages and is illustrated with 7 tables and 34 figures. The bibliographic references include 258 sources, of which 4 are in Cyrillic and 254 are in Latin.

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The public thesis defence will be held on 17.01.2022 at 11:00 in a virtual meeting in the online platform of Medical University - Varna.

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Contents:

Contents:.....	3
Abbreviations	5
Introduction	6
1. Aim and objectives of the dissertation	8
1.1 Aim of the study	8
1.2 Objectives	8
2. Hypotheses	9
3. Materials and methods	10
3.1 Center of research.....	10
3.2 Patient population.....	10
3.3 Collected information.....	11
3.4 Assessment of depressive symptoms levels	11
3.5 Assessment of anxiety	12
3.6 Assessment of global functioning	12
3.7 Stratification and follow-up.....	13
3.8 Statistical design and analysis	15
4. Results	16

4.1	Descriptive analysis of patient characteristics.....	16
4.2	Correlation analysis between sociodemographic characteristics and occurrence of relapse	24
4.4	Correlation analysis between digital characteristics and occurrence of relapse	30
5.	Discussion	40
6.	Summary	54
7.	Conclusions	55
8.	Contributions.....	57
9.	Publications and participations in scientific forums related to the dissertation.....	58
10.	Appendices	59

Abbreviations

SUD – Substance use disorders

GPS – Global Positioning System

DSM – Diagnostic and Statistical Manual of Mental Disorders

NICE - National Institute for Health and Care Excellence

PHQ-9 – Patient Health Questionnaire-9

GAD-7 – Generalized Anxiety Disorder-7

GAF – Global Assessment of Functioning

HIPAA – Health Insurance Portability and Accountability Act

EMA – ecological momentary assessments

SI - Système international d'unités

Introduction

Substance use disorders (SUD) are global health problem, with alcohol use disorder alone affecting 237 million men and 46 million women worldwide. Residents of Europe, North and South America are most affected, with particular risk for those living in countries with low socio-economic indicators. In Bulgaria, the share of alcohol and other drug abusers is increasing. The increase in the incidence of death and disability due to the use of psychoactive substances has serious health and economic consequences. Among the main factors contributing to the burden on the health and social system are direct medical complications, temporary and permanent disability and increased criminogenicity. On the other hand, patients with SUD are less likely to receive medical and psychosocial counseling and treatment for their illness compared to patients with other psychiatric illnesses. This phenomenon is mainly due to lack of health insurance and financial means, and poor social support in the community.

Previous research on the topic shows that between 40-70% of patients with SUD treated in an inpatient setting experience a relapse within 3 months of discharge. Relapse is perceived as a dynamic, fluctuating process in which targeted behavioral changes, such as abstinence, do not occur due to the patient's inability to initiate or maintain them, while resuming the abuse and behavioral patterns derived from it. There are various scientific theories about its origin. Among the predictive factors for relapse studied were age, gender, social functioning, comorbidity with other mental illnesses, and individual characteristics such as intrinsic motivation and self-efficacy. Early recognition and intervention in case of relapse is one of the main goals of the continuing medical care model for the patient. Its full implementation would help to limit the health and social consequences of addiction to surfactants.

Follow-up methods are applicable to assess treatment outcomes. To date, no uniform recommendations have been developed for its implementation, with only 7.1% of patients with SUD receive some kind of continuing care. The most common form of follow-up is telephone. It is a conventional method for assessing the condition of patients through a telephone conversation according to a pre-established schedule. The clinical evaluation could be based on both a structured and an unstructured clinical interview.

With the development of modern technologies, the possibilities of their application in the field of mental health are becoming more and more relevant. Digital follow-up is an innovative, non-invasive, inexpensive, easy-to-use method for assessing the condition of patients in outpatient settings. It is used in the monitoring of a number of psychiatric diseases, providing remote reporting of symptoms, the possibility of a crisis intervention and statistical analysis of a large amount of data to improve our understanding of the studied conditions. Depending on the implemented technology, the information collected could be based on active data such as surveys and questionnaires, as well as passive data - from biosensors, GPS and others. During the COVID-19 pandemic, the methods of digital psychiatry have become even more relevant given the limited access to health services and the need to provide a safe environment for diagnostic and therapeutic purposes.

The research in the dissertation focuses on the relationship between potential sociodemographic, individual and digital predictors of relapse and the time to onset in patients with SUD in conventional and digital follow - up.

1. Aim and objectives of the dissertation

1.1 Aim of the study

To investigate the relationship between potential predictors of relapse and the time to onset in patients with substance use disorder in conventional and digital follow-up.

1.2 Objectives

1. To select patients with substance use disorders who underwent inpatient treatment.
2. To assess the smart device ownership and usage among patients with substance use disorders.
3. To collect main sociodemographic and clinical characteristics of the patient sample.
4. To assess baseline levels of depressive symptoms, anxiety, and global functioning of the patient sample.
5. To establish a schedule for telephone contact for patients randomized in conventional follow-up arm.
6. To perform a training for usage of the study mobile application for patients randomized in digital follow-up arm.
7. To collect data on digital behavioral patterns during a 3-month study mobile application usage.
8. To assess patient sample's treatment outcomes through a telephone call 3 months after discharge.
9. To assess correlations between baseline levels of depressive symptoms, anxiety and global functioning and the risk of relapse and the time to its onset.
10. To determine predictors of relapse related to characteristics of digital behavior.
11. To identify predictors of relapse associated with digitally reported changes in general mental status.

2. Hypotheses

Based on previous related research and the existing cognitive-behavioral theories for relapse in patients with substance use disorders, a hypothesis is formulated that sociodemographic characteristics and indicators of general mental health have predictive value for assessing the risk of relapse and the expected time to onset.

According to Marlatt's cognitive-behavioral model, the occurrence of relapse is determined by the presence of tonic and phasic risk factors. Socio-demographic characteristics such as age, sex, educational level, marital and occupational status are potentially informative for treatment outcomes in patients with substance use disorders. Other important factors that may be relevant in the process of relapse are the baseline levels of some depressive symptoms, anxiety, and global functioning.

Follow-up is an established method of assessing treatment outcomes. It can be done both by conventional methods, such as a telephone call, and by digital means. Tracking through electronic devices allows the collection of a variety of data as aspects of digital behavior, defined as general activity and patterns of usage, as well as to mediate the dynamic monitoring of various psychiatric symptoms.

The hypothesis of the present study states that the socio-demographic data and indicators for general mental health, measured simultaneously and in dynamics with validated instruments, are informative in terms of assessing the risk of relapse and the time until its occurrence. It has been suggested that patients' digital behavior changes when relapse occurs and may indirectly indicate the event.

3. Materials and methods

3.1 Center of research

Second Psychiatric Clinic – University Multiprofile Hospital for Active Treatment “Sveta Marina” – Varna, Bulgaria.

3.2 Patient population

A prospective non-interventional single center study was conducted. A total of 40 patients were recruited during the period of May 2021 till September 2021. Patients were considered eligible if all of the inclusion criteria and none of the exclusion criteria are met.

Inclusion criteria:

1. Age \geq 18 years.
2. Ability to understand the informed consent form, give informed consent, and comply with the study protocol.
3. Confirmed diagnosis of substance use disorder.
4. Upcoming discharge after full-course inpatient treatment for SUD.
5. Ownership of personal smart device.
6. Proficiency in Bulgarian language.

Exclusion criteria:

1. Existing of co-occurring mental illness.
2. Lack of personal smart device.
3. Lack of sufficient digital literacy.

4. Diseases or conditions that could limit the patient's understanding of the provided materials or tasks.

3.3 Collected information

The following information was collected in an electronic database for each of the patients in the trial.

Demographic data:

- *ID number / Initials*
- *Age*
- *Sex: male/female*
- *Marital status: single / married / widowed / divorced*
- *Educational status: no education / primary / secondary / higher education*
- *Smart device's operating system: Android / iOS*

Medical history:

- *Diagnosis of substance use disorder*
- *History of another co-occurring mental disorder*

3.4 Assessment of depressive symptoms levels

According to the NICE recommendations, the Patient Health Questionnaire-9 (PHQ-9) screening diagnostic tool was used to assess the presence and severity of depressive symptoms (see Appendix 1). PHQ-9 is a validated assessment scale based on the diagnostic criteria for depression according to the DSM-V, which consists of nine questions concerning the period of the last two weeks prior administration. Patient responses are evaluated with points from 0 to 3 depending on the frequency of manifestation of the symptoms for the cited period, as 0 marks "not at all", 1 -

"several days", 2 - "more than half days "and 3 -"nearly every day". The minimum sum is 0 and the maximum - 27. A score of 0-4 points indicates the absence of depressive symptoms, from 5-9 - the presence of symptoms of mild severity, from 10-14 - with moderate severity, from 15-19 - with severe and over 20 - extremely severe. The diagnostic tool also considers the degree of impaired functioning due to the symptoms, but this aspect is not reflected in units of measurement.

3.5 Assessment of anxiety

The Generalized Anxiety Disorder-7 (GAD-7) screening diagnostic tool was used to assess the presence and severity of anxiety symptoms (see Appendix 2). GAD-7 is a validated rating scale that consists of seven questions concerning the period of the last two weeks prior administration. Patient responses are evaluated with points from 0 to 3 depending on the frequency of manifestation of the studied symptom for the cited period, as 0 marks "not at all", 1 - "several days", 2 - "more than half the days", 3 - "almost every day"/ The minimum number of points is 0 and the maximum is 21. In clinical trials, the questionnaire demonstrated 89% total sensitivity and 82% total specificity for diagnosing generalized anxiety disorder at a cutoff of 10 points. At a cutoff of 8 points, the scale has 77% total sensitivity and 82% total specificity for other anxiety disorders such as post-traumatic stress disorder, panic disorder and social phobia. The diagnostic tool also considers the degree of impaired functioning due to the symptoms, but this aspect is not reflected in units of measurement.

3.6 Assessment of global functioning

The Global Assessment of Functioning (GAF) screening diagnostic tool was used to assess personal and social functioning (see Appendix 3). GAF is a numerical assessment scale included

in the DSM-IV, which is based on the clinician's subjective assessment of an individual's ability to deal with problems of a personal, social, professional, and psychological nature. The result is from 1 point (severely compromised performance) to 100 points (extremely high performance).

3.7 Stratification and follow-up

After collecting patient data and performing a clinical evaluation using PHQ-9, GAD-7 and GAF, the patients were randomized into two arms. A web-based algorithm, available for free use at randomize.org, was used to perform the randomization.

Patients assigned to the arm with conventional telephone follow-up received a schedule of upcoming contact (see Appendix 4). Follow-up was active, with the study team initiating a telephone contact to seek information on whether relapse had occurred in an unstructured clinical interview. During the conversation, the researchers did not apply interventions of any kind, such as a motivational interview and others. Conventional follow-up was performed for the 3-month period immediately after discharge and was discontinued in case of confirmed relapse.

Patients assigned to the digital follow-up arm were provided with the mindLAMP 2 mobile application for installation, after which they were involved in a 30-minute training session to support its use. Patients were asked to demonstrate their ability to navigate the application on a training device.

The mindLAMP 2 mobile application was developed by the Digital Psychiatry Clinic of Beth Israel Deaconess Medical Center of Boston, an affiliated clinical base of Harvard Medical School, USA. The application is compatible with the current

versions of both Android and iOS and is HIPAA-compliant. The application (see Appendix 5-6) and the admin panel, as well as the supporting server, were provided without compensation to the research team and subsequently modified in Bulgarian and configured according to the needs of the study. The final version of mindLAMP2 for the purposes of present study was with passive data collection settings turned off due to ethical considerations and the chat feature removed. No push notifications and reminders of any kind were used to improve user experience. For reasons of data security, the patient and administrator account did not contain any personal data, and the participants appeared in both platforms with a randomly generated code. All information was encrypted. Only the study researchers had a password-protected access to the admin panel.

For active data collection in the application, ecological momentary assessments consisted of four questionnaires in Bulgarian. The depression and anxiety questionnaires were based on the PRIME-MD self-reported versions of PHQ-9 and GAD-7, respectively. Sleep quality was reported through questions based on the Insomnia Severity Index (ISI). The fourth questionnaire concerned the presence of craving to the substance of abuse.

Patients were instructed to use the application as often as they would prefer but were told that data collection was the main goal of the study and that their responses were reviewed regularly by the team. The digital follow-up was performed in a 3-month period immediately after hospitalization and ended with a telephone contact to clarify the occurrence or non-occurrence of relapse for the past 90 days. Patients were contacted by telephone and in the absence of activity for more than 14 days to clarify the predictive value of changes in activity for relapse.

3.8 Statistical design and analysis

Data were managed and analyzed using IBM SPSS Statistics Software ver. 23. All values are presented as a median value \pm one standard deviation (SD). In all tests p value < 0.05 (two-tailed) was considered significant.

For analysis of acquired data the following statistical methods were used:

1. Statistical data grouping method – collected variables are grouped in variational, interval, categorical, ordinal and scalar statistical series depending on their type.
2. Descriptive methods:
 - central tendency assessments – used to calculate the mean, median and mode of continuous variables.
 - interval assessments - used to calculate significance – p. When the p coefficient equals 0.95 (95%), the probability of type I error is 0.05 (5%).
 - confidence intervals (CI) – a 95% confidence interval was used to interpret the probability of the specified interval contains the actual point estimate in the general population.
3. Graphical methods – line and surface area charts, pie charts, boxplot graphs and histograms were used.
4. Nonparametric analysis –
 - Pearson χ^2 (chi-squared) test was used for assessment of statistically significant differences between categorical variables.

- Assessment of associations between a categorical variable with two groups and an ordinal or continuous variable was made with Mann-Whitney U test.
 - Assessment of associations between a categorical variable with more than two groups and an ordinal or continuous variable was made with Kruskal-Wallis H test.
 - Assessment of associations between an ordinal variable and an ordinal or continuous variable was made with Jonckheere-Terpstra test.
5. Correlation analysis – Spearman coefficient for linear correlation was performed. The correlation coefficient rho can assume values between -1 and +1, and the sign depends on the direction of association. The following ranges were used for interpreting the degree of association:

< 0.19 – very weak correlation;
 0.19 ÷ 0.39 – weak correlation;
 0.40 ÷ 0.59 – moderate correlation;
 0.60 ÷ 0.79 – strong correlation;
 ≥ 0.80 – very strong correlation;

4. Results

4.1 Descriptive analysis of patient characteristics

A total of 85 patients with substance use disorder and no other co-occurring mental illness who confirmed interest in participating were screened for inclusion in the trial. Of these, 68 were men (80%) and 17 were women (20%). The mean age of those screened was 43.4 years, with the youngest patient being 20

years old and the oldest 63 years old. Of these, 52 (61%) had a personal smart device and the remaining 33 (39%) were not technically equipped and were therefore excluded from subsequent participation in the trial. The mean age of those with own smart electronic device was 41.2 years, with the youngest being 22 years old and the oldest aged 63. The mean age of those lacking own device was 43.2 years, with the youngest being 20 years old and the youngest -adult - 62. Regarding the available operating system - 49 of the patients had an Android device (94.3%) and iOS - 3 (5.7%). Of the remaining 52 patients, 12 (23%) did not demonstrate sufficient digital literacy or had personal smart devices with versions of Android and iOS incompatible with the mobile application of the trial. The distribution of screened patients according to sex, ownership, available operating system, and digital literacy is illustrated in Figure 1, Figure 2, Figure 3 and Figure 4.

The study included 40 patients randomized into two arms of 20 patients. The average age of the participants in the digital follow-up arm was 37 years, with the youngest being 22 and the oldest 53 years old. The average age of participants in conventional telephone follow-up arm was 42 years, with the youngest being 30 years old and the oldest 57 years old. A detailed descriptive description of the patient sample is available in Table 1. The distribution of participants according to their socio-demographic characteristics in the individual arms is illustrated in Figure 5, Figure 6, Figure 7, Figure 8.

All 40 patients were followed-up for relapse for a 3-month. Relapse occurred in 30 (75%) of all patients followed. The number of relapses in the digital arm was 14 (70%), and those in the conventional telephone arm - 16 (80%). The median time to

relapse in digital follow-ups was 27 days and in standard follow-ups 40.1 days. The distribution of participants depending on the outcome of treatment is presented in Figure 9 and Figure 10.

Table 1. Sociodemographic characteristics of the patients

Sex	
Men	34 (85%)
Women	6 (15%)
Marital status	
Single	15 (6.9%)
Married	11 (69.3%)
Divorced	14 (13.4%)
Educational status	
Primary	2 (5%)
Secondary	29 (72,5%)
Higher	9 (22,5%)
Employment	
Employed	15 (37,5%)
Unemployed	25 (62,5%)

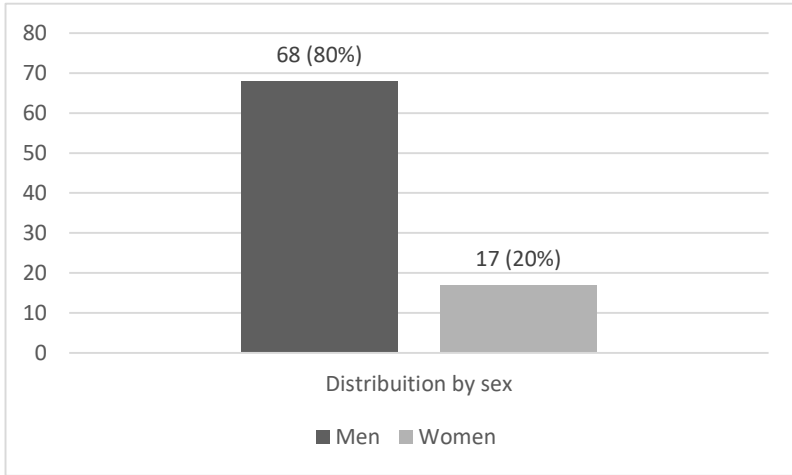


Figure 1. Bar graph depicting patient distribution by sex.

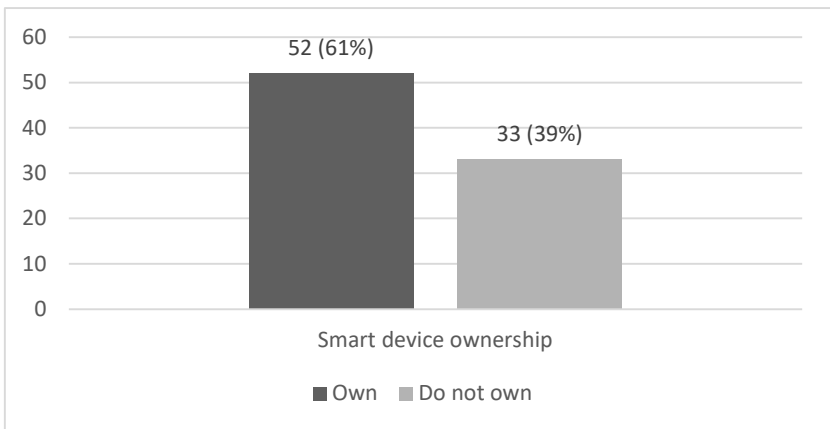


Figure 2. Bar graph depicting patient distribution by smart device ownership

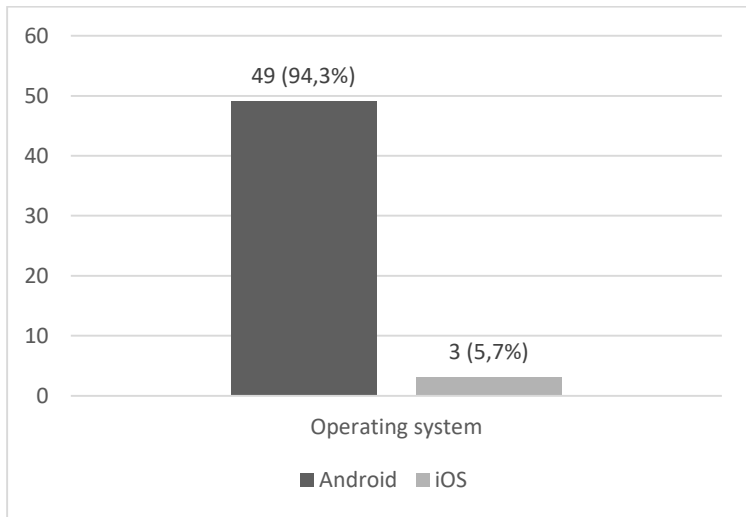


Figure 3. Bar graph depicting operating system distribution.

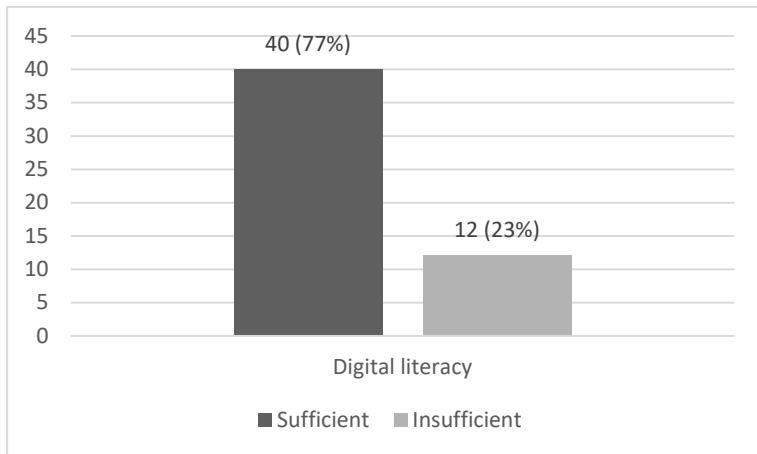


Figure 4. Bar graph depicting distribution by digital literacy.

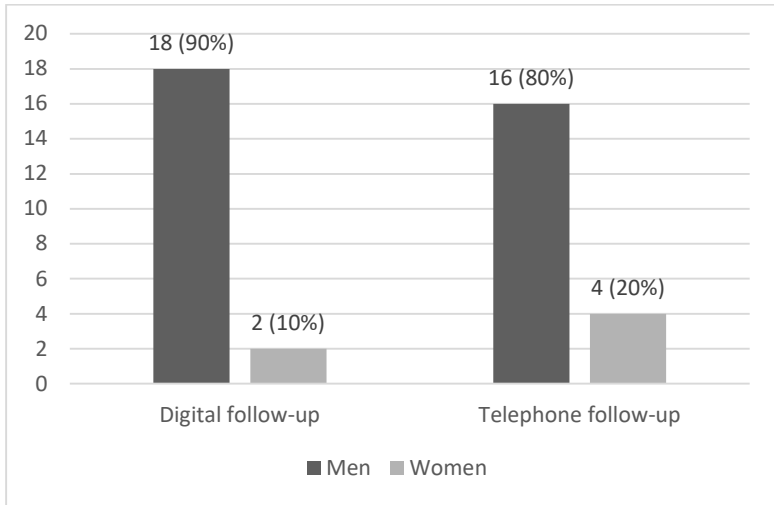


Figure 5. Bar graph depicting patient sample distribution by sex

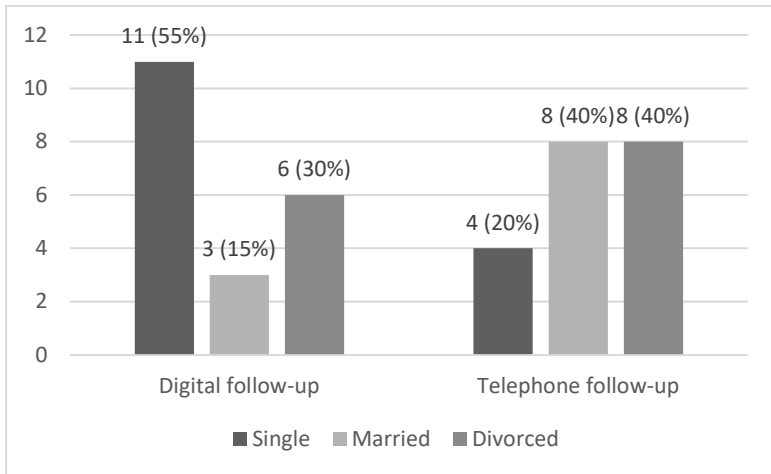


Figure 6. Bar graph depicting patient sample distribution by marital status.

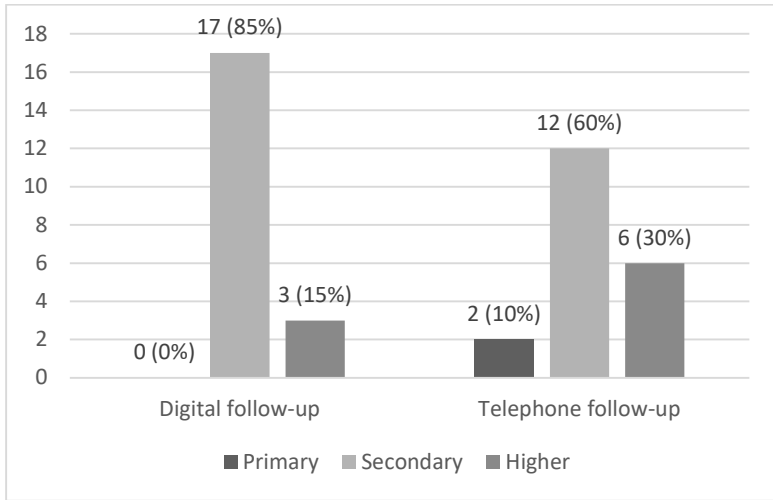


Figure 7. Bar graph depicting patient sample distribution by education.

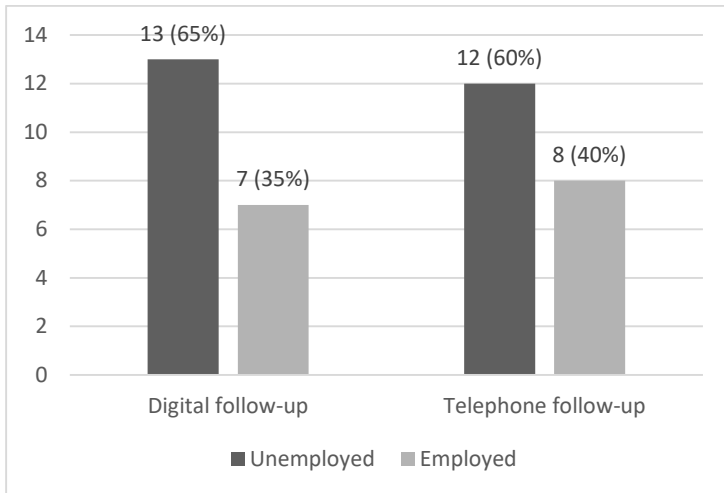


Figure 8. Bar graph depicting patient sample distribution by employment status.

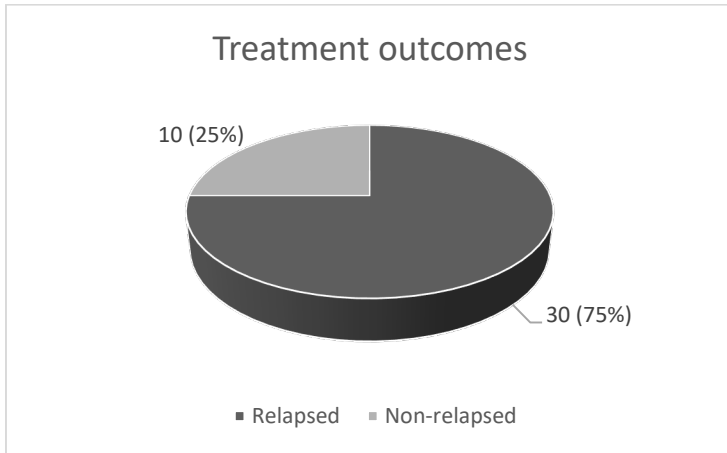


Figure 9. Pie chart depicting patient distribution by treatment outcomes.

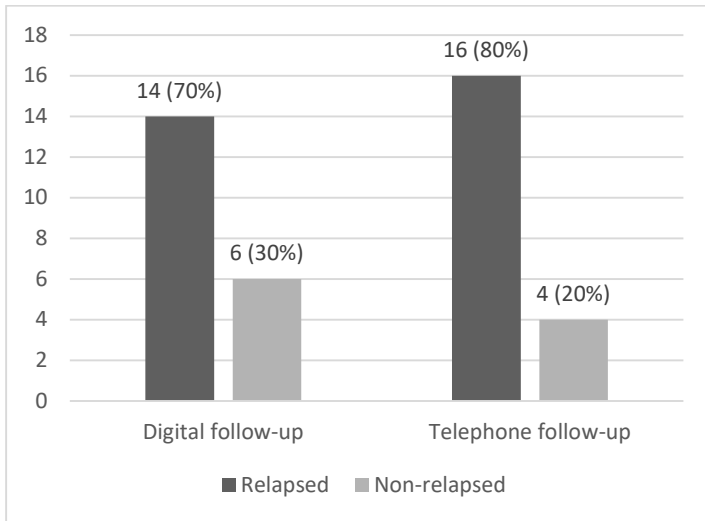


Figure 10. Bar graph depicting patient distribution by treatment outcomes per arms.

4.2 Correlation analysis between sociodemographic characteristics and occurrence of relapse

To identify sociodemographic factors leading to relapse in patients with substance use disorder, Pearson's χ^2 correlation analysis was performed with statistical significance at $p \leq 0.05$. The results of the analysis are summarized in Table 2. There is a statistically significantly higher risk of relapse depending on marital status ($p = 0.022$). No other statistically significant socio-demographic factors were identified.

The assessment of the correlation between sociodemographic data and the time to relapse was assessed by the Kaplan-Meier method, and the log-rank test was used to prove statistical reliability between the curves. A strong correlation was found between marital status and time to relapse ($p = 0.003$). A summary of the results is shown in Table 3. The correlation analysis between the socio-demographic characteristics and the time to relapse is illustrated in Figure 11, Figure 12, Figure 13, Figure 14.

Table 2. Correlation between sociodemographic characteristics and risk of relapse

	Relapsed n (%)	Non-relapsed n (%)	p
Sex			0.810
Men	25 (83.3%)	8 (80%)	
Women	5 (16.7%)	2 (20.0%)	
Marital status			0.022
Single	10 (33.3%)	5 (50%)	
Married	6 (20.0%)	5 (50%)	
Divorced	14 (46.7%)	0 (0%)	
Education			0.428
Primary	1 (3.3%)	1 (10%)	
Secondary	21 (70%)	8 (80%)	
Higher	8 (26.7%)	1 (10%)	
Employment			0.850
Employed	11 (36.7%)	4 (40%)	
Unemployed	19 (63.3%)	6 (60%)	

Table 3. Correlation between sociodemographic characteristics and time to relapse

	Median of the days to relapse	log rank p
Sex		0.932
Men	58 ± 20.671	
Women	42 ± 36.661	
Marital status		0.003
Single	71 ± 20.610	
Married	81 ± (the median has not been reached as of cut-off)	
Divorced	15 ± 1.871	
Education		0.500
Primary	23 ± (the median has not been reached as of cut-off)	
Secondary	61 ± 16.146	
Higher	28 ± 20.870	
Employment		0.349
Employed	71 ± 7.085	
Unemployed	28 ± 11.990	

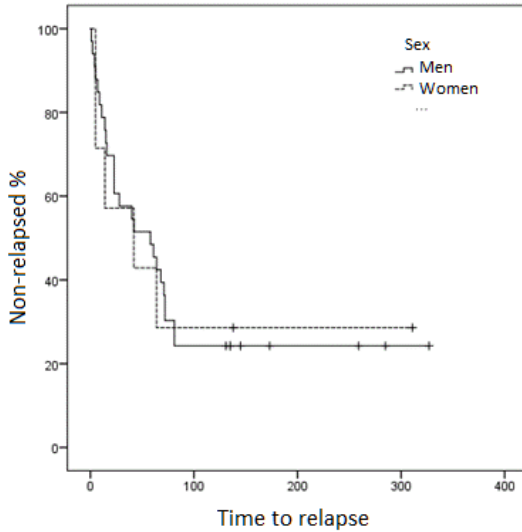


Figure 11. Kaplan-Meier graph depicting correlation between sex and time to relapse (log rank $p < 0,05$)

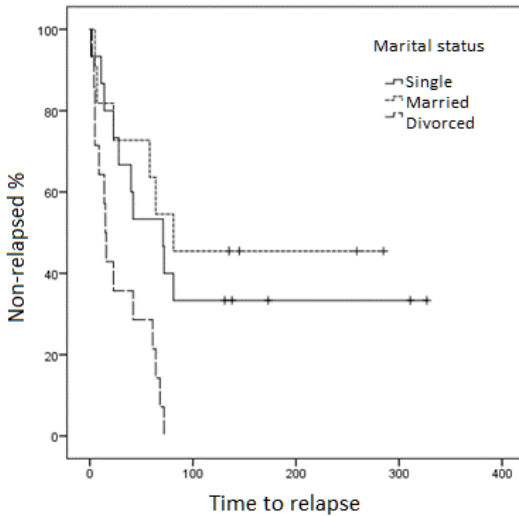


Figure 12. Kaplan-Meier graph depicting correlation between marital status and time to relapse (log rank $p < 0,05$)

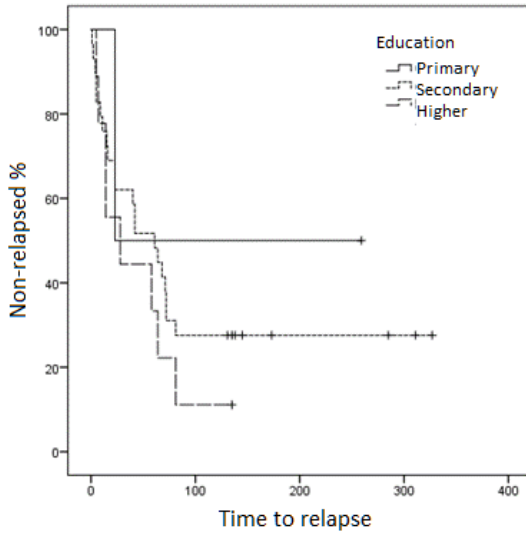


Figure 13. Kaplan-Meier graph depicting correlation between education and time to relapse (log rank $p < 0,05$)

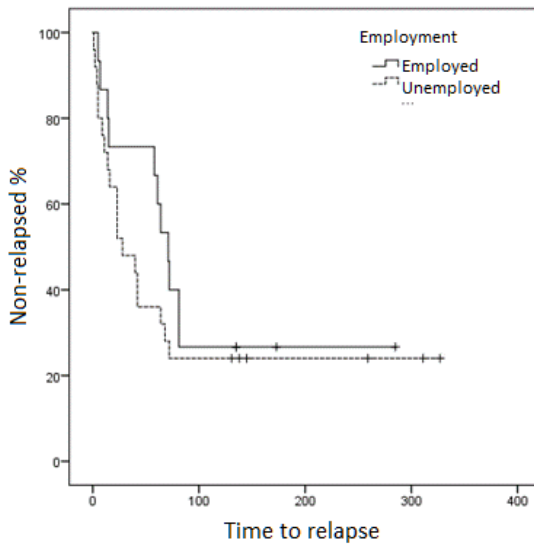


Figure 14. Kaplan-Meier graph depicting correlation between employment and time to relapse (log rank $p < 0,05$)

6.3. Correlation analysis between clinical characteristics and occurrence of relapse

To seek correlation between clinical features according to baseline assessments symptoms related to depression, anxiety and global functioning and the occurrence of recurrence, a nonparametric analysis was performed. The Jonckheere-Terpstra test was used to assess the correlation between the levels of depressive symptoms, anxiety and personal and social functioning and the time of relapse. No statistical significance was found for any of the variables. The results are summarized in Table 4 and illustrated in Figure 15, Figure 16 and Figure 17.

Table. 4 Correlation between clinical characteristics and occurrence of relapse

	Median of scale score	Mann-Whitney p	Jonckheere-Terpstra p
PHQ-9		0.573	
Relapsed	6±5.865		0.578
Non-relapsed	4.5±5.051		
GAD-7		0.875	
Relapsed	3±5.624		0.216
Non-relapsed	2.5±3.573		
GAF		0.223	
Relapsed	59.5±8.398		0.282
Non-relapsed	66.5±11.257		

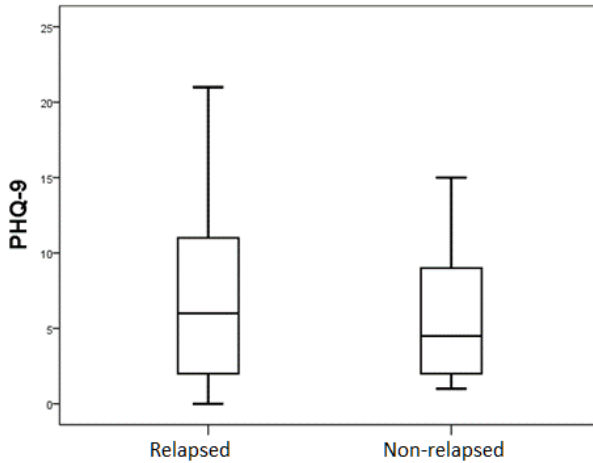


Figure 15. Box plot graph depicting correlation between levels of depressive symptoms assessed with PHQ-9 and occurrence of relapse ($p < 0,05$, Mann-Whitney test)

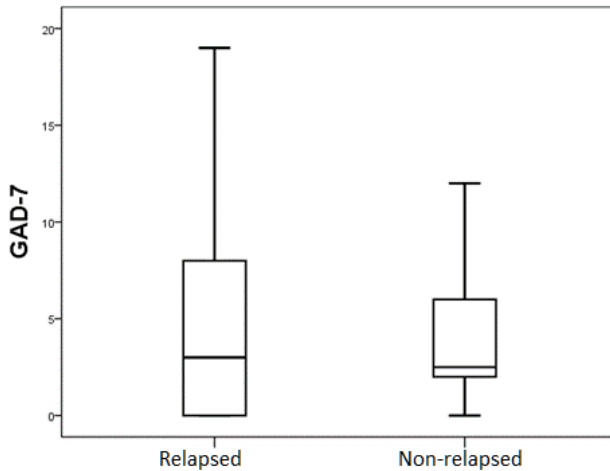


Figure 16. Box plot graph depicting correlation between levels of anxiety symptoms assessed with GAD-7 and occurrence of relapse ($p < 0,05$, Mann-Whitney test)

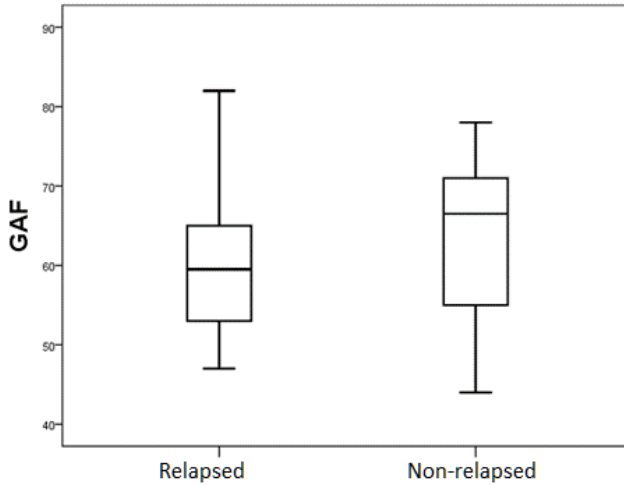


Figure 17. Box plot graph depicting correlation between levels of global functioning assessed with GAF and occurrence of relapse ($p < 0,05$, Mann-Whitney test)

4.4 Correlation analysis between digital characteristics and occurrence of relapse

To assess the interventional value of digital follow-up per se, Pearson's χ^2 was performed with statistical significance at $p \leq 0.05$ for occurrence of relapse and Kaplan-Meier analysis for the time to onset. No association was found between the follow-up method and relapse and the days of abstinence achieved ($p = 0.802$). The median of days to relapse in digitally followed-up was $28 \pm 19,007$, and in conventionally followed-up - $58 \pm 21,243$. The results are summarized in Table 4. The relationship between the follow-up method and the time to relapse is illustrated in FIG. 24.

Before proceeding to the analysis of the data from the received digital questionnaires, the correlation between the clinical evaluation of the researcher and the symptoms reported in the first questionnaire, which took place within the same day, was assessed. A Spearman test was used. No correlation was found between the levels of depressive symptoms assessed with PHQ-9 and the responses in the corresponding questionnaire in the application (Spearman rho = + 0.191, p = 0.686). A strong trend was found for correlation between the anxiety symptoms assessed with GAD-7 and the answers in the corresponding questionnaire in the app, but without statistical significance (Spearman rho = + 0.466, p = 0.080). The results are illustrated in Figure 19 and Figure 20.

Table 5 Correlation between method of follow-up and occurrence of relapse

	Relapsed, n (%)	Non-relapsed, n (%)	p
Method of follow-up			0.465
Digital	14 (46.7%)	6 (60%)	
Telephone	16 (53.3%)	4 (40%)	

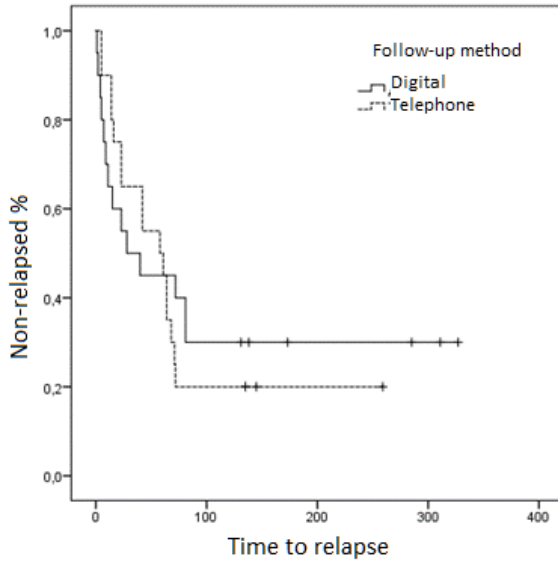


Figure 18. Kaplan-Meier graph depicting correlation between the method of follow-up and time to relapse (log rank $p < 0,05$)

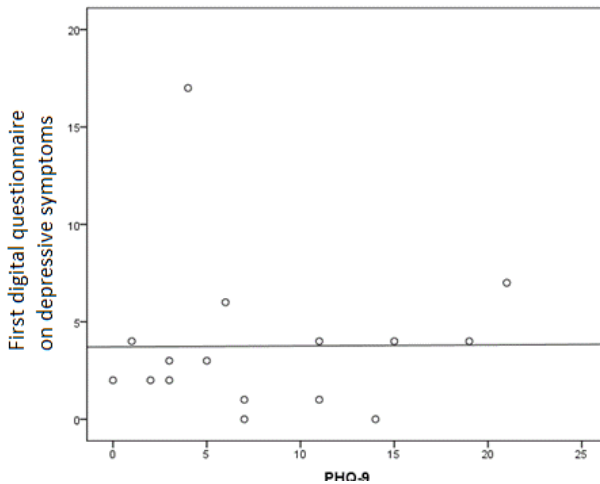


Figure 19. Scatterplot graph depicting the asymmetrical distribution of levels of depressive symptoms assessed with PHQ-9 and via digital questionnaire (Spearman rho = + 0.191, $p = 0.686$)

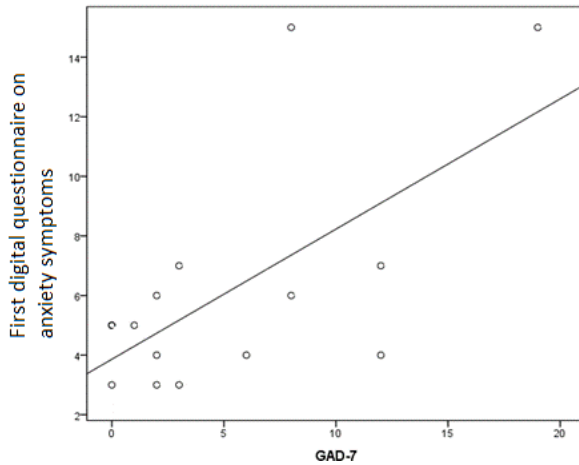


Figure 20. Scatterplot graph depicting the asymmetrical distribution of levels of anxiety symptoms assessed with PHQ-9 and via digital questionnaire (Spearman rho = + 0.466, p=0.080)

A correlation analysis was performed to seek a relationship between symptoms reported in the mobile application and the occurrence of relapse, as well as the time to it. For this purpose, the Mann-Whitney and Spearman tests were used with the following data from the digital questionnaires - first result, highest result, and average result. No statistically significant relationship was found between any of the variables and the occurrence of relapse and the time of abstinence. The summarized results are presented in Table 6.

Table 6. Correlation between digitally reported symptoms and occurrence of relapse

Median of points in questionnaires (relapsed/non- relapsed)	Mann-Whitney p	Spearman rho
Depressive symptoms questionnaire		
First result (3.5±4.835, 2.5±2.160)	0.510	+ 0.185, p=0.608
Highest result (5±6.240, 5±5.269)	0,511	- 0.006, p=0.987
Mean result (3.64±5.969, 1.650±1.123)	0,278	- 0.152, p=0.675)
Anxiety symptoms questionnaire		
First result (6±4.604, 4±1.378)	0.210	+ 0.077, p=0.845
Highest result (6±5.979, 6±1.835)	0,547	+ 0.008, p=0.983
Mean result (5±4.683, 3.66±0.791)	0,479	- 0.380, p=0.313
Quality of sleep questionnaire		
First result (4±1.748, 2±1.265)	0.090	+ 0.211, p=0.534
Highest result (5±1.954, 5±2.229)	0,566	- 0.086, p=0.801
Mean result (3±1.898, 2.04±0.669)	0,159	- 0.204, p=0.548
Craving questionnaire		
First result (5.50 ± 5.763, 5 ± 2.828)	0,384	+ 0.061, p = 0.867
Highest result (8 ± 5.259, 7 ± 3.125)	0.411	+ 0.088, p = 0.808
Mean result (4.850 ± 2.513, 4.805 ± 2.322)	1.000	+ 0.360, p = 0.342

Characteristics of the use of the mobile application as a total activity by number of completed questionnaires and period of use, defined as the days between first and last use, were assessed. A strong correlation was found between the number of completed questionnaires and the occurrence of relapse (Mann-Whitney test, $p = 0.004$), as the median for relapses was $14 \pm 26,450$, and for non-relapsed - $82 \pm 22,396$. There is also a strong statistical significance between the number of completed questionnaires and the time to relapse (Spearman rho = + 0.769, $p = 0.001$). A relationship was also found between the period of activity and the occurrence of relapse (Mann-Whitney test, $p = 0.004$), as the median for relapses was $12 \pm 26,441$, and for non-relapsed - $82 \pm 24,633$. Days of activity are also a predictor of the time to relapse (Spearman rho = + 0.839, $p = 0.000176$). The median of the days between the last use of the application and the occurrence of relapse is 7.50 ± 6.547 . The results are illustrated in Figure 21, Figure 22, Figure 23 and Figure 24.

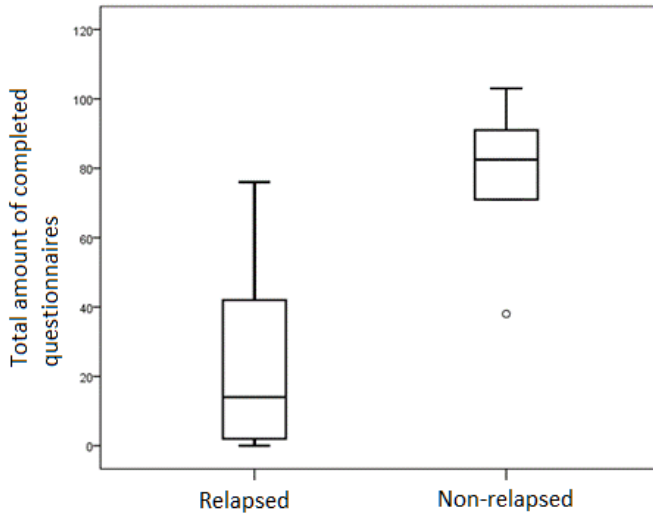


Figure 21. Box plot graph depicting correlation between amount of completed questionnaires and occurrence of relapse ($p < 0,05$, Mann-Whitney test)

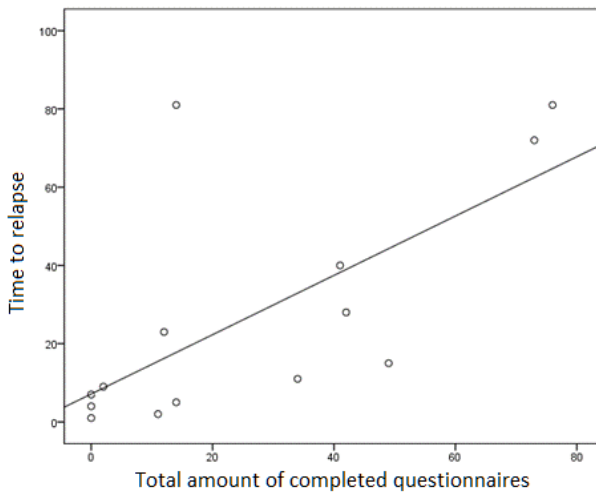


Figure 22. Scatterplot graph depicting correlation between amount of completed questionnaires and time to relapse (Spearman rho = + 0.769, $p = 0.001$)

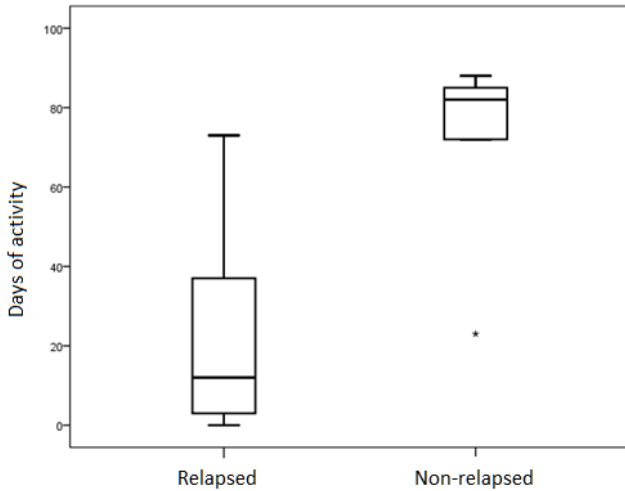


Figure 23. Box plot graph depicting correlation between days of activity and occurrence of relapse ($p < 0,05$, Mann-Whitney test)

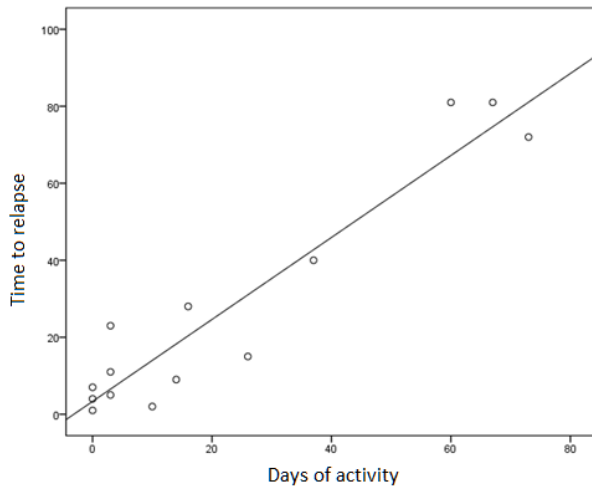


Figure 24. Scatterplot graph depicting correlation between days of activity and time to relapse (Spearman rho = + 0.839, $p = 0.000176$)

For the purposes of the statistical analysis, all completed digital questionnaires with a total number of 836 were processed. Of these, 787 (94.1%) were sent by patients who adhered to abstinence, and the remaining 49 (5.9%) by relapsed patients. Of all 14 patients who relapsed, 10 (71.5%) had no activity after the event. The results are illustrated in Figure 25 and Figure 26.

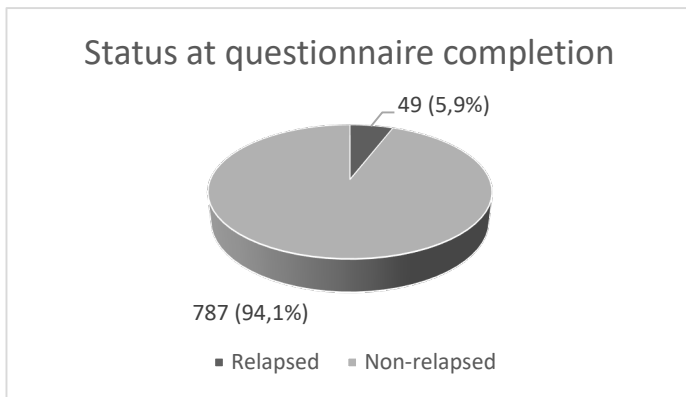


Figure 25. Pie chart graph depicting the distribution of completed questionnaires per clinical status at completion

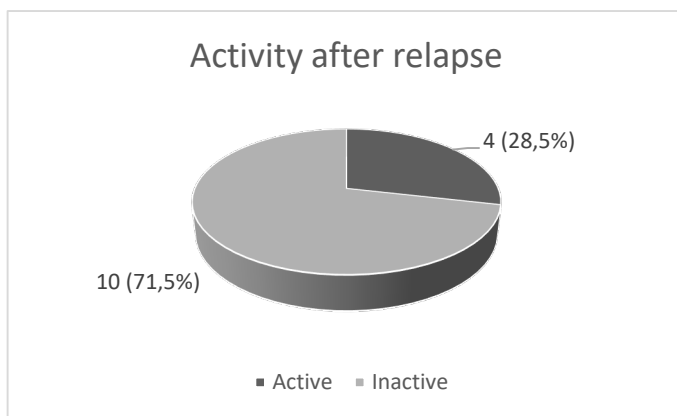


Figure 26. Pie chart graph depicting activity after relapse

To assess age as a potential sociodemographic factor related to digital activity, a Pearson correlation analysis was performed. The analysis showed that the age of the participants did not correlate with the number of completed questionnaires (Pearson $r = -0.296$, $p = 0.205$), nor with the length of the period of use of the mobile application (Pearson $r = -0.402$, $p = 0.079$).

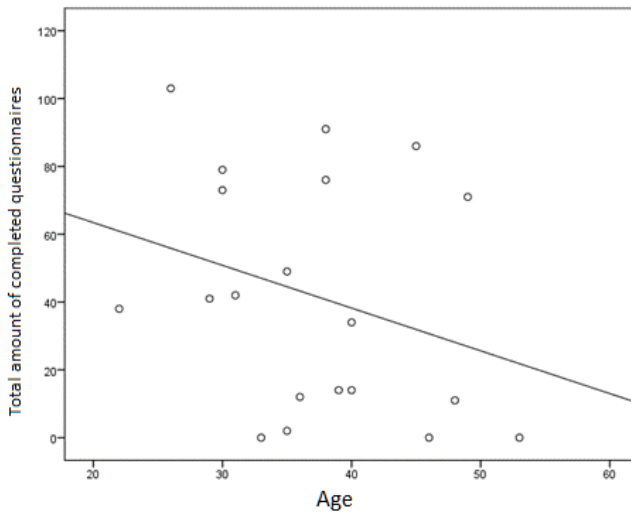


Figure 27. Scatterplot graph depicting correlation between age and amount of completed questionnaires (Pearson $r = -0.296$, $p = 0.205$)

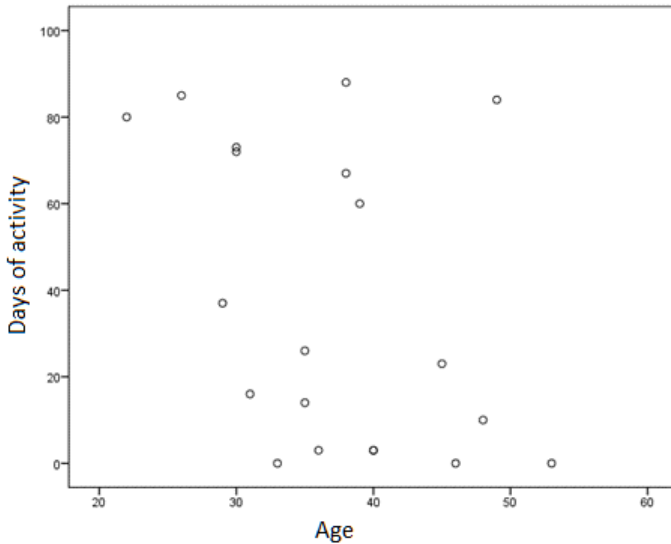


Figure 28. Scatterplot graph depicting correlation between age and total days of activity (Pearson $r = - 0.402$, $p = 0.079$)

5. Discussion

Substance use disorders are a global health and social problem with serious medical, economic and societal consequences. The chronic course of the disease is characterized by a high frequency of relapse after treatment in an inpatient setting or other health care units. An in-depth study of the risk factors associated with relapse, as well as the identification of patients at risk would help to implement timely therapeutic measures and limit the negative consequences for the patient, his relatives and the health system. With the development of digital technologies, a new tool is being provided to study the phenomenon and improve strategies for its early detection.

In the present study of 40 patients with substance use disorders, relapse was recorded in 30 (75%) patients during a 3-month follow-up by telephone or digital means. The data slightly exceed those in past studies from Europe and North America and significantly exceed the reported frequency in Asia. The reason for these results can be found in specific ethnocultural features and traditions, as well as the lack of a unified national strategy for follow-up care aimed at patients with SUD, as well as the weak local involvement of social structures to support affected patient group. In Bulgaria so far there are no studies related to epidemiology and risk factors associated with relapse. No studies have been performed locally on the use of digital devices to monitor patients with mental illness. The conducted research is the first in-depth study on the use of digital methods to report the prevalence of relapse in patients with SUD in Bulgaria, as well as the risk factors that determine it. The study covered all patients who agreed to participate in the study, meeting all inclusion and none of the exclusion criteria and conducted a full course of treatment at the Second Psychiatric Clinic at UMHAT St. Marina - Varna for the period from May 2021 to September 2021, which allowed the formation in an impartial manner of a representative sample of patients.

In the pre-selection of patients for the present study, some characteristics of the studied patient population were considered. There was a disproportionate distribution of patients by sex - 68 (80%) of those screened were men, and only 17 (20%) - women. This circumstance is deducible from the proven higher incidence rate among males. Moreover, men are more likely to seek and receive medical care for their illness. Women face greater difficulties in accessing specialized treatment due to lower social

support and more stigmatizing attitudes. Gender disparity has also been reported in previous epidemiological studies.

From the analysis of the ownership of a personal smart device of the studied patient population, it was reported that 61% of patients have their own digital device. The reported prevalence is lower compared to other studies among patients with mental illness, but it is important to note that none of them are targeted specifically at patients with substance use disorders. Another circumstance is that they were held in countries with developed economies. The prevalence reported in the present study is consistent with older studies among addicts in developed countries. We recognize that these differences are probably due to economic differences between countries, as well as the serious financial burden of addiction, which is entirely borne by patients. It is also a well-known fact that addicted patients tend to gamble and sell off personal belongings in order to obtain funds. The patient population is also characterized by high levels of criminogenicity, which suggests that their property is at risk of theft, which in turn limits the motivation to own personal belongings of high financial value. Of interest for future research on the prevalence of smart devices among patients with SUD is its connection with socio-demographic characteristics such as employment and educational qualifications.

Patients' preferences for the operating system used were also studied, with 49 (94.3%) Android users and only 3 (5.7%) iOS users. An explanation could be found in the relatively higher price of Apple products, as well as the more widespread use of Android devices in Europe. The finding is important with a view to developing future digital tools and prioritizing an operating system.

During the screening procedures, no significant differences were identified in the average age of those who personally owned a smart device (41.2 years) and those who did not (43.2 years). The reported results correlate with those in other studies. This observation is extremely important in order to limit the widespread belief that digital methods are applicable only among younger patients. Moreover, an in-depth analysis of the age of the participants in the digital arm of the study did not support the assumption that young patients would use an electronic instrument more often and for a longer period of time. Of interest for future research is the opportunity to study attitudes towards the use of a personal smart device, preferred platforms and applications among patients in different age groups.

Another important conclusion about the applicability of digital methods was made by assessing digital literacy and the possession of devices running on old versions of operating systems. In the current study, 12 (23%) of the screened participants failed to demonstrate the ability to handle a smartphone or tablet or had a device that was incompatible with the technical requirements of the current version of the study application. Other studies have also recognized the need for satisfactory technical literacy in the implementation of digital medical devices. An additional aggravating role for the local population is the lack of an interface in Bulgarian for some functionalities of both the device itself and the mobile applications. It is important to specify that a uniform standardized approach was not used in the technical readiness assessment due to the lack of such. The observations are based on the researchers' subjective assessment of the patients' skills demonstrated in a training environment. Of interest for future research is the

possibility of rapid assessment of digital literacy using built-in screen time sensors.

In the present study, a risk of relapse assessment was performed on the basis of socio-demographic and clinical data for all participants, regardless of their distribution in a conventional or digital follow-up arm. Characteristics such as sex, marital status, education and employment were used for this purpose. The clinical characterization was reduced to the assessment of depressive and anxiety symptoms, as well as to the degree of personal and social functioning using the validated PHQ-9, GAD-7, and GAF rating scales.

Some of the research conducted so far in the field hypothesizes that female patients are characterized by a more favorable prognosis in terms of treatment outcome. The current study did not establish a statistical significance of gender as a factor for relapse, nor for the length of the abstinence period. Large-scale studies confirm our observations or even suggest that relapse is more common in women. It is important to take into account the circumstance, which has already been commented in detail - due to the specifics of the patient population, the participants in the study were mostly men (85%). It would be appropriate to confirm the results with a larger number of subjects of both sexes.

Despite the numerous studies proving the high predictive role of the level of education and employment, their statistical significance as predictors of relapse and the time until its occurrence has not been established. The probable reason is that in most studies the low educational qualification and unemployment are considered in the context of socio-economic deprivation, which in turn is a strong predisposing factor for

substance abuse. Considered independently outside the context of social and financial well-being, education and employment are not a significant factor in the occurrence of relapse and the length of the abstinence period. It is also important to note that we considered only regulated employment relationships due to the impossibility to assess the actual employment of the patient when in the conditions of the so-called "gray economy".

In the present study, a high predictive value with respect to marital status for relapse was found. The prognosis for the outcome of treatment in divorced patients is the most unfavorable. The observed results could be explained by several circumstances, especially given the predominance of male patients in the sample. The protective role of marital relations in men with SUD has been proven. Men find greater support and understanding from their spouses, as well as greater assistance in conducting treatment. The presence of divorce in the patient's personal history may indirectly indicate the high severity of the disease that caused it, or the emergence of abuse as a mechanism for dealing with the traumatic life event. Finally, the lack of a spouse could be a source of feelings of loneliness and social isolation, which according to a number of studies are a precipitating factor for relapse. According to the data from our study, not only the occurrence of relapse is determined by marital status, but also the time until its occurrence. In divorced patients, abstinence days ($15 \pm 1,871$) were significantly shorter than in single ($71 \pm 20,610$) and married patients ($81 \pm$ median not reached cut-off). These circumstances require the development of additional strategies for follow-up care of patients at increased risk, such as referral to self-help groups, group psychotherapy and inclusion in rehabilitation programs at day hospitals.

Patients in the study were evaluated for baseline levels of depressive and anxiety symptoms and degree of personal and social functioning using PHQ-9, GAD-7, and GAF, respectively. There was no statistically significant relationship between the severity of clinical features and the occurrence of relapse, nor a correlation with the length of time to onset. It is important to specify that the exclusion criterion was the lack of a psychiatric comorbidity. The research conducted so far in the field is focused mainly on patient groups who, in addition to SUD, have been diagnosed with another mental illness. The role of depressive symptoms below the clinical threshold for major depressive disorder is unclear, and other studies suggest a significantly smaller role in relapse processes. Moreover, the neurobiology of addictions suggests the presence of symptoms such as anhedonia, depression, and lack of initiative in the early stages of abstinence. The situation is similar regarding anxiety. A particular difficulty in accounting for its isolated role is the fact that its symptoms overlap with those constituting the withdrawal syndrome. The current findings on the topic, including these from the present study, indicate the need to create and validate diagnostic tools for assessing the levels of depressive and anxiety symptoms, which are consistent with the characteristics of the patient population.

We found surprising the lack of predictive value in terms of levels of personal and social functioning and the occurrence of relapse. Reasons for this could be sought primarily in the homogeneity of the sample, as well as in some features of the GAF scale used. The tool reflects the subjective assessment of the researcher regarding the global functioning of the patient, not taking into consideration the patient's perception and the extent to which he is aware and experiencing the reported disorders. Previous research has shown that the role of self-esteem and self-

confidence in patients with substance use disorders as a protective factor against relapse is much greater.

The main focus of our study was on markers of digital behavior and electronic self-reporting of symptoms and their relationship to relapse. We were interested also in the possibility of digital follow-up per se to demonstrate interventional value, but this hypothesis was rejected - patients from both arms of the study were characterized by comparable relapse rates and periods of abstinence. The electronic follow-up does not in itself help to adhere to targeted behavior when it is not combined with access to psycho-training modules and other methods of intervention. Other recent research supports our observations. Of interest for future research is the perception and effects of digitally mediated intervention among patients addicted to surfactants in Bulgaria.

During statistical analysis of the data, we found an extremely low correlation between the initial assessment of PHQ-9 and the first reporting through the depressive symptoms questionnaire in the mobile application, although the two events took place within 24 hours and target identical complaints. Most patients tend to have significantly higher levels of depressive symptoms when shared in an interview with a researcher. Previous research has shown that self-assessment scales for depression are similarly informative compared to a clinician's assessment. The differences could be sought in the specifics of the patient population and in the form of reporting. Patients with substance use disorders may be more likely to aggravate symptoms that they perceive as "exculpatory" to the abuse. Traditionally, patients do not receive empathy from others for the suffering caused by abuse, which could force them to look for another way to evoke sympathy and understanding. Reasons

could also be sought in some personality traits of the patient group, including the pronounced tendency to manipulation, in which case the aggravation potentially aims at additional medication or welfare assistance. The characteristics of digital self-reporting of symptoms have been poorly studied, and current scientific data show that electronic mediation helps to share circumstances related to high-risk behavior. This could indicate that in a digital environment, the patient feels calmer and less at risk of negative feedback from the clinician. Of interest is the replication of this part of the present study among a larger group of patients.

The correlation between the initial assessment of GAD-7 and the first reporting through the anxiety symptom questionnaire in the mobile application is significantly higher, as again the two assessments are performed within 24 hours. The probable reason for this is the overlap between the clinical presentation of anxiety and that of the withdrawal syndrome, which allows patients to recognize and report them more easily.

Depressive and anxiety symptoms, along with those of sleep disturbances and craving, continued to be monitored in patients in the digital follow-up arm. The statistical analysis considered the first report, the highest and average score of the questionnaires. No significance was found for any of the assessments. Some causes of symptoms of depression and anxiety have already been discussed in detail. It is also important to note that during the study, patients reported mostly low severity and low dynamic variation of complaints. Prolonged monitoring of symptoms is likely to be of greater practical value, especially in patients with co-occurring mental disorders.

According to a number of studies, sleep disorders are a strong predictor of relapse. In the present study, no similar relationship was demonstrated, with only a certain tendency to correlate between higher baseline levels at the first reporting of sleep problems and relapse, but not the time to it. An explanation could be sought in the fact that the examined patients underwent a full course of treatment in a hospital. This suggests that the symptoms of insomnia were alleviated during the hospital stay, and for some of them the treatment continued at home. The presence of sleep problems at the time of discharge could indirectly indicate the inadequacy of treatment measures. Other global studies have shown the negative role of suboptimal hospital stays in increasing the risk of relapse.

Despite our expectations for a high predictive value of the craving questionnaires, this was not proven in the current study. Of interest is the fact that even immediately before relapse, patients continue to report low levels of craving in the digital questionnaire. An explanation could be sought in the impaired criticality of patients with addiction to surfactants with respect to the disease. It has been proven that only 20% of all patients are aware of their problem and seek treatment. The causes are both psychological and social, as well as due to specific neuronal dysfunction in the brain regions responsible for interception, self-esteem and habit formation. Functional neuroimaging techniques have demonstrated the low correlation between reported craving symptoms and established brain activation when a substance-related stimulus is administered. Also, low levels of insight are associated with a worse prognosis and shorter periods of abstinence. Due to these peculiarities of the phenomenon, we tend to conclude that the reporting of symptoms of attraction to surfactants could be strongly influenced by the patient's criticality

regarding his condition and his self-interpretation is significantly difficult.

The study of digital behavior was performed using metadata characterizing the activity in the mobile application mindLAMP. Strong statistical significance was found between the total number of completed questionnaires by the patient and the occurrence of relapse, as the median for relapsed was $14 \pm 26,450$, and for non-relapsed - $82 \pm 22,396$. The indicator also confirmed its predictive value in terms of the length of the abstinence period. Another marker of digital behavior, namely the time of activity, defined as the period between the first and last use of the application, also demonstrates a strong positive correlation in terms of relapse and time to it. The median for those who relapsed was $12 \pm 26,441$ days, and for those who did not relapse - $82 \pm 24,633$ days. The median of the days between the last use and the date of relapse was 7.50 ± 6.547 , which clearly indicates the simultaneous occurrence of both phenomena.

An explanation for the before mentioned results could be sought in the perception of aspects of digital behavior such as indirect markers of intrinsic motivation and self-efficacy. Numerous studies have reported the beneficial role of self-coping ability in maintaining targeted behavior in patients with SUD. Moreover, observations could indicate important aspects of the patient's insight of the disease and the need for treatment, as well as his ability to adhere to health recommendations. Although patients have been explained in detail that the objectives of the study are scientific and no immediate benefits are expected, follow-up is a form of continuing care and should be of interest to those patients who prioritize recovery. It is also important to note that patients were not stimulated and notified in any way to

increase the activity in the application. This allows us to conclude that the demonstrated digital behavior is authentic and not influenced by external factors and interference.

During digital follow-up, we found that through it we are able not only to predict the occurrence of relapse based on low activity on the part of the patient, but also to predict with great accuracy the occurrence of the event. The statistically significant overlap between the period of use and the period of abstinence suggests that relapse and discontinued activity occur simultaneously. This dependence is particularly strongly demonstrated by the fact that 10 (71.5%) of relapsed patients completely discontinued use after relapse. Regarding the completed 836 questionnaires, only 49 (5.9%) were sent by patients who violated their abstinence. It is difficult to determine which comes first - relapse or discontinued activity. On the one hand, the direct effects of substance abuse are expected to limit the patient's cognitive ability to engage in ecological momentary assessments. It is also possible to observe the negative consequence of abstinence violation effect - the patient is disappointed with his behavior and perceives it as a definite failure, which makes it pointless to carry out therapeutic measures and seek medical help. On the other hand, reduced activity could be a sign of a decline in motivation, which subsequently results in relapse.

Regardless of the sequence of events, monitoring is of great practical value, as it allows the identification of patients at risk, answering not only the question of who, but also when. The potential opportunity for the treatment team to be informed in a timely manner about the negative outcome of the treatment provides an opportunity for crisis intervention and limitation of

the consequences for the individual and the health system caused by the relapse. An automated alarm system was not configured in the software we use, although we have the technical ability to implement it for future research. Based on the findings of the present study, we could develop a digital product that informs the treatment team in automatic risk identification - for example, in the absence of activity. The absence of this functionality suggested that the data was reviewed manually in the researchers' admin panel daily. However, it was noted that digital follow-up does not require the involvement of a medical doctor, unlike conventional telephone follow-up. The review of the data could be performed by other staff - nurses, social workers, without compromising interpretation.

Another important practical conclusion for us was to consider the benefits of digital follow-up in terms of time and workforce organization. For the telephone follow-up of 20 patients for 3 months, according to the frequency set by the protocol, it was necessary to hold conversations with a total duration of nearly 10 hours. In comparison, the daily review of the admin panel in the "last activity" section takes less than a minute. Despite the time invested, the information received in a telephone conversation did not exceed its value beyond specifying the status of the patient. As part of the digital follow-up, 836 questionnaires were received concerning various aspects of the patient's condition, the administration of which by trained staff would take nearly 70 hours.

Of interest for future research is the attitude and evaluation of patients towards the mobile application and in-depth study of the difficulties they have encountered in its use. It is similarly intriguing how clinicians are attuned to digital technologies and

what advantages and disadvantages they consider when using them. Another scientific aspect that opens a wide field for further work is the testing of the possibilities for digital intervention.

The main shortcomings of the present study are the relatively small sample, which is still rather traditional for digital psychiatry trials. Apart from the limitations associated with the possession of personal smart devices and the ability of patients to handle them, another important factor is the technology itself. Using a not owned software determined our inability to influence the frequency and type of updates. On the other hand, the study would lose its value if there were large software differences between the participants in the study group. However, further studies including larger patient sample is required for confirming the results.

In the dissertation work for the first time the connection between aspects of digital behavior and the risk of recurrence is proved. Relapse is a major factor in the chronicity of surfactant addictions, with serious negative consequences for both the patient and the health system. Its timely identification would improve early intervention strategies. The efforts made so far to identify factors for unfavorable treatment outcome and subsequent stratification of patients have proven to be insufficiently certain. The method proposed in the dissertation for assessing the risk of recurrence is reliable and justified in terms of economic and staffing. Its routine application would also lead to a complete improvement of our knowledge of addictions in their nosological integrity.

6. *Summary*

In summary, the most important contribution of the present research is to prove the applicability of digital methods as a form of follow-up in patients with addictions, as well as the presence of digital relapse markers through a mobile application configured for active data collection as ecological momentary assessments and subsequent metadata analysis. According to the data from our study, the possession of personal smart devices and digital literacy among the Bulgarian population of patients with SUD is satisfactory and allows the implementation of digital methods, not taking into account the importance of age for their use. The results show that low commitment to the use of the application is indicative of relapse, and the informative value of sociodemographic and clinical characteristics such as symptoms of depression and anxiety are severely limited. To the best of our knowledge, this is the first study worldwide to use digital metadata to assess the risk of relapse in patients with substance use disorders. For Bulgaria this is the first study in the field of digital psychiatry. The derived predictive markers could serve as a way to purposefully identify patients at risk of relapse and develop crisis intervention strategies.

Early diagnosis and therapeutic intervention against relapse in patients with substance use disorders after inpatient treatment would reduce the share of rehospitalizations and would lead to improved health, personal and social functioning of the affected individuals. The introduction of digital methods could be a step towards reducing the time and human resources requirements for follow-up care for patients with mental illness. Moreover, the current epidemiological situation related to the COVID-19 pandemic favors the development of methods that allow the implementation of medical care in safe conditions, as guaranteed by the digital environment.

7. *Conclusions*

1. It was found that 61% of the screened hospitalized patients with substance use disorders have a personal smart device.
2. It was found that there is no statistically significant difference between the average age of those who own a personal smart device and those who does not.
3. A share of 23% of the screened patients did not prove a satisfactory digital literacy.
4. It was found that the preferred operating system among the studied population is Android (94.3%).
5. Relapse occurred in 75% of all followed-up patients.
6. There is no significant difference between the treatment outcome and the time to relapse between patients followed by conventional method and digital means.
7. It was found that the marital status is informative regarding the occurrence of relapse and the time to it, as divorced patients and those without a current partner are more vulnerable.
8. No statistically significant predictive value of socio-demographic factors such as sex, education and employment in relation to the occurrence of relapse and the time to it has been found.
9. There was no statistically significant predictive value of clinical factors such as symptoms of depression, anxiety and global assessment of relapse function and time to onset.

10. The following markers of digital behavior are associated with a higher risk of relapse and shortening of the time to its onset:
 - total amount of completed questionnaires
 - total days of activity
11. No association was found between the age of the participants in the digital tracking and their activity in the mobile application in terms of the total number of completed questionnaires and the length of the period of activity.
12. There was no correlation between the clinically administered PHQ-9 scale and the electronically reported depressive symptoms.
13. A trend towards a statistically significant correlation was established between the clinically administered GAD-7 scale and the electronically reported anxiety symptoms by the patient.
14. There was no statistically significant predictive value of the results and dynamics of electronically reported symptoms associated with depression, anxiety, sleep quality and craving.

8. *Contributions*

1. Theoretical contributions of original nature:
 - the smart device ownership and digital literacy among the Bulgarian population of patients with SUD were studied
 - applicable metadata was identified in the analysis of digital behavior in patients with SUD
2. Theoretical contributions of confirmatory nature:
 - the role of socio-demographic and clinical characteristics in the occurrence of relapse was assessed
3. Applied research contributions:
 - A mobile application for assessment and monitoring of symptoms related to mental illness was configured and put into use in Bulgarian.

9. Publications and participations in scientific forums related to the dissertation

Publications:

- 1. *Digital follow-up in patients with substance use disorders – pilot study assessing feasibility***

Krasteva S.

Journal: Bulgarian Journal of Psychiatry – accepted

Publisher: Bulgarian Psychiatric Association

Participations:

- 1. Poor digital engagement as a potential predictor for relapse in patients with substance use disorder.**

**Samuela Georgieva Krasteva, Zhivko Pavlinov
Apostolov, Hristo Vasilev Kozhuharov**

*2021 34th ECNP Congress Hybrid, 2-5 October 2021,
Lisbon, Portugal;*

Source: ePoster

10. Appendices

Appendix. 1 Diagnostic tool for assessment of depressive symptoms - Patient Health Questionnaire-9 in Bulgarian

ВЪПРОСНИК ЗА ЗДРАВЕТО НА ПАЦИЕНТА - 9 (PHQ-9)

Колко често през изминалите две седмици, сте бил (а) обезпокоен (а) от следните проблеми? (Използвайте "✓", за да означите своя отговор)	Повече от половината от дните			
	Нито веднъж	Няколко дни	Повече от половината от дните	Почти всеки ден
1. Слаб интерес или минимално удоволствие от правенето на различни неща	0	1	2	3
2. Чувство за потиснатост, депресия или отчаяние	0	1	2	3
3. Проблеми със съня: трудно заспиване, неспокоен сън или прекалено много сън	0	1	2	3
4. Чувство на умора или липса на енергия	0	1	2	3
5. Липса на апетит или прекомерно хранене	0	1	2	3
6. Отрицателно мнение за себе си или чувство, че сте неудачник, че сте разочаровали себе си или семейството си	0	1	2	3
7. Проблеми с концентрацията при извършването на различни дейности, като например четене на вестници или гледане на телевизия	0	1	2	3
8. Бавно движение или говор, което прави впечатление на останалите. Или обратното — безпокойство или неспособност да се спрете на едно място, което Ви кара да се движите наоколо много повече от обикновено	0	1	2	3
9. Мисли, че е по-добре да не сте жив (а) или желание да се нараните по някакъв начин	0	1	2	3

FOR OFFICE CODING 0 + _____ + _____ + _____
=Total Score: _____

Ако сте отбелязали никакви проблеми, доколко трудно Ви беше поради тези проблеми да се справяте с работата си, да се грижите за нещата у дома или да се разбирате с другите хора?

Въобще не ми беше трудно

Донякъде трудно

Много трудно

Изключително трудно

Appendix. 2 Diagnostic tool for assessment of anxiety symptoms – Generalized Anxiety Disorder-7 in Bulgarian

**ГЕНЕРАЛИЗИРАНО ТРЕВОЖНО
РАЗСТРОЙСТВО -7
(GAD-7)**

Колко често през изминалите две седмици, сте бил (а) обезпокоен (а) от следните проблеми? (Използвайте "✓", за да означите своя отговор)	Нито веднъж	Няколко дни	Повече от половината от дните	Почти всеки ден
1. Усещане за нервност, безпокойство, сякаш сте на ръба	0	1	2	3
2. Невъзможност да се преустанови или контролира тревогата	0	1	2	3
3. Прекомерна тревога относно различни неща	0	1	2	3
4. Невъзможност за релаксация	0	1	2	3
5. Усещане за напрегнатост до степен на непоседливост	0	1	2	3
6. Раздразнителност и лесна дразнимост	0	1	2	3
7. Страх, че нещо ужасно предстои да се случи	0	1	2	3

FOR OFFICE CODING 0 + + +
=Total Score:

Ако сте отбелязали някакви проблеми, доколко трудно Ви беше поради тези проблеми да се справяте с работата си, да се грижите за нещата у дома или да се разбирате с другите хора?

Въобще не ми беше трудно

Донякъде трудно

Много трудно

Изключително трудно

Appendix. 3 Diagnostic tool for assessment of global functioning – Global Assessment of Functioning in Bulgarian

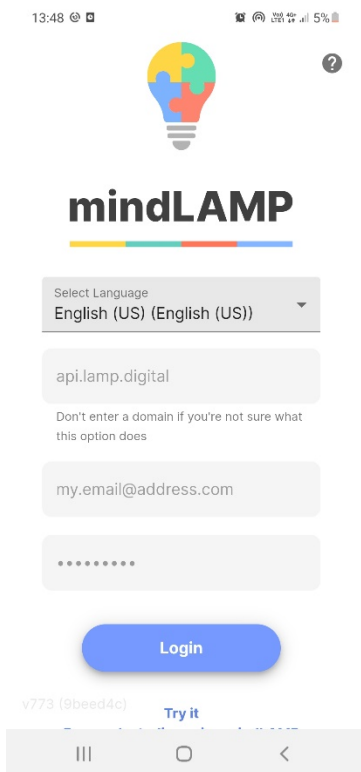
Глобална оценка на функционирането (GAF)

<p>91 – 100 Няма симптоми. Превъзходното функциониране в широк спектър от дейности, житейските проблеми никога не излизат извън контрол, се търси от другите поради многото му положителни качества.</p>
<p>81 – 90 Липсващи или минимални симптоми (напр. Лека тревожност преди изпит), добро функциониране във всички области, заинтересовани и ангажирани в широк спектър от дейности, социално ефективни, като цяло доволни от живота, не повече от ежедневни проблеми или притеснения.</p>
<p>71 – 80 Ако симптомите са налице, това са преходни и очаквани реакции на психосоциални стресови фактори (напр. Затруднена концентрация след семейни спорове); не повече от леко увреждане на социалното, професионалното или училищното функциониране (напр. временно изоставане в работата).</p>
<p>61 – 70 Някои леки симптоми (напр. Депресивно настроение и леко безсъние) <i>или</i> известна трудност в социалното, професионалното или училищното функциониране (напр. случайни пропуски или кражби в домакинството), но като цяло функционира доста добре, има значими междуличностни отношения.</p>
<p>51 – 60 Умерени симптоми (напр. Плосък афект и допълнителна реч, случайни пристъпи на паника) <i>или</i> умерена трудност при социално, професионално или училищно функциониране (напр. малко приятели, конфликти с връстници или колеги).</p>
<p>41 – 50 Сериозни симптоми (напр. Суицидни идеи, тежки обсесивни ритуали, чести кражби в магазини) <i>или</i> всяко сериозно увреждане на социалното, професионалното или училищното функциониране (напр. няма приятели, които не могат да запазят работа, не могат да работят).</p>
<p>31 – 40 Някои увреждания в реалното тестване или комуникация (например, речта понякога е нелогична, неясна или без значение) <i>или</i> сериозно увреждане в няколко области, като работа или училище, семейни отношения, преценка, мислене или настроение (напр. депресиран възрастен избягва приятели, пренебрегва семейството и не е в състояние да работи; детето често бие по-малки деца, предизвикателно е у дома, и се проваля в училище).</p>
<p>21 – 30 Поведението се влияе значително от заблуди или халюцинации <i>или</i> сериозно увреждане, в комуникацията или преценката (например, понякога непоследователно, действа крайно неподходящо, самоубийствена заетост) <i>или</i> невъзможност за функциониране в почти всички области (напр. оставане в леглото през целия ден, без работа, дом или приятели)</p>
<p>11 – 20 Опасност от нараняване на себе си или други (напр. Опити за самоубийство без ясно очакване на смърт; често насилие; маниакално вълнение) <i>или</i> от време на време не поддържа минимална лична хигиена (напр. намазва изпражненията) <i>или</i> грубо увреждане на комуникацията (напр. до голяма степен несъгласувано или няма).</p>
<p>1 – 10 Постоянна опасност от тежко нараняване на себе си или на другите (напр. Повтарящо се насилие) <i>или</i> постоянна неспособност да се поддържа минимална лична хигиена <i>или</i> сериозен самоубийствен акт с ясно очакване на смърт.</p>
<p>0 Неадекватна информация</p>

Appendix. 4 Telephone contact schedule for patients randomized in conventional follow-up arm

Ден 0	Ден 14	Ден 28	Ден 42	Ден 56	Ден 70	Ден 84
Клинична оценка	Телефонен контакт	Телефонен контакт	Телефонен контакт	Телефонен контакт	Телефонен контакт	Телефонен контакт

Appendix. 5. Login page of mindLAMP2 app



Appendix. 6. Main menu of mindLAMP2 app



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