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# CHALLENGES OF MEDICAL AND PHARMACEUTICAL ASPECTS: DEVELOPMENTS, INTERDISCIPLINARY APPROACH, RESEARCH AND CLINICAL APPLICATIONS

Collective monograph

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### 1.1.1 Concept and Classification of Chemical Addictions in Contemporary Psychological Science

Chemical addiction is characterized by an all-consuming preoccupation with a substance, intoxication, tolerance, withdrawal, and, most importantly, significant impairment in social and occupational functioning as a result of substance use. One of the main challenges in developing empirically based treatments for these disorders is that, despite existing agreed-upon diagnostic criteria, there remains considerable conceptual confusion surrounding the terms “dependence,” “addiction,” and “substance abuse.” This conceptual ambiguity contributes to difficulties in establishing a firm and reliable diagnosis of chemical dependence, even among well-trained specialists. Nevertheless, despite ongoing uncertainty regarding what constitutes abuse versus dependence, clinicians frequently encounter patients whose substance use severely impairs their ability to function. The most common substance addictions encountered in psychiatric practice include dependence on opiates, stimulants (e.g., cocaine and amphetamines), and alcohol [1-3].

Addictive behavior refers to a behavior or behavior-related stimulus (e.g., sex or eating) that is both rewarding and reinforcing and is associated with the development of dependence. There are two main forms of addiction: substance-related disorders (including alcohol, tobacco, and cannabis use disorders) and behavioral addictions (including sex, gambling, eating, and shoplifting). The similarities and differences between behavioral addictions and other compulsive behavioral disorders, such as bulimia nervosa and obsessive-compulsive disorder (OCD), are still being investigated by behavioral scientists [4].

Defining addictive behavior is challenging because the concept encompasses a wide range of behaviors and its usage remains controversial. While a central element

of the definition is excessive dependence on a particular substance or activity, the term itself is derived from the Latin meaning “to enslave.” Furthermore, addictive behavior describes patterns characterized by loss of control and a compulsive pursuit of reward despite severe consequences. It is often manifested in compulsive engagement, prioritization of short-term gratification over long-term consequences, and a progression from impulsivity to compulsivity. As a result, addictive behavior represents a spectrum of actions that entrap individuals in repetitive patterns despite negative consequences, reflecting the metaphorical “enslavement” inherent in the concept of addiction [5].

Advances in research continue to reshape the understanding of addiction. Traditionally, addiction was primarily associated with substance use disorders, including alcohol and heroin use, and therefore non-substance-related (behavioral) addictions were not included in major international diagnostic manuals of mental disorders. However, contemporary research suggests that any stimulus capable of producing pleasure may potentially lead to addiction. This shift expands the scope of addiction to include excessive shopping, internet use, computer gaming, gambling, and sexual behavior. Both substance-related and behavioral addictive behaviors are often accompanied by deficits in inhibitory control, emotional regulation, and decision-making. Diagnostic symptoms of substance use disorders and behavioral addictions largely overlap, including dominance over one’s life, euphoric experiences, withdrawal symptoms, interpersonal conflicts, and risk of relapse despite negative consequences [6-8].

From a neurobiological perspective, behavioral addiction can affect brain neurotransmitter systems in a manner similar to pharmacological substances, particularly the dopamine system. These behaviors often follow a three-stage cycle consisting of anticipation, intoxication, and withdrawal, with reinforcement playing a central role at each stage. Reinforcement occurs through positive experiences during initial engagement, negative reinforcement through the alleviation of withdrawal symptoms, and conditioned reinforcement, when cues associated with the behavior or substance trigger intense craving, thereby sustaining addictive behavior [9, 10].

Addiction is defined by the American Society of Addiction Medicine (ASAM) as a chronic brain disorder. There are several reasons why addiction develops in individuals. The propensity for substance dependence may be inherited, indicating a genetic predisposition. Another contributing factor is the environment, including the home setting, peer influence, and family attitudes toward substance use. Mental health issues also play a significant role: more than 50% of individuals with substance use disorders have experienced mental health problems at some point in their lives. Even moderate substance use may exacerbate pre-existing mental health conditions. Another perspective is based on moral reasoning, according to which addictive behavior is viewed as a conscious and voluntary choice made by the individual [11].

Addiction is a neuropsychological disorder characterized by a persistent and intense craving to consume a substance or engage in rewarding behavior despite significant harm and other negative consequences. Repeated drug use can alter synaptic functioning in brain reward pathways similar to natural sources of pleasure such as food or romantic attachment, thereby strengthening craving and weakening self-control in individuals with preexisting vulnerabilities. This phenomenon—the alteration of brain function under the influence of psychoactive substances—has led to the conceptualization of addiction as a brain disorder shaped by a combination of psychosocial and neurobiological factors. Although laboratory studies on animals (e.g., cocaine administration in mice) demonstrate compulsive and involuntary patterns of addiction, in humans the phenomenon is considerably more complex and closely related to behavioral and personality characteristics [12].

Classical features of addiction include compulsive engagement in rewarding stimuli, preoccupation with substances or behaviors, and continued use despite negative consequences. Addiction-related habits and patterns are typically characterized by immediate gratification (short-term reward) combined with delayed harmful consequences (long-term costs) [2].

Examples of substance addictions include alcoholism, cannabis dependence, amphetamine dependence, cocaine dependence, nicotine dependence, opioid dependence, as well as food or eating addiction. Behavioral addictions may include

gambling addiction, shopping addiction, stalking, pornography addiction, internet addiction, social media addiction, video gaming addiction, and sex addiction. DSM-5 and ICD-10 recognize only gambling disorder as a behavioral addiction; however, ICD-11 additionally recognizes gaming disorder [6].

**Signs and symptoms of addiction may vary depending on the type of addiction and include:**

- Continued substance use despite awareness of its consequences
- Neglect of financial responsibilities in order to obtain substances
- Ensuring a stable supply of drugs or substances
- Increasing need for larger amounts over time to achieve the same effect
- Impact on social and occupational functioning
- Unsuccessful attempts to quit use
- Persistent craving for the substance

Other signs and symptoms can be categorized as follows:

- Behavioral changes
- Physical changes
- Irritability, anger, and frequent or sudden mood swings
- Changes in eating and sleeping patterns
- Changes in attitudes toward life circumstances
- Reduced attendance and productivity at work or school
- Fear, paranoia, and anxiety without clear cause
- Frequent conflicts (fights, illegal activities)
- Concealment or denial of certain behaviors
- Lack of motivation
- Periodic hyperactivity
- Substance use in inappropriate settings
- Abnormal pupil size
- Red eyes
- Unpleasant body odor
- Impaired motor coordination

- Tremors
- Poor personal appearance
- Slurred speech
- Sudden weight changes
- Changes in hobbies (loss of interest in previous activities)
- Financial difficulties (unexplained need for money)
- Legal problems related to substance use
- Sudden changes in social circle and peer group [6].

Drugs are psychoactive substances that, with repeated use, are associated with significantly higher rates of substance use disorders, largely due to their effects on the brain's reward systems.

**Key Concepts and Terms of Addictive Behavior and Psychoactive Substance Dependence**

- **Dependence** – an adaptive state associated with withdrawal syndrome following the cessation of repeated exposure to a stimulus (e.g., drug use).
- **Drug sensitization or reverse tolerance** – an escalation of drug effects resulting from repeated administration of a given dose.
- **Withdrawal syndrome** – a set of symptoms that occur after the cessation of repeated drug use.
- **Physical dependence** – a form of dependence resulting from the body's adaptation to regular use of a chemical substance (e.g., drugs, alcohol, nicotine) and may be accompanied by physical and somatic withdrawal symptoms (e.g., delirium tremens, nausea).
- **Psychological dependence** – a form of dependence characterized by emotional and motivational withdrawal symptoms (e.g., anhedonia and anxiety) that affect cognitive functioning.
- **Reinforcing stimuli** – stimuli that increase the likelihood of repetition of associated behavioral responses.
- **Rewarding stimuli** – stimuli that the brain interprets as intrinsically positive and desirable, or as something to be sought.

- **Sensitization** – an enhanced response to a stimulus resulting from repeated exposure.
- **Substance use disorder** – a condition in which the use of psychoactive substances leads to clinically and functionally significant impairment or distress.
- **Drug tolerance** – a reduction in the effect of a drug due to repeated administration at a given dose, leading to an increased need for higher doses [1, 6-9].

According to the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition), the term "drug addiction" is no longer recommended for use in clinical and scientific practice due to its lack of precise operationalization, conceptual ambiguity, and potentially stigmatizing nature. Instead, a unified diagnostic construct—"substance use disorders"—has been introduced, covering a broad spectrum of clinical conditions ranging from mild and moderate to severe chronic relapsing forms.

This approach is based on a continuum model of disorder, according to which problematic substance use is not viewed as a dichotomous condition ("addicted vs. not addicted") but rather as a continuous spectrum of impairments involving cognitive, behavioral, and physiological components. Core diagnostic criteria include impaired control over use, craving, development of tolerance, withdrawal symptoms, and significant impairment in social, occupational, or academic functioning.

The use of the term "substance use disorder" also helps reduce stigma, emphasizing the clinical nature of these conditions as medical disorders rather than moral or behavioral deviance. This aligns with contemporary biopsychosocial models of addiction, which conceptualize it as the result of complex interactions among biological, psychological, and social factors and emphasize the need for comprehensive treatment and prevention approaches [10].

Substance use disorder is a chronic, relapsing brain disorder characterized by drug-seeking and compulsive use despite harmful consequences. This form of addiction alters brain functioning by disrupting the reward system and affecting stress regulation and self-control. Damage to these neural systems may persist throughout life and can lead to death if left untreated. Substances that cause addiction include

alcohol, nicotine, marijuana, opioids, cocaine, amphetamines, and even high-fat and high-sugar foods. Addiction may begin experimentally in social contexts and may also develop as a result of prescribed medications or other behaviors [7].

It has been demonstrated that addiction can be explained through phenomenological, conditioning (operant and classical), cognitive, and cue-reactivity models. However, no single model fully captures substance abuse behavior.

Opioids are narcotic analgesics whose primary effect is pain reduction. Their secondary effect includes producing intense euphoria and relaxation, which underlies their addictive potential. For hundreds, if not thousands, of years, opium was the only commonly used opioid, from which the term “opiate” originates. In the early 19th century, morphine was isolated, and in 1874 heroin was synthesized from morphine, becoming a highly addictive substance. Morphine and its derivatives act on the central nervous system through interaction with opioid receptors (μ, γ, and κ). Sigma receptors were previously considered opioid receptors but this theory is no longer accepted.

μ-opioid receptors are widely distributed in the cerebral cortex, thalamus, hippocampus, locus coeruleus, amygdala, caudate nucleus, putamen, and dorsal spinal cord. They are involved in both analgesic and euphoric effects. γ-receptors are distributed similarly but more limited, mainly in the neocortex, striatum, and substantia nigra, and are thought to be involved in cognitive and motor integration. κ-receptors bind to ketocyclazocine, an opioid analog that induces hallucinations and dysphoric states; thus, they may play a role in psychiatric conditions, although this remains unclear. κ-receptor activity is also involved in gastrointestinal motility, feeding and drinking behavior, thermoregulation, and pain perception [11].

Endogenous opioid-like neurotransmitters, known as endorphins, exist throughout the nervous system and act as agonists of opioid receptors. Well-characterized endogenous opioids include met-enkephalin, leu-enkephalin, β-endorphin, and dynorphin. These substances have multiple precursors that may also interact with opioid receptors.

Opioid effects in the nervous system are highly complex and involve interactions with other neurotransmitter systems. For example, interaction of opioids with μ-

receptors in the brainstem stimulates GABA activity, which in turn inhibits sensory processing in the spinal cord. Enkephalins in the caudate nucleus are co-localized with glutamate and likely modulate its activity. Similarly, opioid mechanisms operate in the raphe nuclei and postrema region involving serotonergic systems. Dynorphin in the arcuate and supraoptic nuclei interacts with tyrosine hydroxylase, thereby influencing catecholamine systems. Research continues to further clarify how opioids interact with receptors and neurotransmitter systems to produce analgesia, euphoria, and dependence [11].

Despite the incomplete understanding of opioid mechanisms, pharmacological treatments for opioid dependence have been developed. Early treatment protocols focused on replacing substances with agents that produce fewer harmful effects. For example, methadone therapy involves the controlled administration of methadone, a synthetic opioid analgesic similar in action to morphine. The rationale was that methadone would reduce drug craving and increase patient responsiveness to rehabilitation. However, methadone itself produces cross-dependence with morphine and heroin, meaning that one chemical dependence is largely replaced by another, although in a more controlled and clinically managed form.

Detoxification under clinical supervision represents another pharmacological protocol for the treatment of opioid dependence. In this model, withdrawal symptoms are modulated and minimized through pharmacotherapy. Clonidine, for example, is an α2-adrenergic agonist that suppresses the excessive autonomic arousal induced by opioid withdrawal. Accordingly, it reduces symptoms such as sweating, muscle spasms, and gastrointestinal cramps. Benzodiazepines, when administered in a systematically tapered regimen, have also been shown to be useful in minimizing withdrawal-related agitation [12-14].

Finally, a more contemporary treatment approach involves the use of opioid antagonists following detoxification. These include naloxone, naltrexone, and cyclazocine, which block the euphoric effects of opioids. Naltrexone is a specific μ-opioid receptor antagonist with a relatively long duration of action and a favorable side-effect profile, making it the most commonly used agent. When naltrexone is

administered, heroin or other opioids do not produce euphoric effects, thereby reducing the motivation for continued use. However, patients with opioid dependence may discontinue naltrexone for several days, thereby restoring the euphoric effects of opioids [15].

Alcohol is the most commonly used substance associated with chemical dependence and is known to interact with GABA receptors at multiple sites in the brain. This interaction leads to decreased skeletal muscle tone, reduced arousal and anxiety, as well as impairments in cognitive and sensory processes. Chronic alcohol use is also associated with decreased dopaminergic activity and reduced synthesis and levels of norepinephrine, which may further contribute to reduced arousal and anxiety. Although withdrawal symptoms in alcohol dependence can be effectively managed with benzodiazepines using a tapering protocol, there is limited empirical evidence supporting the long-term effectiveness of pharmacological treatments for alcohol dependence itself.

Disulfiram (Antabuse) is sometimes used to prevent alcohol consumption in individuals with alcohol dependence because it induces toxicity when combined with alcohol. Disulfiram irreversibly inhibits aldehyde dehydrogenase, the enzyme responsible for converting acetaldehyde (the primary metabolite of alcohol) into acetate, which is easily eliminated from the body. As a result, alcohol consumption during disulfiram treatment leads to acetaldehyde accumulation, producing highly unpleasant effects including tachycardia, facial flushing, nausea and vomiting, dizziness, and shortness of breath. This constitutes a form of aversive therapy in which alcohol consumption, instead of producing relaxation and pleasure, leads to an aversive physiological state. However, many patients with alcohol dependence quickly learn that discontinuing disulfiram allows them to resume drinking without these adverse effects. Another pharmacological treatment for alcohol dependence is naltrexone, a μ-opioid receptor antagonist also used in opioid dependence. Its use is based on the hypothesis that blocking μ-receptors may inhibit brain reward pathways activated by alcohol and thereby reduce alcohol consumption. However, there is no conclusive evidence regarding its efficacy, particularly given patients' ability to discontinue the

medication in order to enhance alcohol's rewarding effects, similarly to disulfiram [16, 17].

Stimulants are substances that increase physical and mental activity, enhance performance, and produce euphoria. The most commonly abused stimulants are amphetamine and cocaine. Amphetamine blocks the reuptake of dopamine (DA) and norepinephrine (NE) (and possibly serotonin, 5-HT) across cortical brain regions and is also a potent stimulator of dopamine release from presynaptic neurons. Thus, it increases the availability of dopamine while simultaneously impairing neuronal regulation of dopamine, norepinephrine, and possibly serotonin. Cocaine is an alkaloid stimulant that exerts its effects by blocking the reuptake of dopamine, norepinephrine, and serotonin. Both amphetamine and cocaine can produce chemical dependence syndromes. Stimulant dependence is often treated pharmacologically using dopamine agonists and antidepressants [8].

Bromocriptine is a D2 receptor agonist used based on the hypothesis that craving for stimulants and withdrawal symptoms are caused by dopamine depletion; therefore, a D2 agonist may restore synaptic dopamine levels. However, the efficacy of this treatment has not been clearly demonstrated. Fluoxetine has also been used based on the assumption that its activating properties (although serotonergic rather than dopaminergic) may substitute for stimulant "need." Bupropion, an antidepressant with both noradrenergic and dopaminergic properties, has been applied in the treatment of amphetamine and cocaine dependence, but there is no conclusive evidence of its effectiveness [18-20].

When discussing chemical dependence, there is currently considerable debate regarding addiction to so-called "soft stimulants," namely nicotine and caffeine. Although there is strong evidence that smoking is a health risk factor for a range of diseases, and that excessive caffeine consumption may be associated with certain gastrointestinal disorders, their status as addictive substances is far less clear than is often presented in the media and by public health authorities.

Some researchers strongly oppose the use of the addiction model to explain nicotine use, citing evidence that, despite frequent comparisons between heroin and

nicotine in the press and public health discourse, the actual similarity between these substances is minimal when considering their immediate functional effects on behavior and cognition. In contrast, other researchers have demonstrated that cocaine and amphetamine produce a marked (>50%) reduction in the threshold of dopaminergic brain reward centers, which is considered a marker of their addictive potential. In comparison, substances such as caffeine and nicotine produce a much smaller and similar effect (<30% reduction in brain stimulation threshold), suggesting that these two groups of substances have substantially different impacts on brain reward systems and, consequently, potentially different capacities to induce addiction [21, 22].

Despite conceptual and terminological controversies in the literature, many individuals wish to quit smoking, and neuropharmacological interventions have been developed to support cessation. The most widely used include nicotine gum and transdermal nicotine patches. The former delivers nicotine orally through chewing, while the latter provides nicotine through the skin in progressively decreasing doses. Both approaches are based on the assumption that individuals benefit from nicotine consumption (nicotine stimulates acetylcholine receptors, which may lead to dopamine release in synapses and thereby induce changes in arousal state), and that replacement in oral or transdermal form substitutes for nicotine obtained through smoking.

However, only about 10.0% of patients report that these methods help them successfully quit smoking, and several studies have shown that the presence or absence of nicotine in delivery systems has little, if any, effect on reported withdrawal symptoms. The low success rate of nicotine replacement therapy clearly suggests that smoking is associated with factors beyond the pharmacological effects of nicotine alone.

Another pharmacological strategy for smoking cessation involves attempting to replace the heightened arousal state and addressing evidence that many smokers experience depressive symptoms upon nicotine withdrawal and may therefore use nicotine as a form of self-medication for mood regulation. This approach involves the use of the antidepressant bupropion, marketed for smoking cessation under the name

Zyban. Bupropion has both noradrenergic and dopaminergic properties and is considered one of the most activating antidepressants available.

However, there is currently no conclusive evidence supporting its effectiveness in smoking cessation [23, 24].

### 1.1.2. Adolescence as a Period of Increased Risk for the Development of Chemical Addictions in the World and in Ukraine

Adolescence is characterized as a critical period of life during which a range of continuous biological, behavioral, and social changes occur that contribute to human development. During the transition from childhood to adolescence, significant changes take place in the brain, affecting both its structure and function. These changes are accompanied by shifts in the social environment, particularly within the socio-emotional system associated with puberty. This results in an increased drive for reward-seeking behavior, especially in the presence of peers. As a consequence, adolescence represents a particularly vulnerable period for risk-taking, problematic, and impulsive behaviors, including cyber aggression, violence in romantic relationships, and various forms of addiction. The availability and use of addictive substances constitute a significant social problem that leads to serious health consequences in young people and negatively affects their surrounding environment. In Ukraine today, adolescence is a period of heightened vulnerability to chemical addictions due to the combination of physiological immaturity and a complex socio-political context [25-27].

**Main factors contributing to this increased risk:**

**• Psychophysiological vulnerability:**

In adolescents, the prefrontal cortex (responsible for self-control) is still developing, whereas the limbic system (the reward center) is highly active. This imbalance promotes impulsivity and sensation-seeking through psychoactive substance use (PAS).

**• Stress and traumatization:**

The war in Ukraine has become a powerful risk factor. Persistent anxiety, loss of homes, separation from family members, or the death of loved ones may push adolescents toward "self-medication" through alcohol or drugs as a means of escaping reality [28-31].

**• Availability and new types of psychoactive substances:**

The spread of electronic cigarettes, vapes, and synthetic drugs ("designer drugs"), which can be easily ordered via messaging platforms, creates an illusion of safety and accessibility. Among adolescents aged 13–15, approximately 40% report having tried electronic cigarettes at least once, while about 20% are current users. A similar trend is observed among adolescents aged 15–16: nearly half report lifetime experience of e-cigarette use, and about 19% report use within the past 30 days. These data indicate a high prevalence of e-cigarette use among adolescents and suggest a tendency toward regular consumption, which increases the risk of nicotine dependence in this age group [32, 33].

**• Social environment:**

The desire to "fit in" with peers remains a dominant motivation. In Ukrainian society, there is still a certain level of tolerance toward alcohol consumption, which adolescents often perceive as a marker of adulthood. Approximately 47% of young people consume alcohol in the presence of their parents, with girls doing so more frequently than boys.

This period is critical because addiction in adolescence develops 3–4 times faster than in adults and has more severe consequences for cognitive development [34].

According to the EDADES survey report (Ministerio de Sanidad, 2022), initiation of alcohol and tobacco use typically occurs between the ages of 16 and 17: 22.3% of students reported lifetime smoking, and 15.6% reported smoking within the last three months, while 56.4% reported lifetime alcohol use and 50.7% reported alcohol use within the past three months. The report also notes that alcohol, tobacco, cocaine, and cannabis use is more prevalent among males. Additionally, it highlights the prevalence of e-cigarette and cannabis use among individuals aged 15–24 and

identifies gambling, problematic gambling, and gambling disorder as significant behavioral addictions. Tobacco and alcohol use remain the most widespread forms of substance misuse among European adolescents [35].

Traditional substance abuse and emerging behavioral addictive patterns continue to raise significant concern. For this reason, numerous studies have been conducted to analyze this issue. For example, Rial et al. (2020) examined the consequences of early initiation and aimed to identify associated variables, such as substance use within the family or peer environment. Currently, not only traditional cigarettes are used; electronic and vaping devices are also widely consumed [36].

According to HBSC study findings, the percentage of daily tobacco users increases with age, peaking among 17–18-year-olds. At this age, gender differences in consumption are minimal. The HBSC study also shows that alcohol consumption increases with age, reaching its highest level among 17–18-year-olds. Gender differences become more pronounced with age, with males reporting higher levels of alcohol consumption. Similarly, psychoactive substance use, including drugs and alcohol, tends to increase with age, largely driven by curiosity, with males generally reporting higher use than females. The HBSC study further emphasizes that cannabis use is more prevalent among males than females, particularly in the 17–18 age group.

According to the ESPAD report, cannabis is the most widely used illicit substance among European students. On average, 16% of respondents reported having used cannabis at least once in their lifetime, while 32% considered it easily accessible. In addition, 4% of students are considered to be at risk of developing severe dependence. This trend may be explained by the emergence of new cannabis varieties and increased potency of cannabis-derived products in recent years [37].

Other studies focusing on polysubstance use analyze factors associated with alcohol, tobacco, and cannabis consumption among secondary school students. Peruga et al. (2022) examined patterns of electronic cigarette and alcohol use among adolescent populations.

In the first phase of a controlled study, 483 medical records were analyzed. The mean age of participants was 70.5 ± 10.5 years (range: 31–93 years). The average length of hospital stay was 16 days (range: 1–143 days).

In the second phase of the study, conducted after the implementation of an educational intervention, 109 medical records of patients hospitalized between December 2018 and February 2019 were analyzed. The mean age of patients was 71.6 ± 11.09 years (range: 38–96 years). The average length of hospital stay decreased to 11.0 days (range: 1–36 days).

The Cumulative Illness Rating Scale (CIRS) is an effective tool for assessing health profiles of both individual patients and population groups, as well as for risk adjustment. However, its reliable application requires appropriate staff training and systematic quality control of documentation. At the initial stage of the project, insufficient consistency in the quality of CIRS documentation was observed, which necessitated an educational intervention [38].

Epidemiological data indicate that substance use typically begins during adolescence (Substance Abuse and Mental Health Services Administration, 2010). Adolescence is defined as the age range from 10 to 18 years, according to the American Psychological Association. Furthermore, adolescent substance use—including alcohol, tobacco, marijuana, and other illicit drugs—is relatively common. In particular, the Monitoring the Future (MTF) survey (2019; Johnston, 2020) reported that 29.0% of 12th-grade students and 18.0% of 10th-grade students had used alcohol in the past month, while 36.0% of 12th-grade students and 29.0% of 10th-grade students reported marijuana use within the past year.

Although cigarette smoking continues to decline and has reached its lowest level in the history of the survey (i.e., daily smoking of half a pack or more is below 1% among both 10th- and 12th-grade students), the use of electronic cigarettes in 2019 represented one of the largest absolute increases ever recorded for any substance in MTF data. For example, 30-day prevalence of nicotine use via electronic cigarettes increased from 11.9% in 2017 to 25.5% in 2019 among 12th-grade students.

These statistics are of major concern not only due to the short-term negative consequences of substance use, which include emotional (e.g., depression), interpersonal (e.g., relationship strain), physical (e.g., accidental injuries), and academic (e.g., learning difficulties) effects, but also due to well-established long-term consequences, such as an increased risk of developing substance use disorders. The lifetime prevalence of alcohol use disorders is approximately 41.0% among individuals who initiated alcohol use at age 12, compared with 17.0% and 11.0% among those who began drinking at ages 18 and 21, respectively.

Therefore, in order to develop effective prevention programs, it is essential to identify the risks and protective processes associated with adolescent substance use [39].

Schools play an important role in preventing psychoactive substance use and promoting healthy decision-making by providing a setting for early identification of at-risk youth and offering targeted interventions (European Monitoring Centre for Drugs and Drug Addiction, 2022). In 2020, nearly 10 million adolescents in the United States (1.6 million aged 12–17 and 8.2 million aged 18–25) met diagnostic criteria for a substance use disorder. Among male adolescents, the prevalence of substance use was higher than among females. However, among females aged 12–20 (2019), higher rates of past-month alcohol use (19.9% vs. 17.2%) and binge drinking (11.8% vs. 10.4%) were reported compared to their male peers, while heavy episodic drinking rates were comparable (2.1% vs. 2.3% for females and males, respectively).

The significance of the present systematic review lies in its broad and integrative approach, which includes not only traditional substance abuse but also digital addictions associated with emerging technologies. By synthesizing findings from multiple studies, this review aims to provide a comprehensive analysis of updated evidence on the most prevalent forms of substance use and other types of addictive behaviors among adolescents. This synthesis serves as a foundation for the development of evidence-based prevention and intervention programs targeting behaviors that are common in young people’s daily lives and pose a serious threat to

their physical and psychological health. Overall, adolescents are placed in an extremely vulnerable position, which may have severe consequences for their development.

The integration of substance-related and behavioral addictions within a single review reflects the need for a comprehensive understanding of the factors influencing adolescent addictive behavior. Both forms of addiction share common neurobiological, psychological, and social characteristics, and their joint analysis allows for a broader understanding of risk and vulnerability factors during this critical developmental stage. Therefore, the primary aim of this systematic review is to analyze updated evidence describing the most prevalent forms of addiction and maladaptive behaviors among adolescents. By examining key data in this field, the review seeks to establish a foundation for prevention and intervention programs aimed at reducing or eliminating behaviors that are widespread in young people's daily lives and harmful to their physical and mental health [40-42].

Statistical data for 2024–2025 indicate changes in the structure of chemical addictions among Ukrainian adolescents: while overall alcohol consumption has decreased, there is a concerning increase in drug use prevalence.

**Key indicators according to the Public Health Center of Ukraine reports and ESPAD 2024 study:**

- **Alcohol use:** the proportion of adolescents (15–16 years old) who regularly consume alcohol is gradually decreasing compared to previous years.
- **Binge drinking:** despite the overall decline, the rate of heavy episodic drinking (five or more drinks on one occasion) remains stable at approximately 14.0% among adolescents. According to EWSD studies, the most commonly used psychoactive substances among users include MDMA/ecstasy (36.7%), psilocybin mushrooms (28.1%), amphetamines (26.6%), and cocaine (18.7%). Among people who inject drugs (data from Integrated Bio-Behavioral Surveillance Studies, IBBS), opioids are the most prevalent substances.
- **Age distribution:** the most active group of alcohol consumers in Ukraine is young people aged 18–29 (86.3%) [43, 44].

- **Drug use:** according to the Ministry of Internal Affairs of Ukraine, one in five adolescents (20%) has tried drugs at least once. In 2024, a significant increase was recorded in adolescents experimenting with new psychoactive substances (e.g., MDMA, psychotropic substances). During 2024, 172,000 individuals (adolescents and adults combined) received treatment for substance use disorders.
- **Vaping:** more than 50.0% of adolescents have experience using electronic cigarettes, which often serves as a "gateway" to stronger substances [45].
- **Impact of war:** the psychological state of adolescents (assessed using the WHO-5 index in 2024) is directly correlated with risk behavior—adolescents with low well-being are more likely to engage in substance use as a coping strategy. The war has radically changed the motivation for substance use: previously driven mainly by "seeking pleasure," it is now increasingly associated with "escaping pain."

**War impact through the WHO-5 index and coping strategies:**

1. **Low well-being as a trigger:** The WHO-5 index measures vitality, calmness, and interest in life. In 2024, a significant proportion of Ukrainian adolescents scored below 50 points (a critical threshold).
   - **Anhedonia:** loss of ability to experience pleasure from everyday activities (hobbies, communication). Psychoactive substances become a source of "quick dopamine," providing temporary emotional relief.
   - **Chronic fatigue:** constant anxiety and stress deplete the nervous system; alcohol and drugs are perceived as a way to "reset" or regain functioning.
   - **Intrusive thoughts:** frequent intrusive memories or fears about the future are common among adolescents with low well-being.
2. **Self-medication mechanism:** the use of cannabinoids or sedative substances helps suppress internal dialogue and anxiety, representing a maladaptive coping strategy in the absence of professional psychological support.
3. **Social isolation:** low well-being is often accompanied by feelings of isolation, particularly in the context of distance learning.

4. **Search for belonging:** adolescents experiencing distress are more likely to join peer groups where substance use is normalized, becoming a form of "social bonding" and compensation for feelings of rejection.

5. **Impact on personality development:** cognitive decline and memory impairment associated with substance use further complicate social integration, creating a vicious cycle of low well-being. War also affects adolescents' ability to learn and plan for the future. When adolescents perceive no meaningful future (low WHO-5 "life interest" scores), risky behaviors no longer appear dangerous, increasing experimentation with synthetic substances. Low well-being is not merely a "bad mood," but a state of psychological deficit in which chemical dependence becomes a form of ersatz adaptation to intolerable reality [2, 46-50].

**Psychoactive substances as a maladaptive coping strategy**

Coping refers to strategies for managing stress. Due to the lack of stable psychological defense mechanisms, adolescents often choose chemical coping pathways. Instead of problem-solving or seeking psychological support (which may still be stigmatized), they opt for altered states of consciousness to temporarily escape wartime reality.

When adolescents use psychoactive substances as a coping mechanism, they replace active problem-solving with chemical disengagement from reality, creating a vicious cycle: substances temporarily relieve symptoms but intensify underlying stress.

Adolescents use psychoactive substances to regulate emotional states beyond their control:

- **Anxiety reduction (tranquilization):** alcohol and cannabinoids are used as accessible anxiolytics to suppress panic attacks or fear of shelling.
- **Mood elevation (stimulation):** in cases of apathy and loss of meaning (war-related distress), stimulants such as amphetamines or synthetic cathinones ("bath salts") may be used to artificially induce energy and a sense of "normal functioning."
- Escapism (escape from reality)
- In conditions of chronic stress, psychoactive substances (PAS) become a "portal" to an alternative subjective reality. Cognitive disengagement allows

adolescents to distance themselves from traumatic memories or distressing news. Rather than actively processing war-related trauma, the adolescent "freezes" it, which may later contribute to severe forms of post-traumatic stress disorder (PTSD). The creation of a perceived "safe cocoon" under the influence of PAS increases subjective feelings of safety, although objective risks (e.g., air-raid alerts, shelling) remain unchanged.

- Illusion of social support
- Since the war has disrupted stable social connections, shared substance use becomes one of the simplest coping mechanisms for restoring a sense of belonging. Group coping emerges as a form of pseudo-solidarity, where adolescents perceive that "we are all in the same situation, so it does not matter." Psychoactive substance use also reduces social barriers and alleviates heightened social anxiety and alienation, which have been exacerbated by remote learning and social isolation.
- Costs of this coping strategy
- However, this strategy has profound negative consequences. It blocks adaptive coping processes: instead of developing resilience, the adolescent brain becomes dependent on an external "crutch," and stress returns with increased intensity once the substance is discontinued. Chemical coping disrupts neuroadaptive processes in brain regions responsible for planning and executive functioning, thereby impairing goal-directed behavior. Due to the unstable hormonal and neurodevelopmental state characteristic of adolescence, war-related coping strategies may rapidly transition into full substance dependence within a relatively short period [49, 51].
- Specific risk factors (2024–2025)
- **Loss of social support systems:**

The breakdown of peer networks due to migration and remote schooling increases feelings of loneliness. Adolescents increasingly seek "communities" in online groups associated with the distribution and use of psychoactive substances, where belonging is reinforced through shared substance use.

- **Normalization of violence:**

Continuous exposure to war-related stress reduces sensitivity to danger. Adolescents

become more prone to risky experimentation, often perceiving the future as uncertain or meaningless.

- According to monitoring data, adolescents who report a "constantly anxious" psychological state are 2.5 times more likely to experiment with synthetic drugs compared to peers who have access to psychological support.

### 1.1.3 Psychological and Social Factors in the Emergence of Addictive Behaviors in Adolescents

#### 1.1.3.1 The Bioecological Approach to Understanding the Influence of the Social Environment on the Development of Addictive Behavior in Adolescents

Despite compelling evidence confirming the influence of social factors on the initiation of psychoactive substance use and the transition to regular use, previous research has been overly focused on individual-level determinants. Theoretically, examining the broader context of family, peers, school, and neighborhood environments provides a more comprehensive understanding of adolescent substance use, as such behavior does not occur in isolation.

**Bioecological Developmental Model**

Bronfenbrenner's bioecological model (1979) has played a significant role in organizing the multitude of socialization factors contributing to the etiology of adolescent substance use. This framework posits that multiple contextual systems, including peers, family, school, and neighborhood environments, shape adolescent development and health-related behaviors. These contexts are conceptualized as interrelated "systems" that may directly or indirectly influence adolescent health behaviors, including psychoactive substance use [52].

The **microsystem** encompasses the immediate social environments that directly affect the child (e.g., peers, siblings, parents).The **mesosystem** consists of the interrelations between different microsystems (e.g., interactions between peers and parents). The **exosystem** refers to broader social structures that do not directly involve

the individual but indirectly influence microsystem functioning (e.g., neighborhood context).

Finally, the **macrosystem** represents the outermost layer of socialization, encompassing cultural values, policies, religion, and laws, which exert cascading effects on individual development through their influence on all other systems.

Accordingly, some contexts within the adolescent social ecology may have more proximal and direct effects on substance use outcomes—such as peers and parents—whereas more distal contexts, such as neighborhood environment, tend to exert indirect influences through these closer social agents.

At the center of these concentric systems lie individual adolescent characteristics, including biological sex, genetic and neurobiological differences, and temperament (i.e., inherited variability in emotional, motor, attentional, and self-regulatory processes). Biologically based individual characteristics often influence adolescents' susceptibility to socialization contexts. Although biological factors are not the primary focus of this review, several models are highlighted to illustrate their role in shaping sensitivity to environmental influences, particularly during adolescence [52].

**Gene–Environment Interactions and Differential Susceptibility**

Previous research indicates that individual genetic variation plays a significant role in shaping susceptibility to social contexts. Historically, gene–environment interactions (G×E) have been conceptualized within the diathesis–stress framework, which suggests that certain individuals may be more vulnerable to maladaptive environments due to their genetic predispositions, thereby increasing the risk of psychopathology, including substance use disorders.

For example, one study found that permissive parenting was associated with increased likelihood of alcohol use, with the strongest effects observed among adolescents carrying specific risk genotypes (e.g., DRD2 A1 allele and OPRM1 G-allele) [53].

Contemporary research further suggests that genetic variation not only increases vulnerability to adverse environments but may also enhance responsiveness to positive

and supportive social contexts. Adolescents with certain genetic profiles may be particularly sensitive to both negative and adaptive socialization environments, whereas individuals without these variants show relatively weaker environmental responsiveness.

Evidence from intervention studies supports this perspective. A combined alcohol prevention program and maternal involvement intervention demonstrated significant effectiveness among ninth-grade students; however, significant outcomes were observed primarily among adolescents with specific genetic variants and moderate to high levels of maternal engagement.

The differential susceptibility hypothesis proposes that some adolescents exhibit heightened sensitivity to environmental influences, including both adverse and protective conditions. Adolescents with specific dopaminergic and GABAergic genetic variants—traditionally considered risk alleles—reported higher alcohol consumption in control conditions. However, the same individuals demonstrated the greatest reductions in alcohol use following preventive interventions, whereas adolescents without these genetic variants showed minimal responsiveness [54, 55].

**Developmental Stage and Substance Use Trajectories**

Additional critical factors influencing the role of genetic effects in substance use include developmental stage and the phase of substance involvement, although these influences are complex and context-dependent. Socialization effects tend to be stronger in the early stages of substance use initiation, which typically occurs during adolescence. In contrast, genetic influences become more pronounced in later stages of use, such as heavy or problematic consumption in adulthood.

For instance, a twin study examining alcohol initiation and progression to heavy drinking (e.g., binge drinking) among adolescents aged 11–19 found that shared environmental influences accounted for a larger proportion of variance in alcohol initiation (65.0%) compared to genetic factors (26.0%), after controlling for age. In contrast, for heavy drinking patterns, less than half of the variance was explained by shared environmental influences (47.0%), while approximately one-third (35.0%) was attributable to genetic effects. Another study similarly demonstrated that genetic

factors accounted for approximately 20.0% of variance in alcohol use at age 14, increasing to nearly 50.0% by age 18.

Some researchers hypothesize that differences between stages of psychoactive substance use and development may reflect differences in the social world of young people compared to adults. In adolescence, parents typically closely monitor their children's social environment and impose restrictions. As young people transition into adulthood and gain more freedom to shape their social world, genetic vulnerability may become more likely to manifest. In summary, research findings confirm the importance of the synergistic influence of genes and the socialization context on adolescent psychoactive substance use [56, 57].

Neurobiological changes occurring during adolescence may also contribute to the etiology of adolescent substance use. The dual-systems model suggests that the increased risk observed in adolescence, including substance use, can be partly explained by an imbalance in the development of two brain systems.

The first reflects a rapidly developing socio-emotional system (primarily located in the striatum), which drives adolescents' seeking of rewarding, exciting, and novel experiences.

The second reflects a more gradual development of the cognitive control system (primarily located in the prefrontal cortex), which supports more deliberative decision-making and the inhibition of potentially harmful impulses.

Recently, researchers have suggested that immaturity of the frontal cortex may be an overly simplistic explanation for adolescents' risky decisions, and that a more nuanced understanding of adolescents' processing of social, cognitive, and affective information is needed. There is growing evidence that the cognitive control system in adolescence is not necessarily immature, but rather more flexible compared to adulthood. Moreover, the degree of engagement of the cognitive control system during adolescence largely depends on motivational relevance, such as task value or the presence of peers. This flexibility in rapidly adjusting cognitive control engagement may contribute to increased vulnerability to potentially harmful stimuli such as

substance use, but it may also support adaptive motivation relevant for positive social development [58].

Social learning theory identifies modeling as a critical mechanism through which the social environment influences behavior. By observing the attitudes and behaviors of influential individuals (e.g., parents, siblings, friends), adolescents develop cognitive representations that are activated when making their own decisions about substance use. If significant social role models maintain positive attitudes toward psychoactive substances or actually use them, adolescents are more likely to adopt these views or imitate such behavior. In addition, social learning theory suggests that acceptance of positive attitudes toward use or engagement in behavior is reinforced when young people perceive that:

1. the role model is rewarded for engaging in such behavior;
2. the role model is perceived as similar to oneself;
3. the role model appears to have higher social status [59, 60].

### 1.1.3.2 The role of the parental environment in the formation of adolescent addictive behavior: processes of socialization and selection

The parental environment is one of the key socialization factors influencing the formation of adolescents' behavioral strategies, particularly in the area of psychoactive substance use. Within the frameworks of social development and social control theories, it is emphasized that the quality of family relationships, the level of parental control, emotional support, and parental modeling determine the level of risk for adolescents engaging in addictive behaviors.

From the perspective of social control theory, strong emotional bonds with parents and a high level of family cohesion serve a protective function, reducing the likelihood of deviant behavior. Adolescents who feel support, acceptance, and emotional involvement from their parents are more likely to internalize prosocial norms and show lower levels of susceptibility to psychoactive substance use.

An important mechanism of parental influence is parental control, which includes setting behavioral rules, monitoring adolescent activities, and consistent discipline. Studies show that an adequate level of control reduces the risk of early initiation of substance use, whereas its absence or excessive strictness combined with low emotional warmth may increase the likelihood of deviant behavior [61].

Another important factor is parental behavior regarding their own substance use. According to social learning theory, adolescents acquire behavioral models by observing significant adults. Thus, parental use of alcohol, tobacco, or other substances may serve as a model for imitation, shaping more tolerant attitudes toward such practices in children. In addition, the availability of psychoactive substances within the family increases the likelihood of early experimentation.

Socialization processes within the family also include the formation of norms and attitudes toward substance use. Parental attitudes that tolerate or minimize the risks of alcohol use may contribute to adolescents developing more liberal views on its acceptability. In contrast, clearly structured rules and consistent enforcement serve a preventive function.

At the same time, the process of selection reflects the reciprocal nature of the influence between adolescents and the parental environment. Adolescents' behavior may influence parenting style: in response to problematic behavior, parents may reduce control due to fatigue or frustration, or conversely increase control in the form of stricter discipline. Such transactional processes may either increase or decrease the risk of further substance use.

Additionally, the quality of parent–child relationships influences adolescents' willingness to self-disclose, which is an important mechanism through which parents obtain information about their behavior. Higher levels of trust and openness facilitate more effective parental monitoring, whereas conflictual or distant relationships reduce this control and increase the risk of deviant behavior.

The parental environment acts as a multilevel systemic factor influencing the formation of adolescent addictive behavior through the interaction of socialization and selection processes. Its influence is realized both directly through behavioral modeling

and control, and indirectly through the formation of norms, emotional closeness, and the selection of adolescents' social environment [62].

Social control theory highlights that the combination of strong bonds with traditional social institutions (e.g., family, school) and strong prosocial values reduces the likelihood of engaging in deviant behavior. Attachment to the family is considered a key social bond in adolescents' decisions to deviate from conventional behavior. Thus, adolescents are less likely to engage in deviant behaviors such as substance use and are more likely to value socially accepted norms when they feel belonging, support, and connection within their family and other traditional institutions.

The social development model integrates social learning theory and social control theory, postulating that youth develop social bonds with agents of socialization across four contextual domains (i.e., family, school, religious and community institutions, and peers) based on perceived opportunities and rewards for participation in prosocial or antisocial actions. Young people who expect rewards for prosocial actions are more likely to engage in prosocial behavior. In contrast, young people who expect rewards for antisocial actions are more likely to engage in antisocial behavior, including psychoactive substance use. The social development model also integrates a developmental perspective that reflects changes occurring in social environments. It is assumed that the importance of socialization agents within these four contextual domains changes as youth mature. Specifically, while parents are the primary unit of socialization in childhood and early adolescence, during middle and late adolescence this shifts, and peers become the primary socialization unit as more time is spent outside the family [63].

Parents are influential authority figures in adolescents' social world, affecting both adolescents' substance use behavior directly and their choice of friendship networks. Research examining the role of parental socialization in adolescent substance use focuses on two broad components: parental control (demandingness) and parental warmth (responsiveness). Parental control reflects child-directed behaviors aimed at shaping behavior that parents consider acceptable, including setting clear rules regarding adolescent behavior, supervision, and discipline. In contrast, parental

warmth reflects child-directed behaviors that communicate being loved, including involvement, praise, affection, and emotional availability. Both parental warmth and control have been shown to play a protective role in reducing the risk of substance use [64, 65].

In addition, two perspectives have been proposed for conceptualizing these constructs: a dimensional approach, which treats these two aspects of parenting separately, and a categorical approach, which combines them into overall parenting styles. Specifically, based on every possible combination of the two-dimensional model of parental control and warmth, four parenting styles have been identified: authoritative (high control, high warmth), authoritarian (high control, low warmth), permissive (low control, high warmth), and neglectful (low control, low warmth). These classifications continue to be widely used in research on the role of parenting in adolescent substance use. However, this review focuses on broader approaches. It has been demonstrated that other forms of parenting behavior, more specific to substance use, can predict early initiation of adolescent substance use as well as patterns of use (e.g., quantity and frequency). In particular, parental substance use and parental approval of substance use (primarily alcohol) have a significant impact on adolescent substance use behavior. According to social learning theory, when adolescents observe their parents using psychoactive substances, a modeling effect may occur. Moreover, in families where parents use substances, the availability of these substances for their children is higher. Parents who allow their children to try alcohol may also transmit messages of acceptance regarding its use. Both general and substance-specific parenting behaviors will be discussed [66-68].

Proactive family management practices, which encompass a broader context of parental control, are associated with adolescent initiation of substance use. Specifically, parents who exercise high levels of control are more likely to monitor their children, which in turn limits the onset of substance use. Previous research supports the importance of distinguishing the unique effects of specific aspects of parental control practices. A strong predictor of the initiation and escalation of substance use in adolescence is parental control. However, some researchers question

interpretations from previous studies due to how parental control is operationalized. In particular, parental control has been defined as behaviors involving attention to the child's location, activities, and communication, and monitoring these aspects. However, when analyzing the items used to assess parental control, they generally reflect actual knowledge of the child's activities and communication rather than active monitoring efforts. This is an important distinction, as parents likely obtain this knowledge either through active monitoring, solicitation, or voluntary disclosure by children. Research shows that when examined in a single model, adolescent disclosure is a more robust predictor of adolescent substance use than parental knowledge obtained through active monitoring methods. It is likely that adolescent disclosure may be partly facilitated by open and trusting parent–child relationships and strong emotional family bonds [69, 70].

Propensity score analysis can include many variables preceding the onset of substance use in order to simulate random assignment and establish more robust causal relationships between predictors and outcomes. When controlling for 33 confounding factors, including other aspects of parenting (e.g., control, discipline, and supervision), maternal knowledge of youth activities predicted substance use initiation and attitudes toward substance use.

Research shows a significant interaction between parental and peer-related risk factors. Specifically, low levels of parental knowledge about adolescents' activities were less strongly associated with substance use in cases where peer antisocial behavior was high. These findings highlight the importance of early adolescence as a critical period in which the influence of both parents and the social environment can significantly determine the risk of developing problem behavior [71].

Results indicate that high parental knowledge and low levels of inconsistent discipline, as reported by adolescents' friends, predict low levels of cigarette smoking, marijuana use, and alcohol use in middle adolescence. Parental knowledge likely has a broader effect than expected; high levels of parental control protect against substance use behavior both within the family and within the broader peer context. Other studies examine possible mechanisms through which parental knowledge reduces adolescents'

risk of substance use. High parental knowledge may minimize adolescents' exposure to deviant peer groups that engage in substance use. Moreover, high parental knowledge may be particularly important for girls. For example, one study found that low parental knowledge in girls predicted greater involvement with male friends in middle adolescence, which in turn predicted more problematic alcohol use in late adolescence.

Parental knowledge may reduce the influence of deviant peers who facilitate the initiation of substance use. Finally, some studies suggest that the relationship between parental knowledge and adolescent substance use is best characterized as a bidirectional and transactional process. That is, despite robust evidence supporting an association between parental knowledge and adolescent substance use, adolescents' substance use may also influence the extent to which parents engage in monitoring and acquire knowledge about their children's activities. Prior research indicates that adolescents who use psychoactive substances may be particularly reluctant to spend time with family members or disclose details about their activities, thereby reducing parental knowledge [72].

In turn, parents of adolescents who use psychoactive substances may disengage from effective parenting practices, such as seeking information about their adolescents' activities, due to frustration. This reflects a negative reinforcement mechanism, whereby the escalation of adolescent problem behavior leads parents to withdraw from parenting efforts. It is also possible that reduced parental control reflects parents' belief that their child is trustworthy and responsible. In this sense, decreases in parental control and monitoring may represent an adaptive response that allows adolescents to gain greater independence [73, 74].

Excessive parental control may increase risk among youth already vulnerable to problematic substance use, particularly when parent–child attachment is weak. In such cases, adolescents may perceive high levels of control as unjustified given the already strained relationship with their parents. It has also been shown that inconsistency or variability in parental knowledge is associated with increased risk of alcohol, cigarette, and cannabis use among adolescents.

Another important consideration is the source of information regarding parental knowledge. In general, parents tend to overestimate their level of knowledge, partly due to social desirability bias, whereas adolescents' reports of parental knowledge are typically stronger predictors of substance use than parental reports. Some authors suggest that discrepancies in findings across informants may reflect subtle differences in how parental control/knowledge is conceptualized. Parental reports may reflect behaviors parents believe they are engaging in, whereas adolescent reports may reflect the behaviors that young people actually perceive or experience.

Moreover, discrepancies between parental and adolescent perceptions of parental knowledge are predictive of adolescent substance use. For example, parent–child discrepancies in reports of parental knowledge have been positively associated with various forms of risky behavior, including substance use. Such discrepancies may indicate relational discord or underlying dysfunction in the parent–child relationship (aspects of parental warmth). Although parental control and knowledge are among the most robust predictors of adolescent substance use, aspects of parental warmth—such as family cohesion, bonding, involvement, and overall parent–child relationship quality—also significantly influence adolescent behavior [75-77].

For instance, family cohesion, defined as the level of emotional closeness, acceptance, support, and connectedness within the family, has been shown to have a protective effect against later alcohol-related problems in adolescence. Similarly, parental support, characterized by praise, affection, and encouragement, is associated with lower levels of substance use and alcohol dependence among adolescents and young adults. Adolescents whose parents exhibit high levels of warmth are more likely to seek guidance and information from parents, to internalize negative attitudes toward substance users, and to adopt parental rules regarding substance use.

In turn, the quality of parent–child relationships may exert both direct effects on reducing the risk of substance initiation and indirect effects through adolescents' selection of peers who may exert pressure or provide access to substances. Importantly, conflictual or disrupted parent–child relationships may contribute to adolescents' affiliation with substance-using peer groups and increase the risk of developing

substance use disorders in adulthood. While a certain degree of parent–child conflict (e.g., regarding after-school activities or peer associations) is normative during adolescence as youth seek autonomy and peer orientation increases, highly conflictual relationships significantly elevate the risk of maladaptive outcomes, including substance use [78, 79].

Previous research indicates that key correlates of adolescent substance use include parental attitudes toward substance use and parental behavior itself. Among these, parental substance use is particularly influential. Parental alcohol use predicts adolescent alcohol use, parental cigarette smoking predicts adolescent smoking, and parental cannabis use predicts adolescent cannabis use. Evidence also suggests cross-substance effects (e.g., parental smoking predicting adolescent alcohol use). Moreover, the likelihood of adolescent substance use increases with the number of substance-using parents in the household and the duration of exposure to parental substance use, suggesting a dose–response relationship [80, 81].

Other studies have examined whether the association between parental alcohol use and adolescent substance use is stronger for maternal or paternal use; however, findings are inconsistent. Some studies indicate that paternal substance use is a stronger predictor of adolescent alcohol use, whereas others suggest stronger maternal influence. Still others report comparable effects of both parents on adolescent substance use behavior.

Another parenting practice associated with adolescent substance use is parental permission for tasting or sampling alcoholic beverages. Research by Jackson et al. (2012) suggests that positive parental attitudes toward alcohol tasting may stem from the belief that allowing children to sample alcohol under supervision increases the likelihood of responsible drinking later or reduces future risk, given that many children dislike the taste of alcoholic beverages. However, such permissiveness may also increase the risk of problematic alcohol use by conveying the message that underage drinking is acceptable and unlikely to result in consequences. Prior research indicates that supervised alcohol tasting in late childhood increases the likelihood of consuming a full alcoholic drink by mid-adolescence.

More recent evidence shows that parental permission for alcohol consumption before age 13 is associated with higher frequency and quantity of drinking, as well as alcohol-related problems in late adolescence. This relationship may be explained by changes in adolescents' cognitive alcohol expectancies. Specifically, early alcohol exposure has been linked to weaker negative alcohol expectancies (e.g., "I will feel sick"), stronger positive expectancies, and more favorable implicit and subjective evaluations of alcohol use (e.g., "I will feel happier") [82].

Taken together, these findings indicate that parental substance use and parental permissiveness regarding substance use are risk factors for early initiation of substance use, as well as escalation to more problematic levels of use.

Previous research provides some evidence that the roles of parental control and parental warmth in adolescent substance use may differ depending on biological sex. Sex development theory suggests that relationships with parents are more important for girls than for boys; therefore, girls' substance use may be more strongly influenced by parental factors than boys' use. For example, prior studies indicate that girls are not only subject to stricter parental control than boys, but also that the role of deviant peers in later substance use is stronger among girls in conditions of low parental control than among boys. Similarly, earlier research shows that relationship quality (particularly mother–daughter bonding) plays a greater role in girls' alcohol use than in boys' alcohol use. However, other studies suggest that parental knowledge and the interaction between parental knowledge and affiliation with deviant peers significantly influence substance use among boys but not girls. Overall, research findings suggest that boys and girls have similar risks of substance use during adolescence in the context of parental substance use. Nevertheless, some studies indicate a stronger effect of parental smoking on boys' smoking compared to girls, as well as a stronger impact of regular parental alcohol use on boys than on girls aged 12–15 years [83-85].

Similarly, prior research suggests that the risk posed by parental substance use for adolescent alcohol consumption decreases with age, with stronger effects observed among 12–15-year-olds compared to 21–25-year-olds, although it remains significant into early adulthood. However, other studies demonstrate that parental

control/knowledge and involvement consistently predict substance use throughout adolescence and university years. In late adolescence, parent–child communication and youth self-disclosure may become more effective mechanisms for obtaining information about substance-related behavior than active monitoring and questioning strategies.

From a developmental perspective, adolescence is a period during which young people spend less time with parents, family involvement decreases, the emphasis shifts toward autonomy from parents, and the quality of parent–child communication declines. At the same time, adolescence is characterized by increased time spent with peers, heightened sensitivity to social rewards, and engagement in novel experiences that emphasize peer socialization and conformity to perceived group norms. Thus, peers are considered increasingly influential compared to parents during the transition from childhood to adolescence. This section examines various aspects of peer socialization, as associations between peer context and substance use are thought to operate through both direct mechanisms (e.g., peer pressure, availability of substances) and indirect mechanisms (e.g., social norms). It is well established that peer substance use and peer attitudes are robust predictors of adolescent risk behaviors, such as cigarette smoking, marijuana use, and alcohol consumption. However, several important methodological issues may obscure the strength and direction of the association between adolescents and their peers.

First, studies that rely on adolescents' self-reports of both their own substance use and perceived peer substance use may overestimate the true association due to shared method bias, adolescents' tendency to project their own behavior onto peers, and overestimation of peers' risk behaviors. Second, it is often difficult to determine whether peer substance use and attitudes lead to adolescent substance use, or whether adolescents who use substances select peers with similar behaviors. These processes are referred to as peer socialization and peer selection, respectively.

Peer socialization reflects an adolescent's change in substance use behavior in response to peer influence in order to conform to group norms (i.e., peer substance use predicts adolescent substance use). Importantly, although prior research suggests that

peer socialization is strongest within close friendships, adolescents may also be influenced by high-status peers with whom they have limited direct interpersonal contact outside dyadic friendship contexts. In contrast, consistent with the homophily principle, according to which individuals gravitate toward others similar to themselves, peer selection refers to individuals choosing to associate with others who resemble them (i.e., adolescent substance use predicts peer substance use).

Prior research supports the role of both selection and socialization in adolescent substance use. For example, studies show that perceived peer alcohol use or approval of alcohol use predicts adolescent alcohol consumption even after controlling for prior levels of adolescent risk behavior, supporting the role of peer socialization. Other studies demonstrate that adolescent alcohol use predicts peer alcohol use after controlling for prior peer use, supporting peer selection effects.

However, the literature remains inconclusive regarding which process has the stronger influence on adolescent behavior. Some findings suggest that peer socialization plays a more prominent role during adolescence due to generally low baseline levels of substance use. Other studies indicate that selection effects are stronger during adolescence for alcohol, cigarette, and marijuana use. Yet another study using propensity score analysis to control for a wide range of confounding factors found that these processes were relatively equal in magnitude with respect to adolescent alcohol use.

Importantly, although previous work supports selection and socialization processes for alcohol, tobacco, and marijuana use, most studies have examined these processes separately for each substance, thereby ignoring the possibility of concurrent polysubstance use among adolescents. Both socialization and selection processes contribute to alcohol use; socialization appears to be a stronger predictor of marijuana use, while neither socialization nor selection significantly predicted tobacco use. Some influence of early adolescent smoking on later use was mediated by changes in perceptions of friends' smoking behavior [86-88].

### 1.1.3.3 The Role of Descriptive and Subjective Peer Norms in the Development of Adolescent Risk Behavior

In addition to the direct influence of peers, adolescents' substance use behaviors develop through indirect processes. According to social learning theory, adolescents do not necessarily need to directly observe their peers using psychoactive substances for such behaviors to become socially reinforced. Contemporary research confirms that adolescent substance use is largely determined by peer influence, particularly through the perception of social norms. A meta-analysis by Watts L. (2023) indicates that adolescents' perceived norms regarding peer behavior and approval (perceived norms) exert a stronger influence than the actual behavior of the peer group. Social norms theory distinguishes between descriptive norms (what others do) and injunctive or subjective norms (what is approved), both of which, according to research by Barry C. (2025), significantly affect alcohol and cannabis use. Furthermore, recent studies demonstrate that these norms are formed not only in offline contexts but also through social networks, where subjective norms act as a mediator between peer influence and actual behavior.

In particular, perceptions of peer approval and substance use during early adolescence may have a particularly strong impact, given that direct peer pressure is often relatively rare. This is consistent with social norms theories that extend social learning theory by distinguishing two additional constructs: descriptive and subjective norms [86, 89].

Descriptive norms reflect individuals' perceptions of the normative behavior of the peer group. Subjective (injunctive) norms reflect individuals' perceptions of the extent to which such behavior is approved by the peer group, thereby fostering adolescents' motivation to conform to group expectations. Adolescents generally tend to inaccurately assess both the behavior of others and social norms related to substance use, including among unfamiliar peers, classmates, and close friends [89].

Not only do adolescents overestimate peer involvement in health-risk behaviors, but they also tend to underestimate peer engagement in adaptive behaviors, with the

magnitude of these misperceptions being substantial. For example, one study found that when popular adolescents were directly asked about their substance use, they reported almost no cigarette smoking and no marijuana use during the previous month. However, peers believed that these high-status adolescents smoked up to three cigarettes per day and used marijuana up to nine times per month. These misperceptions are thought to reinforce substance use behavior [90].

The overestimation of substance use among high-status peers and classmates has led to the development of social norms campaigns aimed at correcting these widespread misconceptions by providing accurate information about actual prevalence rates, primarily on university campuses. Unfortunately, these interventions have shown only modest effects [91].

Although peers are generally considered to exert both positive and negative influences on adolescent behavior, research has primarily focused on negative outcomes associated with problem behaviors, including substance use. Prior studies suggest that some adolescents may experience social pressure that encourages prosocial behavior (e.g., achieving academic success, avoiding drugs). For example, research has shown that friendships characterized by positive qualities such as support, school engagement, academic involvement, and participation in religious activities have a protective effect against substance use [92].

#### 1.1.3.4 Age and Gender Characteristics of the Influence of Social Factors on the Development of Adolescent Addictive Behavior

Previous research indicates that peer influence on problem behavior, including psychoactive substance use, varies depending on the stage of ontogenetic development and biological sex. Empirical evidence demonstrates that the role of peers is not uniform across developmental stages and tends to fluctuate throughout adolescence and early adulthood.

In particular, longitudinal studies show that friends' substance use is a significant predictor of individual behavior primarily during middle adolescence, whereas in later

stages this influence gradually decreases when controlling for covariates. Similarly, the risk of alcohol use associated with peer behavior is higher in younger age groups (12–15 years) and decreases with increasing age (16–25 years).

Furthermore, longitudinal findings among middle and high school students indicate that the strongest peer influence on alcohol use is observed at approximately 14–16 years of age (9th–10th grades).

Synthesis of contemporary research suggests that peer influence is not linear but curvilinear: it peaks in mid-adolescence and declines during late adolescence and emerging adulthood [93, 94].

As noted earlier, research on cognitive control and self-regulation systems suggests that heightened susceptibility to peer influence in early and middle adolescence compared to late adolescence may be associated with the later maturation of brain regions (e.g., the prefrontal cortex) that enhance the ability to resist negative peer influence, relative to systems more strongly associated with social reward sensitivity.

Overall, contemporary empirical studies on peer socialization have predominantly focused on adolescents and university students, whereas peer influence in adult populations remains underexplored. Most studies confirm that adolescence represents a critical developmental period in which peer influence plays a central role in shaping substance use behaviors.

At the same time, studies involving adult populations primarily focus on romantic partners or marital relationships rather than broader peer networks or friendships. This highlights the importance of selection mechanisms, whereby individuals choose partners with similar behavioral patterns, including substance use.

Additionally, research indicates that in early adulthood, peer influence persists but becomes more differentiated, manifesting through close friendships and romantic relationships, including various forms of social pressure and normative influence. Thus, in adulthood, social influence shifts from broad peer networks toward more intimate social relationships, particularly romantic partnerships [95-97].

Findings from contemporary research on gender differences in susceptibility to peer influence remain mixed. Some studies suggest that boys may be more susceptible to both deviant and normative peer influence, particularly in relation to substance use. In contrast, other studies indicate that girls may exhibit greater conformity, reflected in stronger orientation toward social norms and the behavior of significant others.

However, a substantial number of recent empirical studies have not found statistically significant gender differences in susceptibility to peer influence, especially in adulthood. Where such differences are observed, results suggest that males may demonstrate greater similarity to their friends' behaviors and higher sensitivity to peer influence compared to females.

First, causal models of early alcohol use in adolescents of both sexes indicate a significant role of family factors directly related to substance use, particularly family norms regarding alcohol and maternal prenatal alcohol exposure.

Second, in models specific to girls, a link has been identified between suicidal ideation and early alcohol use.

Third, in the model specific to boys, early alcohol use is associated with individual psychological characteristics such as sensation seeking and negative attitudes toward school.

Overall, contemporary evidence suggests that gender differences in peer influence are context-dependent and may vary according to age, social environment, and the type of behavior under consideration [98-100].

The school context is an important socialization factor that should be considered in relation to adolescent substance use, given that young people spend a substantial proportion of their time in school. Previous research indicates that school climate can be understood through two main dimensions: school organization and classroom climate. School organization is conceptualized as structural components of the school environment, such as student–teacher ratios (i.e., class size), school policies, school location, and staffing levels. In contrast, school climate refers to interpersonal relationships established within the school, such as the quality of student–teacher relationships, classroom atmosphere, and the level of cohesion within classrooms.

Factors related to school organization are assumed to have a more distal effect on student substance use. School organization influences community norms by promoting less tolerant attitudes toward adolescent substance use through school policy and by enabling teachers to provide support and guidance to students regarding health-risk behaviors, based on student–teacher ratios [101].

Classroom climate is considered to have a more direct effect on student substance use. For example, prior studies suggest that positive student–teacher relationships and a more supportive school atmosphere are protective against early initiation of alcohol use and problematic drinking behaviors (e.g., binge drinking). Other studies show that strong emotional attachment to school (i.e., school connectedness, engagement) is a key protective factor against substance use, as adolescents may be more likely to adopt school-based norms and expectations regarding substance use [102].

School connectedness not only reflects the extent to which students feel affiliated with their school, but also includes the value they place on educational goals and their commitment to participation in academic and school-based social activities. Prior research indicates that high levels of school connectedness are associated with lower rates of alcohol, tobacco, and drug use. For example, one study demonstrated that higher behavioral and emotional engagement in school significantly reduced the risk of substance use initiation, as shown through discrete-time survival analysis. Specifically, the likelihood of initiating substance use was approximately one-third lower among students with higher behavioral engagement and 40% lower among those with higher emotional engagement.

Adolescents who feel strongly connected to their school may develop a shared identity with other students and may refrain from substance use in order not to disappoint teachers and peers. In contrast, adolescents who fail to establish strong school bonds are at greater risk of developing antisocial attitudes and behaviors. One indicator of low school engagement that has attracted attention in relation to adolescent substance use is truancy (i.e., unexcused school absences). Prior studies show that truancy is a strong predictor of substance use initiation and involvement.

One mechanism linking truancy to increased substance use is exposure to unstructured, unsupervised, and risk-prone peer environments that arise from being absent from school. Truancy has been shown to be associated both concurrently and prospectively with higher levels of multi-substance use, as well as with greater escalation of substance use after initiation. Another study by the same research group examined school suspension as a predictor of problematic substance use in adolescence and early adulthood. A school suspension risk index was operationalized as the sum of five binary risk indicators derived from official school records: poor academic performance (failing one or more subjects based on standardized test scores), poor attendance (missing 20% or more of school days in a given academic year), failing grades in core subjects, one or more suspensions, and grade repetition.

In mid-adolescence, suspension was positively associated with problematic drug use, but not with problematic alcohol use [103, 104].

In late adolescence, school suspension was positively associated with both problematic drug use and problematic alcohol use. In early adulthood, suspension remained positively associated with problematic drug use. A curvilinear association with problematic alcohol use was also observed in early adulthood, with a relatively modest increase at low levels of suspension followed by a sharp rise at higher levels of suspension. Thus, school suspension represents an early indicator of both short-term and long-term risk for substance use [105, 106].

In summary, these findings are consistent with Hirschi's Social Control Theory (1969), which posits that weak social bonds to conventional institutions (e.g., family and school) increase the likelihood of deviant behavior, including substance use among youth. According to this theory, strong bonds to social institutions function as protective factors, whereas their absence weakens social control over adolescent behavior (Hirschi, 1969).

Adolescence, as a developmental period characterized by an increased need for autonomy, is often accompanied by declining academic engagement and reduced attachment to the school environment, which may weaken the social bonds that inhibit

risk-taking behavior. Such reduced school engagement may have long-term effects that persist into adulthood.

These conclusions also support the Social Development Model (Catalano & Hawkins, 1996), which integrates principles of social control and social learning. According to this model, adolescents develop social bonds through perceived opportunities for involvement, social interactions, skills, and rewards. When these processes occur within antisocial contexts (e.g., negative peer influences or weak attachment to the school community), the likelihood of substance use increases.

Compared with individual factors and other socialization contexts, research on neighborhood influences in the etiology of adolescent substance use is relatively recent. Such studies distinguish between structural characteristics of neighborhoods (e.g., socioeconomic status, poverty levels, residential instability) and social processes within neighborhoods (e.g., cohesion, collective efficacy, and informal social control), which may differentially influence youth behavior.

Empirical evidence shows that adolescents' subjective evaluations of their neighborhood quality (e.g., perceived safety and social cohesion) are generally more strongly and consistently associated with alcohol and drug use than objective structural indicators. This highlights the importance of social processes and perceptions of the environment in understanding substance-related risk behaviors [107-109].

Identifying factors associated with adolescent substance use—particularly during the typical age of onset—is essential for the development and refinement of prevention and intervention programs. Theoretical frameworks such as Bronfenbrenner's Bioecological Model, Social Learning Theory, Social Control Theory, and the Social Development Model emphasize the importance of ecological systems, as well as the role of substance use and attitudes toward substance use among significant others in the etiology of substance use [110].

Attempts to understand adolescent substance use without an ecological perspective are likely to provide an incomplete picture, given that adolescent risk behavior is embedded within multilevel systems. The studies reviewed here indicate that peers and parents typically exert stronger and more proximal influences on

adolescent behavior than other contextual factors. Moreover, these influential figures may act as “gatekeepers” of more distal socialization factors. For example, high levels of parental monitoring may offset the risks associated with living in disadvantaged neighborhoods, whereas deviant peers may offset the protective effects of highly connected schools.

It is also important to note that although adolescents may be particularly sensitive to risk due to the wide range of affective, physical, and cognitive changes occurring during this developmental period, this does not necessarily imply increased vulnerability in all contexts. For instance, previous research suggests that genes are not deterministic, and adolescents considered at elevated risk for substance use based on traditional conceptualizations may actually demonstrate better outcomes than their peers when placed in adaptive environments [109, 111].

Similarly, neurobiological evidence suggests that, contrary to traditional views of adolescent cognitive control as immature, adolescents may in some contexts exhibit more flexible cognitive control systems compared to adults, potentially conferring certain advantages.

From a clinical perspective, this review highlights that more comprehensive approaches focusing on the complex social ecology of adolescents—such as Multidimensional Family Therapy (MDFT)—may be particularly effective in treating adolescent substance use disorders. These multidimensional interventions emphasize the importance of targeting multiple levels of socialization, including parents, peers, schools, and the juvenile justice system. Addressing multiple ecological domains may contribute to the observed effectiveness of MDFT compared with other standard treatments.

Overall, psychosocial risk and protective factors during this critical developmental period play a central role in the initiation of alcohol, cigarette, and marijuana use. A key challenge is to better understand youth motivation for specific behaviors and how adolescent cognitive flexibility can be leveraged to redirect them away from unhealthy behaviors and toward opportunities for learning and the development of healthy lifestyles [112, 113].

### 1.1.3.5 Theoretical Approaches and Models of Psychosocial Prevention of Substance Use Disorders in Different Countries

Psychosocial prevention of substance use disorders (alcoholism, drug addiction) is based on a complex integration of medical, psychological, and sociological theories.

**Main theoretical approaches:**

**1. The biopsychosocial approach (the most widely used worldwide)**

This approach conceptualizes addiction not as a purely medical condition, but as the result of the interaction between biological factors (genetics), psychological characteristics (self-esteem, coping strategies), and the social environment. The biopsychosocial model (BPS) is considered the contemporary "gold standard" in understanding addiction. It rejects a unidimensional view of individuals as simply "sick" or "weak-willed," instead conceptualizing the problem as a complex interplay of three domains.

**1.1 Biological component (the body).** Addiction is understood as a chronic brain disorder. Key factors include genetic predisposition, such as inherited differences in neurotransmitter functioning (e.g., dopamine deficiency); neuroplasticity, whereby psychoactive substances "reprogram" the brain's reward system, making substance use a dominant survival priority; and physiological adaptation, including tolerance and withdrawal symptoms [114].

**1.2 Psychological component (the individual).** This dimension addresses why a person feels the need to alter their state of consciousness: substance use as a means of escaping stress, pain, or anxiety due to insufficient coping skills; low self-esteem or lack of life meaning; beliefs such as "alcohol helps me socialize" or "drugs enhance creativity"; and unresolved experiences of trauma, abuse, or loss in childhood.

**1.3 Social component (the environment).** Individuals do not exist in isolation; their environment shapes behavior. This includes family patterns (e.g., parental substance use becoming normalized), influence from deviant peer groups, availability of substances, economic instability or unemployment, or conversely, a culture of social drinking; and lack of support or absence of belonging to a healthy community.

According to this model, prevention cannot be limited to "lectures about harm." It must be comprehensive: medically (health promotion), psychologically (development of emotional intelligence and stress resilience), and socially (creation of a safe environment and healthy recreational alternatives).

In contrast to fear-based approaches (e.g., lectures about "black lungs"), this approach employs interactive methods such as role-playing (e.g., rehearsing scenarios like "You are offered drugs in a peer group"), brainstorming sessions (identifying alternatives to substance use, such as ways to experience excitement or relaxation), and structured training programs (step-by-step practice of social responses). Life skills and soft skills are universal competencies that help individuals not only avoid addiction but also achieve success in their careers and personal lives.

**3. Harm Reduction Approach**

The harm reduction approach is widely implemented in European countries such as Portugal and the Netherlands. Instead of focusing on total abstinence or prohibition, it prioritizes reducing the negative health and social consequences of substance use. This approach is considered both pragmatic and humanitarian. Its core philosophy is that if substance use cannot be fully eliminated in the short term, efforts should focus on preventing death, infectious disease transmission, and social exclusion.

**4. Paradigm Shift: From Punishment to Support**

Within this framework, the substance user is viewed as a client rather than a criminal. Instead of incarceration for drug use, individuals are offered medical and social services. Assistance is provided without requiring immediate abstinence, which enables engagement with hard-to-reach populations.

**5. Key Instruments and Interventions**

**Opioid Agonist Therapy (OAT) programs:** These involve the supervised use of medical substances such as methadone or buprenorphine. OAT allows individuals to discontinue illicit drug use, reduce injection-related risks, and reintegrate into work and family life.

**Needle and syringe exchange programs:** These interventions aim to prevent HIV/AIDS and hepatitis B and C transmission.

**Supervised consumption facilities:** These are controlled environments where individuals can use substances under medical supervision, reducing the risk of overdose deaths (e.g., through timely administration of naloxone).

**Drug checking services:** These services analyze the chemical composition of substances at festivals or nightlife settings to prevent poisoning from adulterants [117, 118].

**6. Reduction of Crime Rates**

When individuals receive treatment, they are less likely to engage in criminal behavior (e.g., theft) to obtain drugs on the illicit market.

**7. Economic Benefits**

From a cost-effectiveness perspective, it is less expensive for governments to fund syringe exchange programs than to treat HIV infections or maintain incarceration systems.

**8. Destigmatization**

Reducing social stigma encourages individuals to seek help earlier and more frequently.

**International Examples**

**The Netherlands:** One of the first countries to introduce needle exchange programs in the 1980s, with a policy focus on distinguishing between “soft” and “hard” drugs.

**Portugal:** In 2001, Portugal decriminalized possession of all drugs for personal use. This led to a significant reduction in overdose deaths and new HIV infections.

Importantly, harm reduction does not exclude treatment; rather, it serves as a bridge toward recovery. Many participants in such programs eventually transition to full rehabilitation [119, 120].

**9. Risk and Protective Factor Model**

This model focuses on minimizing risk factors (e.g., family dysfunction, peer pressure) and strengthening protective factors (e.g., school support, hobbies). It is based on a “balance scale” principle: prevention aims to reduce the weight of risk factors while increasing protective influences.

**Risk factors** (forces that increase vulnerability to addiction) are categorized as follows:

- **Individual level:** genetic vulnerability, childhood aggression, psychological trauma, early substance initiation.
- **Family level:** conflict, lack of emotional attachment, permissive parental attitudes toward alcohol, or parental substance use.
- **Social level (school/peers):** association with substance-using peers, academic failure, bullying.
- **Macro-environmental level:** availability of cheap alcohol and tobacco, advertising exposure, low socioeconomic conditions.

**Protective factors** (buffers against addiction) include high cognitive ability, strong self-control, life goals and hobbies, a stable emotional bond with at least one parent, teacher support, and involvement in prosocial activities such as sports and volunteering.

**10. Substance Use Prevention in Ukraine**

Ukraine is gradually transitioning from a post-Soviet punitive model—focused primarily on surveillance and deterrence—to a combination of internationally recognized evidence-based practices.

**11. Harm Reduction in Ukraine**

Harm reduction programs, including opioid agonist therapy (OAT) and syringe exchange initiatives, are actively implemented in Ukraine and funded by both the state and international organizations (e.g., the Public Health Alliance). This represents one of the most structured and scientifically grounded prevention approaches in the country. Its success is largely due to the transition from purely NGO-driven initiatives to state-level financing through the Public Health Center of the Ministry of Health of Ukraine [121-122].

**12. Opioid Agonist Therapy (OAT)**

Medications such as methadone and buprenorphine are administered legally under medical supervision. This reduces the need for illicit drug procurement, eliminates associated criminal activity, and decreases the risk of overdose from

contaminated substances. Patients can reintegrate into society, maintain employment, and receive co-treatment (e.g., antiretroviral therapy for HIV).

**13. Needle Exchange and Counseling Programs**

Ukraine has one of the highest HIV/AIDS prevalence rates in Eastern Europe. Providing sterile injecting equipment is not considered facilitation of drug use, but rather a critical barrier to epidemic spread.

**14. Outreach Work**

Outreach social workers directly engage with drug-using populations in their environments. This approach enables support for individuals who would otherwise not access formal healthcare services.

**15. Role of the Public Health Alliance and the Global Fund**

International donors have enabled Ukraine to implement innovations such as HIV self-testing and naloxone distribution to people who use drugs. The civil sector has also contributed to legislative changes that frame addiction as a medical condition rather than a criminal offense.

In the context of the Ukrainian harm reduction model, it is important to emphasize the synergy between medicine (pharmacotherapy), psychology (psychosocial support), and sociology (community-based interventions). This represents an optimal example of how the biopsychosocial approach is implemented in practice through concrete intervention tools.

In secondary education institutions, the basic instrument is the “Health Basics” course and elective programs approved by the Institute for the Modernization of Educational Content (IMEC) for the 2024/2025 academic year [123].

The “Peer-to-Peer” program is one of the most sustainable approaches, in which trained adolescent peer educators transmit knowledge to their peers. This minimizes psychological barriers and increases trust in information related to healthy lifestyles and risk behavior prevention.

Life skills development courses are aimed at fostering assertiveness (the ability to say “no”), critical thinking, and stress management abilities.

In light of wartime challenges, addiction prevention is being integrated into the national mental health program “How Are You?”. The 2030 Strategy for Drug Policy emphasizes destigmatization and the expansion of access to psychosocial care [124, 125].

Rehabilitation services are developing through a network of private and state institutions operating within the biopsychosocial model, including 12-step programs and therapeutic communities.

The use of volunteering and sports as alternatives to psychoactive substance use represents a classic application of the protective factors model. In the scientific literature, this is referred to as positive prevention. Sport does not merely “occupy time”; it directly influences mechanisms associated with addiction. Physical activity stimulates the release of endorphins, dopamine, and serotonin, producing natural feelings of pleasure and reward and thereby reducing the need for chemical stimulation. Sport provides a legitimate outlet for adrenaline discharge and the release of muscular tension accumulated during adolescent developmental crises. A structured training regimen also strengthens volitional control and locus of control. Adolescents who observe physical progress are less likely to engage in self-destructive behaviors involving substances.

Volunteer activity addresses fundamental psychological needs that adolescents often attempt to satisfy in deviant peer groups. By helping others, adolescents gain the status of a “useful person” and receive positive social reinforcement, which fosters healthy self-esteem. Engagement in real-world problem-solving (animal welfare, environmental protection, support for veterans) reduces existential emptiness that is often filled by substance use. Volunteer environments also serve as inherently “healthy” reference groups in which substance use is not normalized.

The “Icelandic Model” is one of the most successful examples worldwide. In the 1990s, Iceland had the highest adolescent alcohol use rate in Europe. The government introduced free sports and arts participation vouchers for every adolescent. Over 20 years, alcohol use declined from 42% to 5%.

In the Ukrainian context, volunteering has become part of national identity. Programs such as “Building Ukraine Together” (BUR) and youth centers operate on the principle of active engagement, providing adolescents with a sense of drive and belonging—powerful protective factors against addiction [126-129].

**Conclusions**

1. Chemical addictions are a complex, multidimensional phenomenon encompassing both substance use disorders and behavioral addictions. Contemporary scientific understanding is based on an integrated framework combining neurobiological, psychological, and social approaches, emphasizing dysregulation of the brain’s reward system, loss of control, and compulsive behavioral patterns.

2. Modern classification and conceptualization of addiction are dynamic and continuously evolving under the influence of new empirical findings that expand the boundaries of the concept of addiction. Despite differences among types of addictions, they share common clinical features (tolerance, withdrawal, relapse, and impaired social functioning), which underscores the need for a comprehensive approach to diagnosis, prevention, and treatment.

3. Adolescence is a critical developmental period for the emergence of risk behaviors and chemical addictions due to the interaction of neurobiological immaturity (an imbalance between heightened limbic system activity and still-developing prefrontal control systems) and social factors. Empirical data indicate a high prevalence of psychoactive substance use among adolescents: approximately 40–50% report lifetime use of electronic cigarettes, around 14% report episodes of binge drinking, and approximately 20% have experimented with illicit drugs. This confirms that early initiation of substance use significantly increases the risk of later addiction development.

4. In Ukraine during 2024–2025, an additional key risk factor is war-related stress, which transforms substance use motivation into a mechanism of self-medication and escapism. Adolescents with low psychological well-being (WHO-5 index < 50) are 2.5 times more likely to experiment with synthetic drugs. The combined effects of social instability, loss of social ties, and elevated anxiety contribute to faster addiction

development (3–4 times faster than in adults) and increase the role of psychoactive substances as a maladaptive coping strategy.

5. The bioecological approach explains adolescent addictive behavior as the result of interactions between social contexts (family, peers, school, society) and individual biological characteristics that determine vulnerability to risk behavior, highlighting the interplay of genetic and environmental influences, social learning, and neurobiological mechanisms in substance use. This provides a comprehensive explanation of both risk and protective factors in adolescence.