

Polydrug Addiction: Multidisciplinary Forensic and Pharmaceutical, Organizational and Legal, and Technological Study of Factors of Formation and Development

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Abstract. Multidisciplinary forensic and pharmaceutical, organizational and legal, and technological study of alcohol-containing liquids as factors in the formation and development of polydrug addiction among the public population of Ukraine was conducted. Determined that the combined intake of several psychoactive substances leads to the formation and development of new variants of polydrug addiction. Noted that among psychoactive substances, the main factors in the formation and development of polydrug addiction are liquids containing ethyl alcohol. Classification and stages of circulation of psychoactive alcohol-containing liquids were proposed. The formation and development of polydrug addiction because of the combined use of psychoactive alcohol-containing liquids in the order of increasing strength was systematized. The factors of the development and spread of polydrug addiction from the

position of forensic pharmacy, organization and management of pharmacy, drug technology, marketing, management, health care, and narcology were provided. Focused attention that among the factors of the formation and development of polydrug addiction, the combined, consecutive, or simultaneous use of psychoactive substances of different classification and legal groups (psychoactive substances in the composition of medicines, narcotic drugs, psychotropic substances, etc.) and psychoactive alcohol-containing liquids (alcoholic drinks of I and III levels of ethanol strength; psychoactive alcohol drugs of I-III levels of ethanol strength).

Keywords: polydrug addiction, forensic pharmacy, organization and economics of pharmacy, psychoactive substances, alcohol-containing liquids, psychoactive alcohol drugs, alcoholic beverages.

Introduction. The World Health Organization emphasizes the problem of public health security due to the spread of polydrug addiction. Polydrug addiction is formed with the simultaneous use of psychoactive substances of different classification and legal groups. Psychoactive substances include psychoactive drugs, narcotic drugs, psychotropic substances, alcohol-containing liquids, and alcoholic beverages. Polydrug addiction is widespread on the background of infectious (COVID-19, monkeypox virus, etc.) and comorbid (psychiatric, narcological, cardiology, gastroenterological, HIV/AIDS, etc.) diseases in accordance with ICD-10 and the updated edition of ICD-11 [1-15].

Among psychoactive substances, the most common among adolescents are alcoholic beverages – beer, which is consumed daily by about 1% of 12-13-year-old children, which acts as a provoking factor in the initial stages of the formation of polydrug addiction [16, 17].

The issues of the organization of pharmaceutical business, drug technology and forensic pharmacy to increase the level of medical care and pharmaceutical support for patients were covered in the publications of: Shapovalova V.O., Trachtenberg I.M., Stefanov O.V., Sosin I.K., Gromovyk B.P., Ponomarenko M.S., Tolochko V.M., Trokhymchuk V.V., Volokh D.S., Shapovalov V.V. and others.

The problem of pharmaceutical correction of addictive disorders (narcotics, alcohol, etc.) with a combined diagnosis (comorbid, polymorbid, concomitant diseases) in different periods were devoted to the works of domestic and foreign scientists: Trachtenberg I.M., Stefanov O.V., Lynskii I.V., Voloshyn P.V., Minko O.I., Sosin I.K., Shapovalova V.O., Chuiev Yu.F., Shapovalov V.V., Haiduchok I.G., Anderson P., Bouman W.P., Chapman M. and others.

Criminal and law aspects of combating offenses committed by persons under the influence of psychoactive substances were highlighted in the works of: Shapovalova V.V., Tatsii V.I., Hetman A.P., Shepitko V.I. etc.

It were Doctor of Pharmaceutical Sciences, Prof. Shapovalova V.O., Doctor of Pharmaceutical Sciences, Prof., advocate Shapovalov V.V. (Jr.), Police Colonel Shapovalov V.V., State Adviser of the 3rd cl. Galatsan O.V., Police Colonel Khalin M.M., Police Major General Petrenko S.L., Police Colonel Galavan Z.S., Police Colonel Nikonov M.M., Advocate Abrosymov O.S., Judge Bondarenko V.V., Colonel of the Tax Service Danilyuk O.V. who proposed to conduct an interdisciplinary and multidisciplinary study of the problem of polydrug addiction in the system of legal relations "doctor-patient-pharmacist-advocate" in the light of the organization of the pharmaceutical business, drug technology, forensic pharmacy, forensic medicine, forensic psychiatry, forensic narcology, medical and pharmaceutical law, medical chemistry, organization of health care, criminal and legal, social and economic, medical and pharmaceutical disciplines [18-43].

At the same time, comprehensive studies on the factors of the formation and development of polydrug addiction based on forensic pharmacy have not been conducted in Ukraine until now. Therefore, it has become relevant to research this type of polydrug addiction, such as the combined use of psychoactive substances of different classification and legal groups with alcohol preparations, alcohol-containing liquids, and alcoholic beverages.

The purpose of the study was to conduct a multidisciplinary forensic and pharmaceutical, organizational and legal, and technological study of alcohol-containing liquids as factors in the formation and development of polydrug addiction among the public population of Ukraine.

Materials and methods. The review of scientific sources of the world's leading scientists on the formation, development and spread of polydrug addiction was conducted.

More than 200 scientific sources on the topic of the work were used. The forensic and pharmaceutical practice of polydrug addiction (more than 30 cases) was analyzed. Systematized psychoactive alcohol-containing liquids (more than 50), psychoactive alcohol preparations (more than 70), psychoactive combined preparations (more than 80), alcoholic beverages (more than 100).

To achieve this goal, the methods of normative and legal, documentary, comparative, graphical and tabular analysis were used.

The research of the article is a fragment of research works of Kharkiv Medical Academy of Postgraduate Education on "Improving the organizational and legal procedure for providing patients with drugs from the standpoint of forensic pharmacy, organization and management of pharmacy" (state registration number 0116U003137, terms 2016-2020) and "Pharmaceutical and medical law: integrated approaches to the system of drug circulation from the standpoint of forensic pharmacy and organization of pharmaceutical business" (state registration number D/21U000031, terms 2021-2026).

Results and discussion. Established that the main factors in the formation of polydrug addiction among some categories of the population are the abuse of psychoactive substances. Psychoactive substances can be in legal or illegal circulation. Psychoactive substances can be used without a doctor's prescription [44].

According to WHO terminology, psychoactive substances include substances that cause addiction, pathological habituation, have a stimulating or depressant effect on the nervous system, cause mental (hallucinations, impaired thinking, perception, behavior, etc.) and behavioral (impaired motor activity, ability to control mechanisms, etc.) disorders [45-47].

The combined intake of several psychoactive substances leads to the formation and development of new variants of polydrug addiction. Mental and behavioral health disorders in persons with polydrug addiction are more pronounced than in monodependence. Polydrug addiction is characterized by the rate of progression (speed of development) of the disease. The transition of patients to the search for new combinations of the use of two or more psychoactive substances may be since the previously known methods of combination and modification ceased to give the desired euphoric, narcotic, and pain-relieving effects [48, 49].

We present examples No. 1-4 from forensic and pharmaceutical practice according to the topic of the article.

Example 1. Police officers of the National Police of Ukraine in Poltava region entered the fact that on November 11, 2017, three minors were taken to the district hospital with poisoning in the Unified Register of Pretrial Investigations [50, 51]. Teenagers aged 13-15 used alcohol, energy drinks and pills of unknown origin. Later, it was established that ninth-graders from a local school were admitted to the hospital. All three were admitted to the intensive care unit of a local health care institution with drug poisoning by the drug "Clozapine". Currently, the health status of the patients is of medium severity.

The drug "Clozapine" (INN – Clozapine; analogue – azaleptin) belongs to the clinical and pharmacological group of antipsychotic drugs [52]. ATC code N05AH02. Indicated for schizophrenia, psychosis, Parkinson's disease. It has contraindications: hypersensitivity to clozapine, granulocytopenia, bone marrow dysfunction, myasthenia gravis, comatose states, toxic psychosis (including alcoholic), diseases of the cardiovascular system, liver and kidney failure, glaucoma, drug intoxication; pregnancy, etc.

Clozapine side effects. From the blood side: leukopenia, neutropenia, eosinophilia, leukocytosis, etc. Metabolic and digestive disorders: weight gain, diabetes, etc. Mental disorders: restlessness, excitement. From the side of the nervous system: drowsiness, sedative effect, dizziness, headache, tremor, etc. Vascular disorders: hypertension, hypotension, etc. Respiratory disorders: food aspiration, respiratory depression. Gastrointestinal disorders: constipation, nausea, vomiting, etc. Hepatobiliary disorders: hepatitis, pancreatitis, etc. From the side of the kidneys and urinary system: urinary incontinence, delay in urination. Clozapine overdose has the following symptoms: drowsiness, hallucinations, excitement, delirium, convulsions, collapse, tachycardia, cardiac arrhythmia, etc. Nomenclature and legal group of Clozapine – according to a doctor's prescription. Clozapine has pronounced psychoactive properties.

Example 2. National Police of Ukraine in the Poltava region opened criminal proceedings on the fact of poisoning of three citizens [50]. Established that on November 11, 2017, three people died in the village of Z. after consuming an unknown alcoholic beverage. After drinking, the persons went to their homes: the 1st woman died at home; 2nd woman died near the landfill; the man reached the house, he had time to call an ambulance, but soon he died in the intensive care unit of the district hospital. Forensic doctors are currently determining the cause of death and the composition of the poisonous substance.

Example 3. National Police of Ukraine in Cherkasy region reported the poisoning of two schoolgirls who took 10 tablets of a medical drug [53]. It was established that on February 18, 2021, in the city of U., two girls got drunk on No-shpa tablets. The drug was purchased at a pharmacy. Girls wanted to attract the attention of their loved ones, there were misunderstandings with loved ones (quarrels arise) and problems with boyfriends.

Example 4. During the urgent investigation of the tragic incident regarding the poisoning of two girls, it was established that on February 16, 2021, two 7th-grade students consumed unknown substances and poisoned themselves at the academic lyceum in the city of Kyiv, Kyiv region. One girl died, the other schoolgirl is in a medium-stable condition in the hospital [54, 55]. The mentioned cases created a great resonance, the Internet and mass media immediately spread across social networks.

A similar story happened in the city of U. in Cherkasy region with two eighth graders who drank the same pills but survived. This raises suspicions that schoolgirls in different regions of Ukraine watched the same video on the TikTok network.

Later, the police reconstructed the approximate course of events. It was established that during the break, two seventh-grader friends went to a pharmacy located near the lyceum, where they bought an analog drug "No-shpa" (No-spalgin) without a doctor's prescription. They returned to school and drank 40 pills of the drug during the break. Doctors could not save one girl. She was 13 years old. Another, 12 years old, is still in the hospital [56].

So far, the police have identified pharmacists who confessed to selling the drug to children. Considering that the drug the girls drank can be purchased without a prescription, the investigators sent letters to the State Medical Service regarding the legality of the sale of drugs to children and to the Department of Health of the Kyiv Regional State Administration to prevent such violations in the future.

The president's commissioner for children's rights responded to the tragedy on the same day and called on parents to be aware of the dangers and games spread on the Internet. Children may not understand the consequences of their actions, may consider entertainment that leads to catastrophic consequences [57].

Quarrels with relatives, bullying by classmates or in social networks are among the reasons for suicide attempts among children [58].

The Ministry of Social Policy, the Ministry of Education and Science, the Ministry of Health, as well as the National Police must take measures to prevent tragic events and early detection of families in difficult life circumstances.

For example, the Minister of Education and Science reported that the Ministry of Education and Science of Ukraine is developing mechanisms to combat violence and suicides in schools together with the Minister of Internal Affairs of Ukraine [59, 60]. According to him, a police officer was assigned to each school to ensure security. In addition, together with the Ministry of Internal Affairs and the National Police, a memorandum is being prepared, which will provide for the work of the juvenile police. The police are considered as a partner, as a defender of the rights and freedoms of all participants in the educational process against aggressive manifestations and outbreaks of hidden aggression.

Educational courses for children and parents regarding social networks will appear in Ukraine, as well as strengthen communication on the issue of children's behavior in these networks. This topic was chosen to address the disparities revealed by the COVID-19 pandemic and its impact on the mental health of people worldwide [61]. It is estimated that both anxiety and depressive disorders increased by more than 25% during the first year of the pandemic. Marginalized groups and individuals particularly feel mental health impacts due to existing health and social inequalities, as evidenced by several studies. These findings call for urgent global action to prioritize mental health and address inequitable social determinants. Accessible and affordable mental health services must be provided at the community level so that no one is left behind. Similarly, countries around the world need to increase investment to ensure access to mental health care for everyone and raise awareness against stigma and discrimination surrounding mental health.

Note that among psychoactive substances, the main factors in the formation and development of polydrug addiction are liquids containing ethyl alcohol. Psychoactive alcohol-containing liquids and their combinations with simultaneous use: alcoholic beverages, beer, psychoactive alcoholic preparations, preparations with psychoactive narcotic, psychotropic substances. According to WHO terminology, ethyl alcohol belongs to psychoactive substances, it is used to produce various medicinal forms of drugs, alcoholic preparations, as well as in the production of low-alcohol and strong alcoholic beverages [62-72].

Further, the classification (Fig. 1) and stages of circulation (Fig. 2) of psychoactive alcohol-containing liquids were proposed.

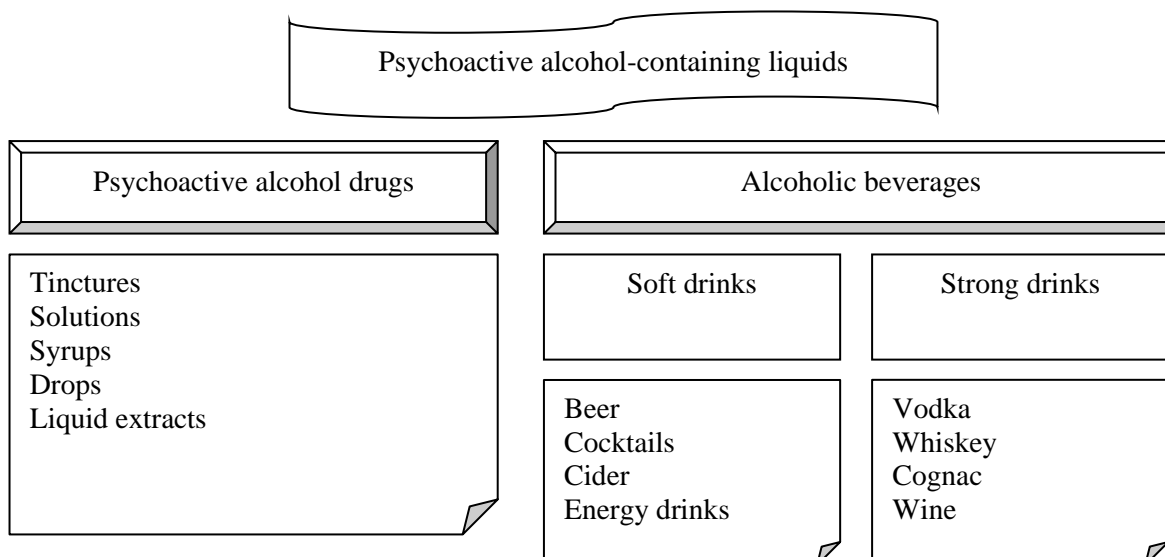


Fig. 1. Classification of psychoactive alcohol-containing liquids (*source: own development*).

The classification of psychoactive alcohol-containing liquids (Fig. 1) includes 2 groups of psychoactive substances: psychoactive alcohol preparations and alcoholic beverages. Examples of dosage forms for psychoactive alcohol preparations: tinctures, solutions, syrups, drops, liquid extracts. Alcoholic drinks are divided into low-alcohol (beer, cocktails, cider, energy drinks) and strong (vodka, whiskey, cognac, wine) drinks of different alcohol strengths. The circulation of psychoactive alcohol-containing liquids consists of 9 stages (Fig. 2).

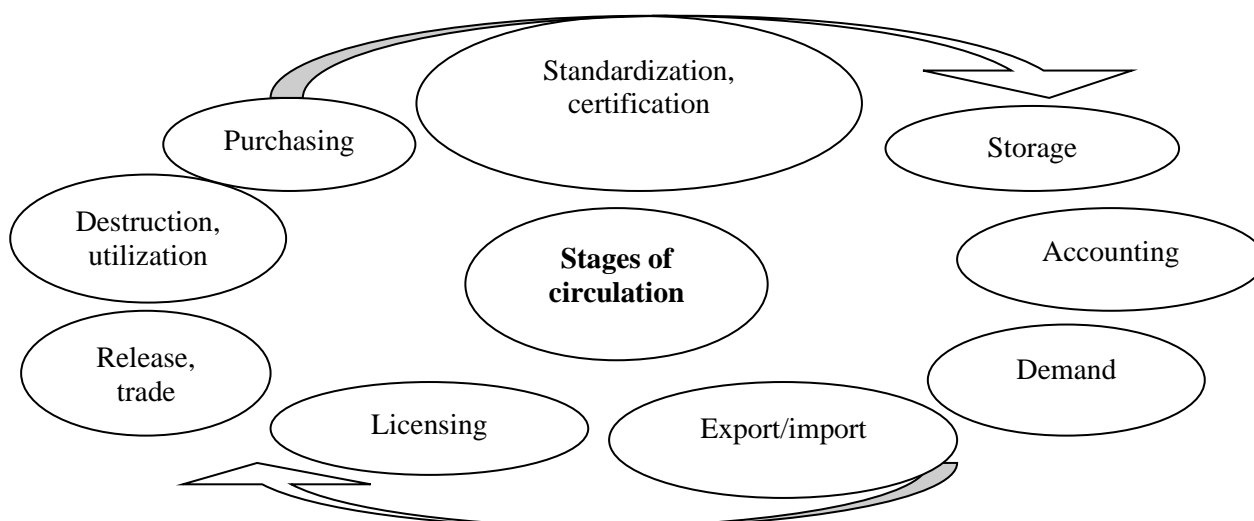


Fig. 2. Stages of circulation of psychoactive alcohol-containing liquids (*source: own development*).

In the future, the systematization of sequential addiction in the formation and development of polydrug addiction due to the combined use of psychoactive alcohol-containing liquids in the order of increasing strength: alcoholic beverages, beer, psychoactive alcoholic preparations (tinctures), psychoactive combined preparations (codefemol) and psychoactive substances – narcotic drugs (marijuana), psychotropic substances (amphetamines), precursors (volatile solvents), tobacco (Fig. 3).

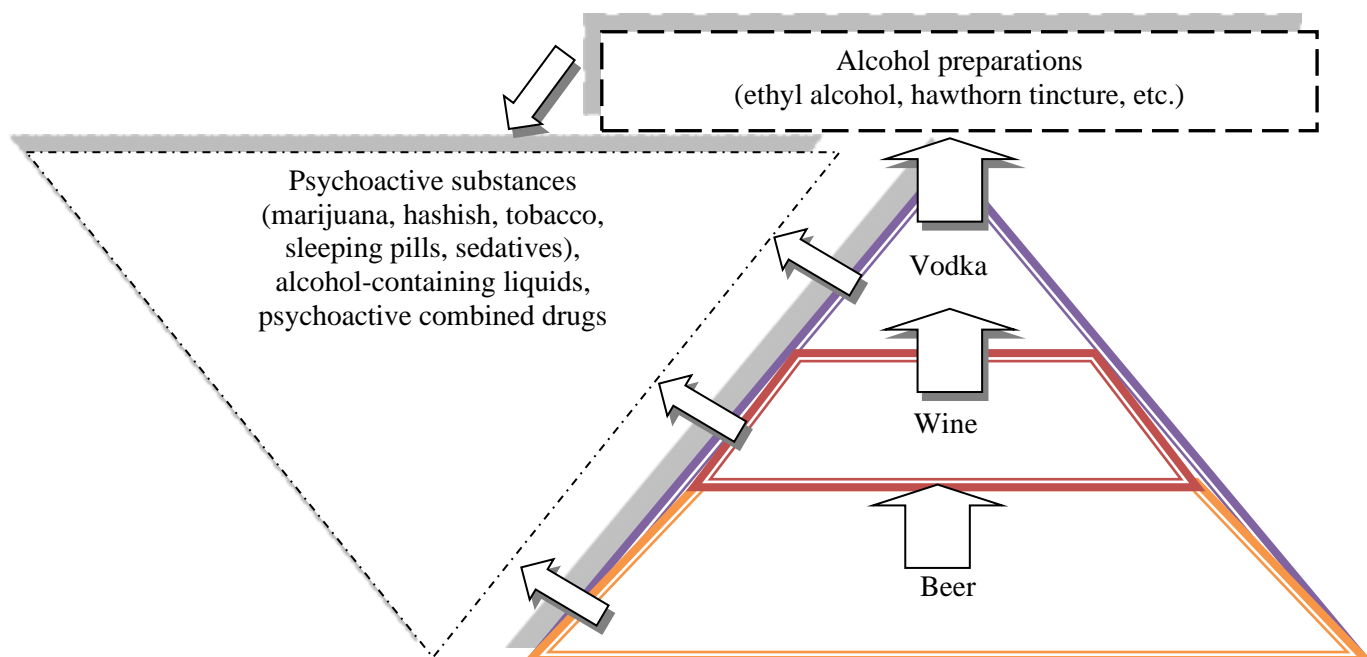


Fig. 3. Typical scheme of sequential addiction in the formation and development of polydrug addiction (*source: own development*).

The analysis of the sources of scientific literature proved that a typical sequential addiction to alcohol-containing liquids occurs because of drinking beer with a subsequent increase in the strength of alcohol-containing liquids to achieve a euphoric effect (wine, vodka, alcoholic preparations). Also, to find new sensations from narcotization, individuals begin to combine the use of psychoactive substances of various classification and legal groups (tobacco, narcotic drugs, psychotropic substances, volatile solvents, psychoactive combined drugs) with other alcohol-containing liquids.

In the future, alcoholic beverages (Fig. 4), psychoactive alcoholic preparations (Fig. 5) and psychoactive alcohol-containing liquids (Fig. 7) were systematized according to the levels of ethanol strength.

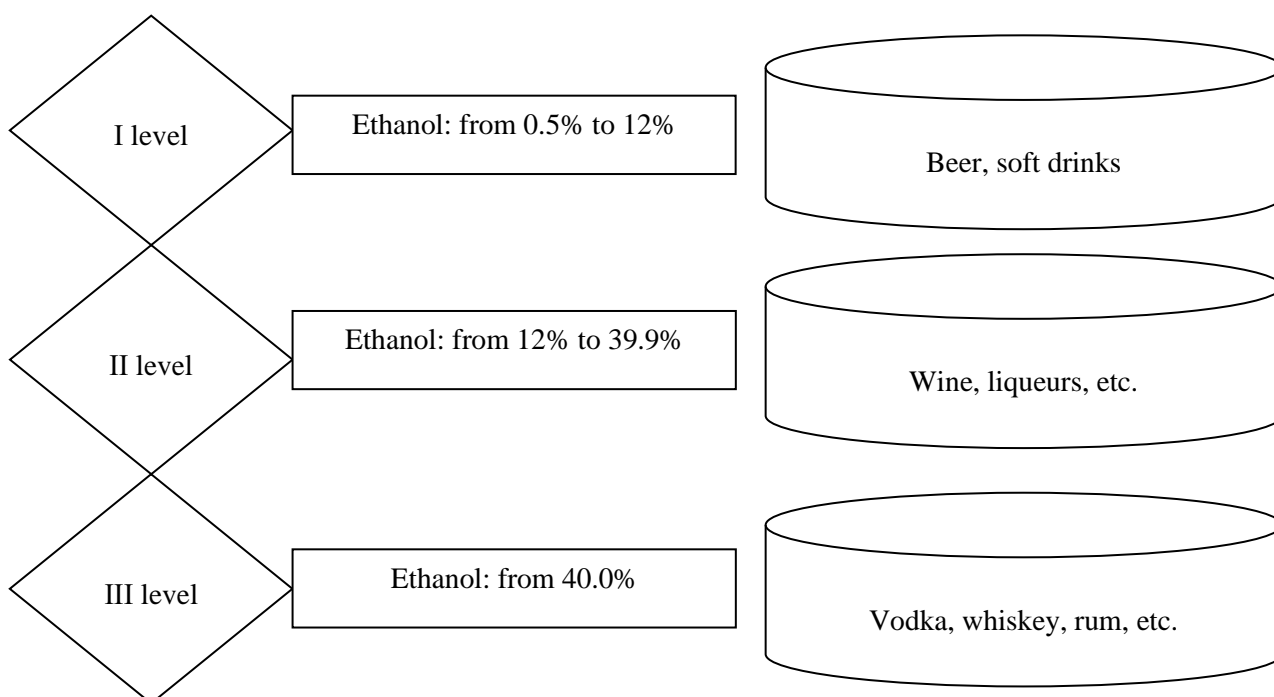


Fig. 4. Systematization of alcoholic beverages by levels of ethanol strength (*source: own development*).

Shown that psychoactive alcohol preparations according to the levels of strength of ethanol in medicinal forms (Fig. 5) exist in I, II and III levels. Drops and solutions of psychoactive alcoholic preparations can be of the 1st level of strength, containing ethanol in a concentration of 0.5% to 39.9%, as well as of the 3rd level of strength – with ethanol in a concentration of 70.0%; similarly for medicinal forms, tinctures, and balms – at the II strength level contain ethanol in a concentration from 40.0% to 69.9% and at the III strength level – from 70.0%.

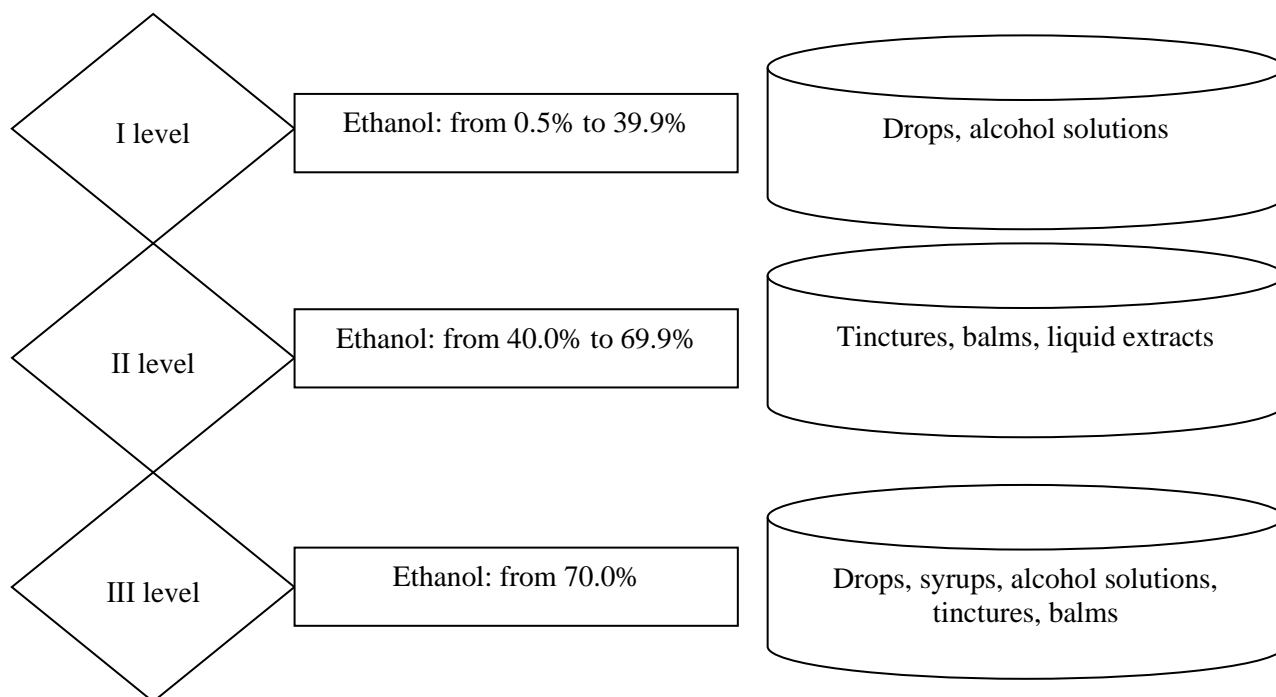


Fig. 5. Systematization of psychoactive alcoholic preparations by ethanol strength levels (*source: own development*).

The distribution of psychoactive alcoholic preparations by ethanol strength shown on Fig. 6.

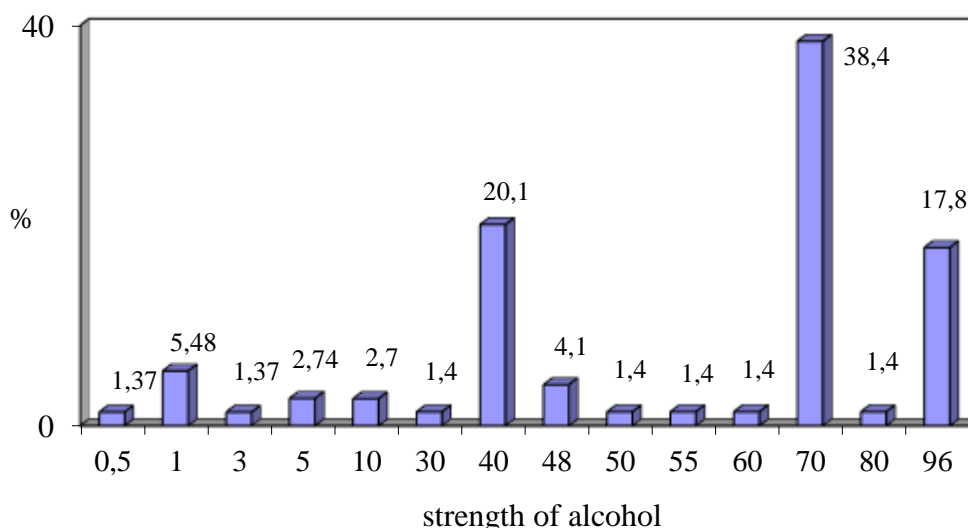


Fig. 6. Distribution of psychoactive alcoholic preparations by ethanol strength (*source: own development*).

The distribution of psychoactive alcoholic preparations by ethanol strength (Fig. 6) showed that ethyl alcohol with a strength of 70% (38.4%) is used most in the pharmaceutical market of Ukraine, ethanol with a strength of 40% (20.1%) is in the second place, and the third place – 96%

alcohol with 17.8%.

In the future, psychoactive alcohol-containing liquids were systematized according to the levels of ethanol strength, which are grouped into I, II, and III levels (Fig. 7).

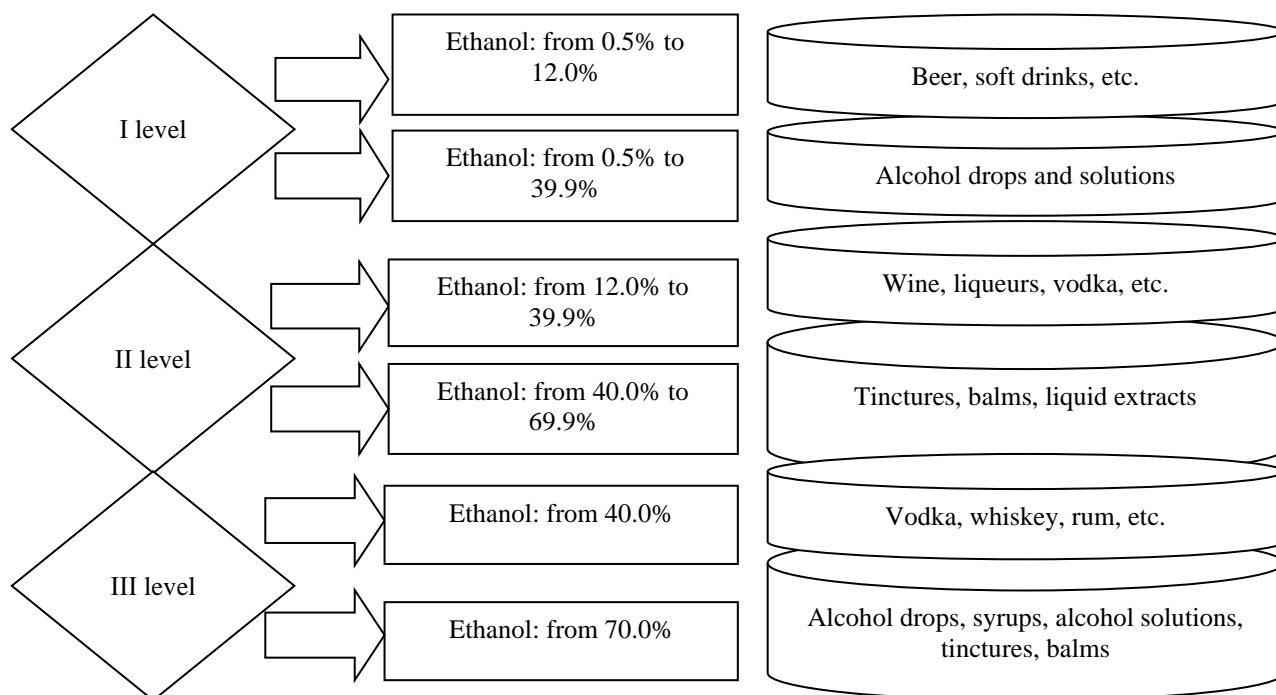


Fig. 7. Systematization of psychoactive alcohol-containing liquids by ethanol strength levels (*source: own development*).

The systematization of psychoactive alcohol-containing liquids according to the levels of ethanol strength showed that ethyl alcohol of the III level in alcoholic beverages is from 45.4%, and in psychoactive alcoholic preparations – from 70.0%. Psychoactive alcohol-containing liquids of the III level of ethanol strength have a wide range: alcoholic beverages (vodka, whiskey, rum); psychoactive alcohol preparations (drops, syrup, solution, tincture, balm).

It should also be noted that psychoactive alcohol-containing liquids of the 1st strength level are no less widespread on the Ukrainian market due to their greater availability at a price. Ethyl alcohol with a strength of up to 12.0% is used in beer and soft drinks. Ethyl alcohol of strength levels I-III is added to all dosage forms of alcoholic preparations (tincture, solution, drops).

Simultaneous or consecutive use of psychoactive substances of different classification and legal groups and psychoactive alcohol-containing liquids, alcoholic beverages, alcoholic preparations can provoke the formation of polydrug addiction (Fig. 8).

Within the framework of the study, the factors of the development of polydrug addiction were determined from the perspective of forensic pharmacy. It is noted about the compatible, consecutive, or simultaneous use of psychoactive substances of different classification and legal groups and psychoactive alcohol-containing liquids.

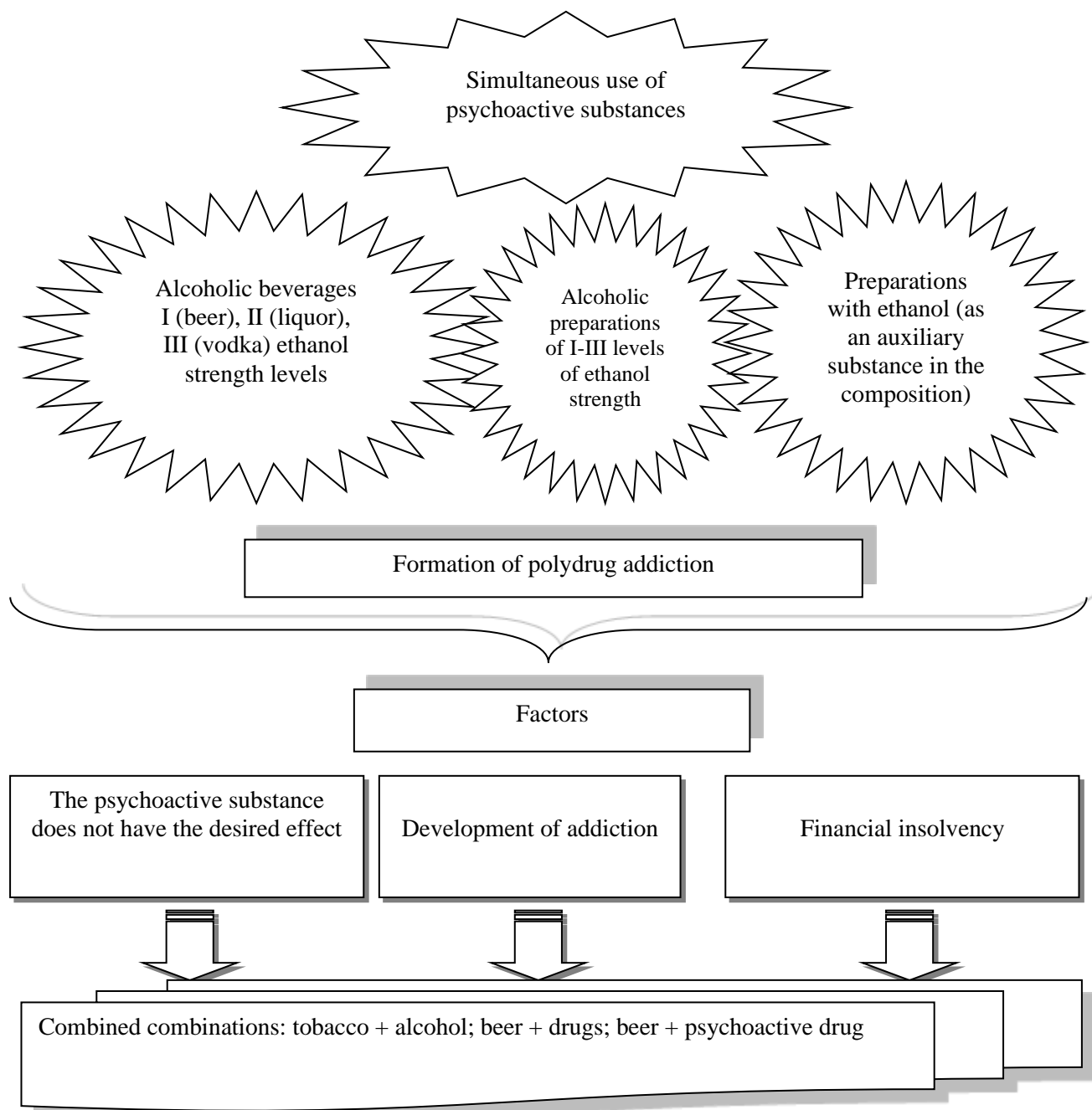


Fig. 8. Factors in the formation of polydrug addiction from the perspective of forensic pharmacy (source: own development).

Conclusions. A multidisciplinary forensic and pharmaceutical, organizational and legal, and technological study of the factors of the formation and development of polydrug addiction was conducted. Forensic and pharmaceutical practice regarding the consequences of the use of psychoactive alcohol-containing liquids and psychoactive drugs has been systematized. Classification and stages of circulation of psychoactive alcohol-containing liquids are proposed. A typical scheme of sequential addiction in the formation and development of polydrug addiction has been developed. Alcoholic beverages, psychoactive alcoholic preparations and psychoactive alcohol-containing liquids are systematized by ethanol strength levels. Distribution of psychoactive alcoholic preparations by ethanol strength on the pharmaceutical market of Ukraine: ethyl alcohol with a strength of 70% (38.4%); ethanol strength 40% (20.1%); 96% alcohol with 17.8%. Determined that the combined intake of several psychoactive substances leads to the formation and development of

new variants of polydrug addiction. The factors of the formation of polydrug addiction are formulated from the standpoint of forensic pharmacy. Noted that among psychoactive substances, the main factors in the formation and development of polydrug addiction are liquids containing ethyl alcohol, i.e., psychoactive alcohol-containing liquids and their combination when used simultaneously. The factors of the development and spread of polydrug addiction are provided from the perspective of forensic pharmacy and pharmaceutical law. Among the factors of the formation and development of polydrug addiction, the combined, consecutive, or simultaneous use of psychoactive substances in the composition of drugs, narcotic drugs, psychotropic substances, and psychoactive alcohol-containing liquids is indicated. Further research is aimed at summarizing typical cases from forensic pharmaceutical practice regarding the criminal, administrative, medical and social consequences of polydrug addiction.

Conflict of interest. The author declares that he is the sole author of this work and has approved it for publication. The author certifies that the research was conducted in the absence of any commercial or financial relationships that could be interpreted as a potential conflict of interest.

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