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Review Article

Breaking The Cycle; The Journey from Drug Addiction to Abuse

Viraj Gadekar*, Samrudhi Bendre, Shruti Talole, Aditya Shedale

PIMS, College of Pharmaceutical Sciences, Loni (DU).

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ABSTRACT

Drug abuse and addiction are problems that affect people everywhere and have been part of human life for thousands of years. This article explains how a person moves from trying drugs for the first time to becoming addicted, and why this cycle is so hard to break. At first, drug use often begins with curiosity, peer pressure, or the desire to escape stress and sadness. In the beginning, it may look harmless, and the person feels they are in control. But drugs change the brain's reward system. They release chemicals like dopamine, which make the person feel pleasure. The brain quickly learns to connect drugs with happiness, and this makes the person want to use them again. When drug use becomes regular, it turns into abuse. Abuse means using drugs in a way that starts to cause problems in daily life. A student may stop focusing on studies, or a worker may miss work. Families may notice mood swings, secrecy, or changes in behaviour. At this stage, the brain's ability to make good decisions becomes weaker, and it is harder to resist cravings. Over time, abuse develops into addiction. Addiction means drug use becomes compulsive the person feels they must use drugs even if it harms their health, relationships, or career. Normal pleasures like hobbies or friendships no longer feel rewarding. The person becomes trapped in a cycle of craving, using, withdrawal, and relapse. The article also looks at the history of drug use. In ancient times, substances like opium, cannabis, and soma were used in medicine and rituals, but misuse was already seen as dangerous. In the empiric era, drugs like laudanum and coca leaves were widely available, and dependence often developed without people realizing it. The industrial era brought stronger drugs like morphine and cocaine, which were praised as medical miracles but soon led to widespread addiction. Finally, the patient care era marked a big change, as addiction began to be treated as a health condition rather than a crime. Breaking the cycle of addiction is not easy. It requires more than just stopping drug use. Effective recovery includes medical treatment, therapies like Cognitive Behavioural Therapy (CBT), medicines such as methadone or buprenorphine, and strong support from family and community. Prevention is also very important. Teaching young people about the risks of drugs, reducing stigma, and promoting healthy coping

*Corresponding Author: Viraj Gadekar

Address: PIMS, College of Pharmaceutical Sciences, Loni (DU).

Email : virajgadekar28@gmail.com

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skills can stop many from entering the cycle. Harm reduction strategies, like needle exchange programs, also save lives.

INTRODUCTION

Drug abuse and addiction are problems that affect millions of people around the world. The path from trying drugs for the first time to becoming addicted is not something that happens overnight. It is a slow process, shaped by many things like the brain, emotions, family, friends, and society. To understand how to stop this cycle, we first need to see how it begins and why it is so hard to break. Experts agree that addiction is not just about weak willpower or bad choices. It is a health condition that changes the brain and makes it very difficult for a person to stop using drugs, even when they want to.[1] The journey often starts with experimentation. A person may try drugs out of curiosity, because of peer pressure, or to escape stress and sadness. At this stage, it may feel harmless. The person thinks they are in control. But drugs affect the brain's reward system. They release a chemical called dopamine, which creates strong feelings of pleasure. even small amounts of drugs can "teach" the brain to connect drugs with happiness. This makes the person want to try them again.[2] When drug use becomes more regular, it turns into abuse. Abuse means using drugs in a way that starts to cause problems in life. A student may stop focusing on studies, or a worker may miss work. Families may notice mood swings, secrecy, or changes in behaviour. At this stage, the brain's control system starts to weaken. The part of the brain that helps us make good decisions and control impulses becomes weaker with repeated drug use. This makes it harder to say "no" to cravings, even when the person knows drugs are harmful.[3] The next stage is addiction. Addiction is when drug use becomes compulsive. The person feels a strong need to use drugs again, even if it destroys health, relationships, or career. addiction as a chronic brain disorder where people continue

to use drugs despite harmful consequences. At this stage, the brain is hijacked. Normal pleasures like hobbies, friendships, or achievements no longer feel rewarding. The person becomes trapped in a cycle: craving, using, feeling withdrawal, and then using again to feel better. Withdrawal symptoms like anxiety, sadness, or physical pain make it even harder to stop.[4] Breaking this cycle is not easy. It requires more than just stopping drugs. It means treating the brain, the mind, and the social environment together. Therapies like Cognitive Behavioural Therapy (CBT) help people change negative thoughts and learn healthier ways to cope with stress.[5] Medicines like methadone or buprenorphine can help people addicted to opioids by reducing cravings and stabilizing brain chemistry.[1] Support from family, friends, and community programs is also very important. Recovery is not only about stopping drugs but also about building a meaningful life that makes relapse less likely.[6] Addiction is also shaped by social and cultural factors. Poverty, unemployment, family problems, and living in environments where drug use is common all increase the risk. On the other hand, strong family support, good education, and access to healthcare protect people from falling into addiction drug use cannot be understood without looking at the society around the person. This means that breaking the cycle is not only about treating individuals but also about improving communities.[7] Recovery is a lifelong journey. Relapse returning to drug use after a period of stopping is common. But relapse does not mean failure. Just like other long-term illnesses such as diabetes or asthma, addiction needs ongoing care and management. Treatment works best when it is long-term and addresses medical, psychological, and social needs together.[1] Prevention is also very important. Teaching young people about the risks of drugs, reducing stigma around seeking help, and promoting healthy coping skills can stop



many people from ever entering the cycle. Harm reduction strategies, such as needle exchange programs or safe consumption spaces, also save lives and give people a chance to recover. These strategies accept that while not everyone can quit immediately, reducing harm is a step toward breaking the cycle.[8] In simple terms, the journey from drug abuse to addiction is like falling into a trap. At first, it may feel like a choice, but slowly the brain and body become dependent. The good news is that this cycle can be broken. With the right mix of medical treatment, therapy, family support, and community care, people can recover and live meaningful lives. Addiction is not the end of the story; it is a challenge that can be overcome with compassion, science, and support. The history of drug abuse and addiction shows how substances moved from traditional use to widespread harm. Ancient cultures used opium, cannabis, and coca for medicine and rituals. With trade and colonization, these drugs spread globally, and in the 19th century many were sold in tonics, leading to hidden addictions. Governments later passed control laws, but for decades addiction was treated as a crime, creating stigma and suffering. Modern science shows addiction changes the brain, so treatment and prevention work better than punishment. Each era's main drugs—heroin, cocaine, crack, opioids—reflect social conditions. History helps us avoid old mistakes and support recovery.

1. History of Drug abuse to addiction: Drug abuse is not just a problem of modern times; it has been part of human history since prehistoric days. From the earliest civilizations, people discovered plants and natural substances that could change the way they felt or thought. While some of these were used for healing or in religious rituals, others were misused for pleasure or escape, leading to harmful effects. This shows that the struggle with drug abuse is not new—it has been a continuous

challenge for societies across different eras, only changing in form as new substances and technologies appeared.

1.1 Drug addiction in ancient era: Drug abuse and addiction are often seen as modern problems, but history shows that they have been part of human life since the earliest civilizations. Ancient societies discovered plants and natural substances that could heal, inspire, or alter the mind. While many of these substances were used for medicine and religion, they were also misused, leading to patterns of dependence that resemble what we now call addiction. By looking at the ancient world, we can see how drug use was woven into culture, spirituality, and daily life, and how the dangers of misuse were already recognized thousands of years ago. In prehistoric and early ancient societies, psychoactive plants were often linked to religion and healing. Archaeological evidence shows that humans used opium poppies, cannabis, and fermented drinks as early as 5000 BCE. These substances were not only medicines but also tools for connecting with the divine. For example, in the **Rigveda**, an ancient Indian text (1500–500 BCE), the drink *soma* was described as both a god and a sacred plant-based elixir. It was consumed in rituals to achieve altered states of consciousness and was believed to grant immortality or divine insight.[9] While *soma* was revered, its intoxicating effects also reveal how early societies blurred the line between sacred use and potential misuse. The repeated need for such substances in rituals shows an early form of dependence—not necessarily addiction in the modern medical sense, but a cultural reliance on drugs to achieve spiritual experiences. In Mesopotamia, clay tablets from around 3000 BCE mention the use of opium, cannabis, and mandrake for both healing and pleasure. The Sumerians even called the opium poppy the “joy plant,” suggesting awareness of its euphoric effects. Egyptian medical papyri, such as



the **Ebers Papyrus** (c. 1550 BCE), list hundreds of remedies, many involving psychoactive plants. Opium was used to calm children, relieve pain, and induce sleep. However, ancient texts also hint at the dangers of overuse. Egyptian society recognized that excessive reliance on intoxicants could lead to moral and physical decline. This awareness shows that even in the ancient world, people understood the risks of drug misuse, even if they lacked the scientific language of “addiction.” In classical Greece, drugs were part of both medicine and leisure. Physicians like **Hippocrates** (c. 460–370 BCE) recommended opium for pain relief, while **Dioscorides** (1st century CE) described hundreds of medicinal plants in his *De Materia Medica*, including cannabis and opium. These texts became the foundation of pharmacy for centuries. But alongside medical use, there was also abuse. In Greek and Roman society, wine was central to daily life and religious festivals. While moderate drinking was socially accepted, excessive drinking was criticized by philosophers like Plato and Aristotle, who linked it to loss of self-control. Roman writers such as Seneca and Pliny the Elder also warned about the dangers of overindulgence in both alcohol and opium [10]. The recognition of compulsive behaviour—people unable to stop drinking or using drugs despite harm—shows that the ancients observed patterns like modern addiction. They may not have had the scientific framework of brain chemistry, but they understood the social and personal damage caused by substance abuse.

In India, beyond soma, other substances like cannabis (*bhang*) were used in religious rituals and Ayurvedic medicine. Cannabis was believed to aid meditation, relieve pain, and bring spiritual insight. Yet, texts also warned against overuse, noting that it could cloud the mind and weaken the body. In ancient China, the use of psychoactive

substances was tied to both medicine and Taoist practices. Early texts like the *Shennong Bencao Jing* (c. 200 CE) described cannabis and opium as medicinal plants. Taoist alchemists experimented with psychoactive herbs to achieve immortality or altered states. However, misuse was recognized: some Taoist writings warned that overindulgence in such substances could harm health and shorten life.[9] Although the word “addiction” did not exist in the ancient world, the concept of being enslaved by substances was present. Ancient writers described people who could not control their drinking, who sought out opium or cannabis repeatedly, or who suffered when deprived of these substances. In Rome, the Latin word *addictus* originally referred to someone bound to a creditor, but it later came to describe people bound by habits or substances. This shows that ancient societies recognized the compulsive nature of drug use. They may have explained it in moral or spiritual terms weakness of will, loss of virtue, or punishment from the gods but the underlying pattern of dependence was clear. Drug abuse in the ancient era was not only a personal issue but also a social one. Excessive drinking in Greece and Rome was linked to disorderly behaviour, violence, and decline in civic responsibility. In Egypt and Mesopotamia, misuse of opium or alcohol was seen as a threat to family and community stability. Religious authorities often tried to regulate or ritualize drug use, turning it into something sacred to prevent uncontrolled abuse. This tension between controlled, ritual use and uncontrolled, harmful use is a theme that runs throughout history. It shows that societies have always struggled to balance the benefits of drugs with their dangers.

1.2. Drug addiction in empiric era: The empiric era, which broadly refers to the period before the rise of modern scientific medicine in the late 19th and early 20th centuries, drug use was largely



guided by trial-and-error practices, traditional remedies, and anecdotal evidence rather than systematic research. Substances such as opium, coca leaves, cannabis, and alcohol were widely used for both medicinal and recreational purposes. Physicians and healers prescribed these drugs to relieve pain, reduce anxiety, or treat common illnesses, but they lacked a clear understanding of the long-term consequences. For example, opium was praised as a “divine medicine” in many cultures, yet its addictive potential was not fully recognized until much later [11]. This lack of awareness meant that drug abuse often began innocently, with patients or users consuming substances for relief, only to find themselves dependent over time. The transition from drug use to abuse in the empiric era was often subtle. People initially consumed drugs in small, controlled amounts, but tolerance developed quickly. Tolerance meant that the body required larger doses to achieve the same effect, leading to repeated use. Without modern diagnostic tools or knowledge of neurobiology, early physicians could not explain why patients craved these substances or why withdrawal symptoms occurred when use stopped. Instead, they often attributed such behaviours to moral weakness or lack of discipline. This moral framing stigmatized users and prevented the development of effective treatments [12]. Early diagnostic approaches to adolescent drug abuse were rudimentary and often failed to distinguish between casual use and pathological dependence. Another important factor in the empiric era was the social and cultural acceptance of certain drugs. Alcohol, for instance, was deeply embedded in rituals, celebrations, and daily life across many societies. Similarly, coca leaves were chewed in South America for stamina, and cannabis was used in India for spiritual and medicinal purposes. Because these substances were normalized, their harmful effects were often overlooked. Abuse became visible only when individuals displayed

severe behavioural changes, health deterioration, or social decline. Historical accounts show that opium dens in China and laudanum use in Europe became symbols of widespread addiction, yet governments and medical authorities struggled to respond effectively [13]. The empiric era also marked the beginning of attempts to study addiction scientifically, though knowledge remained limited. Early medical journals documented cases of patients who could not stop using morphine or alcohol despite harmful consequences. These observations laid the groundwork for later scientific definitions of addiction. For example, the U.S. Surgeon General’s early reports in the 19th century described “inebriety” as a disease rather than a vice, signalling a shift from moral judgment to medical recognition [1]. However, treatments remained primitive, often involving isolation, religious counselling, or abrupt withdrawal, which could be dangerous and ineffective. The consequences of drug abuse in the empiric era were severe. Health problems such as liver disease from alcohol, respiratory issues from opium, and malnutrition from chronic use were common. Socially, individuals faced stigma, unemployment, and family breakdown. Economically, communities suffered as productivity declined, and resources were drained by the costs of supporting addicted individuals. A recent empirical analysis highlights how these same patterns of financial strain, health deterioration, and social disintegration remain central to understanding addiction today [14]. This continuity shows that while our scientific understanding has advanced, the human and social costs of addiction have deep historical roots. One of the most striking aspects of the empiric era was the lack of regulation. Drugs were freely available in pharmacies, markets, and even household remedies. Laudanum, a mixture of opium and alcohol, was sold over the counter in Europe and



used by both adults and children. Cocaine was included in tonics and beverages, most famously in the original formula of Coca-Cola. Because these substances were marketed as safe and beneficial, people consumed them without suspicion. Only after widespread abuse and visible social harm did governments begin to impose restrictions, such as the Opium Acts in Britain and the Harrison Narcotics Tax Act in the United States. These early laws marked the beginning of modern drug control policies, but they also reflected the slow recognition of addiction as a public health issue rather than merely a personal failing.

Drug abuse in the empiric era was shaped by limited medical knowledge, cultural acceptance, and the absence of regulation. What began as

legitimate use of substances for relief or ritual often escalated into abuse due to tolerance, dependence, and lack of awareness about long-term effects. Addiction in this period was poorly understood, frequently stigmatized, and inadequately treated. Yet, the observations and case studies from this era laid the foundation for modern addiction science. Today, with advances in neuroscience and psychology, we understand that addiction is a chronic brain disease influenced by biological, psychological, and social factors. Looking back at the empiric era reminds us how far we have come in recognizing addiction as a medical condition, while also showing that the challenges of drug abuse—health decline, social disruption, and economic burden—have remained consistent across history.

Tab no 1.1 different addictive substances and their perceived benefits, harms and risks during empiric era

Substance	Goods (perceived benefits)	Bads (harms and risks)
Opium	- Widely used as a pain reliever and sedative. - Prescribed for cough, diarrhoea, and insomnia. - Considered a “divine medicine” in many cultures. - Used in laudanum (opium + alcohol) as a household remedy in Europe.	- Highly addictive, with tolerance developing quickly - Withdrawal symptoms poorly understood - Caused respiratory depression and overdose deaths - Social decline linked to opium dens (esp. in China).
Cannabis	- Used in India and Middle East for spiritual rituals and relaxation - Medicinal use for pain, digestive issues, and as an appetite stimulant - Sometimes used as an anaesthetic in folk medicine.	- Overuse linked to impaired memory, judgment, and coordination. - Stigmatized as causing laziness or “madness” in some colonial accounts - Lack of dosage control led to unpredictable effects.
Coca Leaves	- Chewed by Andean populations for energy, stamina, and altitude sickness relief - Helped reduce hunger and fatigue during labor - Considered a sacred plant in indigenous rituals.	- When processed into cocaine (19th century), led to addiction and health damage - Overuse caused insomnia, agitation, and heart strain - Misuse in tonics and beverages (e.g., early Coca-Cola) spread dependence.
Cocaine	- Used as a local anesthetic in 19th-century medicine (especially in eye and dental surgery) - Believed to increase energy, alertness, and confidence - Marketed in tonics and beverages (e.g., early Coca-Cola) as a “health booster - Used to treat morphine addiction and depression.	- Highly addictive, with rapid tolerance and dependence - Caused insomnia, paranoia, agitation, and cardiovascular strain - Overuse led to malnutrition, weight loss, and social decline - Later linked to severe health damage when refined into crack cocaine.

Alcohol	- Widely used for social bonding, rituals, and celebrations - Served as a pain reliever, disinfectant, and sedative - Considered a safe household remedy for colds, digestion, and sleep - Provided calories and was safer than contaminated water in some regions.	- Addictive, with withdrawal symptoms (delirium tremens, seizures) - Long-term use caused liver disease, heart problems, and brain damage - Associated with violence, accidents, and family breakdown - Social stigma and moral condemnation of “drunkenness.”
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1.3. Drug addiction in industrial era: The industrial era, roughly from the late 18th century to the early 20th century, was a period of massive change. Factories, cities, and new technologies transformed daily life. Alongside these changes came new patterns of drug use. People worked long hours in difficult conditions, and many turned to substances for relief, energy, or escape. At the same time, advances in chemistry and medicine made drugs more widely available in stronger, purer forms. For example, morphine was isolated from opium in the early 19th century, and cocaine was extracted from coca leaves in the mid-19th century. These scientific breakthroughs were celebrated as medical miracles, but their addictive potential was not fully understood.[11]

Opium and its derivatives were among the most widely used drugs of the industrial era. Opium had been used for centuries, but in the 19th century it became more concentrated and accessible. Morphine, named after Morpheus, the Greek god of sleep, was used to treat pain, cough, and diarrhoea. During the American Civil War, morphine was given to thousands of soldiers, leading to what was later called “soldier’s disease,” a wave of morphine addiction among veterans.[13] Laudanum, a mixture of opium and alcohol, was sold over the counter in Europe and used by both adults and children. While these drugs provided real relief, they also created dependence, with users experiencing withdrawal symptoms when they tried to stop. Cocaine followed a similar path. For centuries, coca leaves

had been chewed safely by indigenous people in South America. But when cocaine was isolated in the 19th century, it became a powerful stimulant. Doctors prescribed it for depression, fatigue, and even morphine addiction. Sigmund Freud famously praised cocaine as a “magical drug” in the 1880s. It was also added to tonics and beverages, including the original formula of Coca-Cola. At first, cocaine was seen as a wonder drug, but soon reports of paranoia, hallucinations, and compulsive use appeared in medical journals. By the early 20th century, cocaine addiction was recognized as a serious problem.[1] Alcohol was another major substance of abuse in the industrial era. Drinking was deeply embedded in social life, but industrialization changed patterns of consumption. Cheap distilled spirits like gin and whiskey became widely available in urban centres. Workers often drank to cope with long hours and poor conditions. Excessive drinking led to health problems, family breakdown, and workplace accidents. The social costs of alcohol abuse gave rise to the temperance movement, which called for moderation or prohibition. By the early 20th century, countries like the United States introduced prohibition laws, though these were later repealed due to unintended consequences such as black markets and organized crime.[15] Tobacco also spread rapidly during the industrial era. Cigarettes, made possible by new rolling machines, became cheap and popular. Smoking was marketed as modern and fashionable, and soldiers in wars were often supplied with cigarettes. While tobacco was not immediately



recognized as addictive, by the late 19th century doctors began to notice links between smoking and health problems. Still, it remained socially acceptable, and its addictive nature was underestimated until much later.[16] The industrial era also saw the beginning of modern drug regulation. As addiction became more visible, governments and medical authorities began to act. In Britain, the Opium Acts of the 19th century restricted sales. In the United States, the Harrison Narcotics Tax Act of 1914 regulated opiates and cocaine, marking the start of federal drug control. These laws reflected a growing recognition that drug abuse was not just a personal failing but a public health issue. At the same time, addiction began to be studied scientifically. Early psychiatrists and physicians debated whether it was a disease, a moral weakness, or a social problem. This debate laid the foundation for modern addiction science.[17] The consequences of drug abuse in the industrial era were severe. Health problems included liver disease from alcohol, lung damage from tobacco, and overdose deaths from opiates. Socially, addiction led to unemployment, poverty, and family disruption. Economically, communities bore the costs of lost productivity and increased healthcare needs. These patterns were documented in early public health studies, which showed that drug abuse was not just an individual issue but a societal burden.[15] The industrial era also highlighted the global dimension of drug trade, as colonial powers profited from opium in Asia and tobacco in the Americas, spreading addiction worldwide. The industrial era transformed drug use into a modern social and medical problem. Scientific advances made drugs more powerful and accessible, while industrial life created new pressures that encouraged their use. What began as medical treatments or social habits often escalated into abuse and addiction. The harms health decline, social disruption, and economic costs became

increasingly visible, leading to the first drug control laws and the beginnings of addiction science. Looking back, the industrial era shows how technological progress and social change can unintentionally fuel addiction, a lesson that remains relevant today as we face new challenges with synthetic drugs and opioids.

Tab 1.2 Preparation of morphine in industrial era.

Step	Process / Stage	Explanation
1	Opium Poppy	The opium poppy was cultivated as the raw material. Its seed pods contain a milky latex rich in alkaloids.
2	Harvesting of Opium Latex	Farmers made small cuts in the poppy pods to collect the sticky latex, which dried into raw opium.
3	Crude Opium Extract	This raw opium was used directly in traditional medicine for pain, cough, and diarrhoea, but it was impure and variable in strength.
4	Isolation of Morphine (1805)	Friedrich Sertürner, a German pharmacist, successfully isolated morphine as the first pure alkaloid from opium, marking a breakthrough in chemistry.
5	Industrial Refinement	With industrial chemistry, morphine could be purified and mass-produced, making it widely available to doctors and hospitals.
6	Medical Applications	Morphine revolutionized medicine: it was used for pain relief in surgery, for war injuries, and to treat cough and diarrhoea. It was considered a “wonder drug.”
7	Consequences	Widespread use led to addiction, tolerance, and withdrawal symptoms. Many soldiers after the U.S. Civil War developed



		“Soldier’s Disease” (morphine dependence).
8	Regulation & Control	The harms led to early narcotics laws, such as the Harrison Narcotics Tax Act (1914, USA), which marked the beginning of modern drug regulation.

1.4. Drug addiction in patient care era: The patient care era represents a turning point in the history of drug addiction. Earlier periods, such as the empiric and industrial eras, saw drugs like opium, morphine, cocaine, and alcohol used widely with little understanding of their addictive potential. By the mid-20th century, however, the devastating social and health consequences of addiction were undeniable. Governments, medical professionals, and communities began to recognize that addiction was not simply a matter of weak will or criminal behaviour but a complex health condition requiring structured care. This recognition gave rise to what we now call the patient care era, where treatment, rehabilitation, and patient-cantered approaches became central.

One of the most important changes in this era was the medicalization of addiction. Research in neuroscience and psychology demonstrated that substance use disorders are chronic, relapsing conditions that alter brain chemistry and behaviour. Addiction as a “chronic, relapsing brain disease characterized by compulsive drug seeking and use despite harmful consequences” [1] This definition helped shift the focus from punishment to treatment. Hospitals, clinics, and rehabilitation centres began to develop specialized programs to help patients recover, much like treatment for diabetes or hypertension. In the patient care era, patient-cantered care became a guiding principle. This approach emphasizes treating individuals with dignity, involving them in decisions about their treatment, and tailoring care to their unique needs. A scoping review published in *BMJ Open*

highlights that patient-cantered care in addiction treatment improves outcomes by fostering trust, reducing stigma, and encouraging long-term engagement.[18] Instead of one-size-fits-all solutions, treatment plans began to include a mix of medical, psychological, and social support tailored to each patient. Another hallmark of this era is the integration of addiction treatment into mainstream healthcare. In earlier times, people with substance use disorders were often excluded from hospitals or treated in isolation. Today, addiction medicine is recognized as a medical specialty, and treatment is increasingly offered alongside other healthcare services. However, challenges remain. people who inject drugs still face structural stigma in inpatient care, which can discourage them from seeking help and worsen health outcomes [19]. Overcoming stigma remains one of the biggest tasks of the patient care era. Treatment methods also evolved significantly. Medication-assisted treatment (MAT) became a cornerstone of care. Drugs like methadone, buprenorphine, and naltrexone are now used to manage opioid addiction by reducing cravings and withdrawal symptoms. These medications, when combined with counselling and behavioural therapies, have been shown to improve recovery rates and reduce overdose deaths. Similarly, nicotine replacement therapies and medications like varenicline are used to help people quit tobacco, while disulfiram and acamprosate are prescribed for alcohol dependence. The use of medications reflects the recognition that addiction is a medical condition requiring medical solutions. Alongside medications, psychological and social interventions play a vital role. Cognitive-behavioural therapy (CBT), motivational interviewing, and contingency management are widely used to help patients change their behaviour and cope with triggers. Support groups such as Alcoholics Anonymous (AA) and Narcotics Anonymous (NA) provide



peer support and community, which are crucial for long-term recovery. Rehabilitation centres often combine medical treatment with vocational training, family therapy, and social reintegration programs, recognizing that addiction affects every aspect of a person's life. The patient care era also emphasizes harm reduction. Instead of focusing only on abstinence, harm reduction strategies aim to minimize the negative consequences of drug use. Examples include needle exchange programs, supervised injection sites, and distribution of naloxone to reverse opioid overdoses. These measures save lives and reduce the spread of infectious diseases like HIV and hepatitis C. While harm reduction has sometimes been controversial, evidence shows it is effective in improving public health outcomes.[20] Despite these advances, the patient care era faces significant challenges. Access to treatment remains uneven, especially in low- and middle-income countries. A review of rehabilitation and medical care in India highlights gaps such as inadequate facilities, lack of trained professionals, and persistent stigma [21]. Even in high-income countries, many people with substance use disorders do not receive adequate care due to cost, stigma, or lack of integration between addiction services and general healthcare. Structural stigma within hospitals continues to discourage patients from seeking help, leading to delayed treatment and worse outcomes. Another challenge is the opioid crisis, particularly in North America. The widespread prescription of opioid painkillers in the late 20th century led to a surge in addiction and overdose deaths. This crisis has tested the capacity of the patient care model, highlighting the need for better prescribing practices, expanded access to MAT, and stronger public health responses. The crisis also underscores the importance of viewing addiction as a systemic issue involving healthcare, policy, and society, not just individual behaviour. The patient care era also recognizes the importance of

addressing co-occurring conditions. Many people with substance use disorders also suffer from mental health issues such as depression, anxiety, or post-traumatic stress disorder. Integrated treatment that addresses both addiction and mental health is now considered best practice. This holistic approach reflects the understanding that addiction is not an isolated problem but part of a broader web of health and social challenges. Drug addiction in the patient care era is understood as a chronic medical condition that requires comprehensive, patient-centered treatment. Advances in neuroscience, medicine, and psychology have transformed how addiction is treated, moving away from punishment and stigma toward rehabilitation and integration into mainstream healthcare. Medications, therapies, harm reduction, and support systems all play a role in helping patients recover. Yet, challenges such as stigma, unequal access, and the opioid crisis remind us that the work is far from finished. The patient care era represents progress, but it also calls for continued commitment to treating addiction with compassion, science, and equity.

2. Classification of addictive drugs: Drug addiction is a big problem in today's world. Addictive drugs are substances that change the way the brain works. They can make a person feel happy, relaxed, or full of energy, but they also cause harm and can make people dependent on them. Once someone starts using these drugs often, it becomes very hard to stop, even when they know it is dangerous. To study them better, scientists and doctors put addictive drugs into different groups. These groups are based on how the drugs affect the brain and body. The main groups include stimulants, depressants, opioids, hallucinogens, dissociative, cannabis, and inhalants. Each group has its own effects and risks. By learning about these groups, we can understand



how drugs affect people's health and find better ways to prevent and treat addiction.

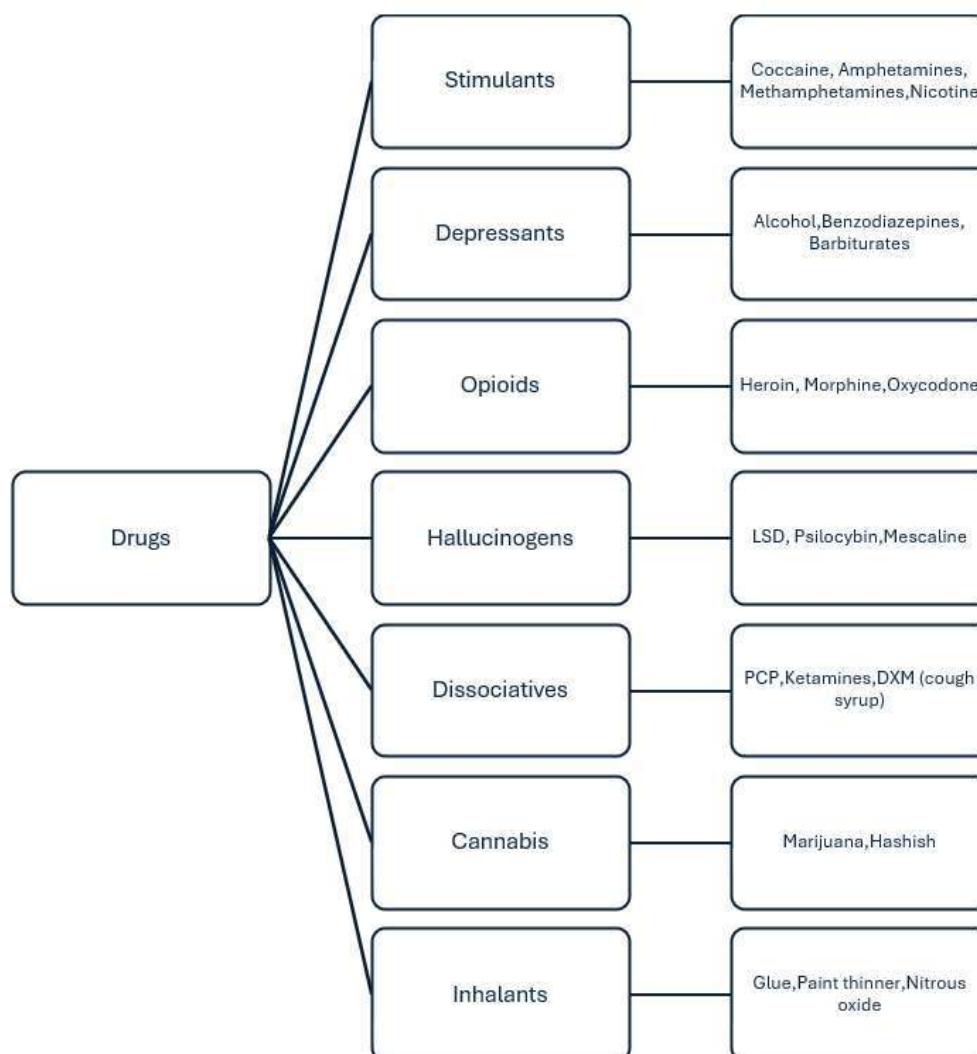


Fig.2.1 Classification of Addictive Drugs

2.1 Stimulants: Stimulant drugs are substances that make the brain and body work faster by stimulating the central nervous system. They are called “stimulants” because they increase energy, alertness, and activity, often making people feel more awake, confident, and focused. Stimulants work by raising the levels of brain chemicals such as dopamine and norepinephrine, which are linked to pleasure, reward, and attention. When these chemicals are released in large amounts, people feel excited, motivated, and full of energy, but

these effects last only for a short time and are often followed by tiredness or sadness. Stimulants can be natural, medical, or illegal. Natural stimulants include caffeine in coffee and tea, nicotine in tobacco, and coca leaves used traditionally in South America. Medical stimulants include drugs like methylphenidate (Ritalin) and amphetamines (Adderall), which doctors prescribe for conditions such as attention deficit hyperactivity disorder (ADHD) and narcolepsy. Illegal stimulants include cocaine, crack cocaine, methamphetamine

(crystal meth), and MDMA (Ecstasy), which are often taken for their euphoric effects. Stimulants have been used for centuries, from chewing coca leaves in the Andes to the invention of synthetic amphetamines in the 20th century, showing both their medical importance and their potential for abuse. Cocaine works by blocking the reuptake of dopamine, keeping it in the brain longer and producing intense pleasure, while amphetamines increase the release of dopamine and norepinephrine, creating stronger stimulation. Nicotine activates receptors that release dopamine, which explains why smoking is so addictive [22]. Overstimulation of the brain's reward system is the main reason stimulants are addictive. Over time, the brain reduces its natural dopamine production, making it difficult for users to feel pleasure without the drug. This leads to dependence and addiction. Although stimulants can be helpful in medicine, misuse is widespread. Students and professionals sometimes misuse prescription stimulants to stay awake longer or improve performance, while illicit stimulants like cocaine and methamphetamine are used recreationally for their euphoric effects [23]. When prescribed and monitored, stimulants can be safe and effective, but misuse in higher doses or without medical supervision is dangerous. Although stimulants may seem helpful in the short term, their long-term effects are harmful and often life-threatening. Short-term effects include increased energy, alertness, and confidence, but also anxiety, restlessness, insomnia, and loss of appetite.[4] Long-term misuse can cause addiction, paranoia, hallucinations, psychosis, memory problems, and cognitive decline. Physically, stimulants increase heart rate and blood pressure, raising the risk of heart disease,

stroke, seizures, and sudden death. Cocaine and methamphetamine are especially harmful [24], because they are linked to severe health damage and social problems such as crime and trafficking. Cocaine and methamphetamine are among the most dangerous substances, both to the user and to society. Socially, stimulant misuse fuels organized crime, while prescription stimulant misuse among students is a growing concern worldwide. Legally, stimulants are tightly controlled. In the United States, cocaine and methamphetamine are classified as Schedule II drugs, meaning they have limited medical use but high abuse potential. Prescription stimulants are also Schedule II, requiring strict regulation. Treatment for stimulant addiction is challenging. Unlike opioids, there are currently no FDA-approved medications to treat stimulant addiction, though research is ongoing. Instead, treatment relies on behavioural therapies such as Cognitive Behavioural Therapy (CBT), counselling, and support groups. Prevention is equally important and requires education, awareness, and community programs to teach young people about the risks.[25] Brain imaging studies show that stimulant addiction changes brain structure and function, which explains why recovery is difficult and relapse is common. Despite these challenges, recovery is possible with proper support. In conclusion, stimulants are a double-edged sword: they are valuable in medicine for treating ADHD and narcolepsy, but when misused, they cause serious harm to individuals and society [23]. Understanding how stimulants work, their effects, and their risks is essential for prevention and treatment. Stimulants are both beneficial and dangerous, and society must balance their medical value with the need to control misuse.[22]

Tab 2.1 classification of Stimulants their uses misuses and medicines

Type of Stimulant	How They Work (Mechanism)	Medical Use	Common Misuse	Examples / Medicines
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Caffeine (natural)	Blocks adenosine receptors → increases alertness	Mild stimulant for drowsiness, found in drinks	Overuse in energy drinks, insomnia, anxiety	Coffee, tea, energy drinks
Nicotine (natural)	Stimulates nicotinic receptors → dopamine release	No major medical use today (historically for relaxation)	Cigarette smoking, tobacco chewing, vaping	Cigarettes, tobacco products
Cocaine (illicit)	Blocks reuptake of dopamine, norepinephrine, serotonin → intense euphoria	Limited medical use as local anesthetic in surgery	Recreational use for “high,” very addictive	Cocaine (illegal form), topical anesthetic in ENT surgery
Amphetamines (synthetic)	Increase release of dopamine and norepinephrine	ADHD, narcolepsy treatment	Misuse for staying awake, weight loss, performance enhancement	Adderall, Dexedrine
Methamphetamine (synthetic)	Strong release of dopamine → powerful stimulation	Rarely prescribed (severe ADHD, obesity)	Recreational use (“crystal meth”), highly addictive	Desoxyn (rare medical use)
Methylphenidate (synthetic)	Blocks dopamine and norepinephrine reuptake	ADHD, narcolepsy	Misuse by students for studying, staying awake	Ritalin, Concerta
MDMA (Ecstasy) (synthetic, stimulant + hallucinogen)	Increases serotonin, dopamine, norepinephrine	No approved medical use (studied for PTSD)	Recreational party drug, dehydration, overheating	Ecstasy (illegal), under research trials

On basis of this table clearly understood types of stimulants, however we further study working mechanism of drugs in detail

2.2 Depressants: Depressant drugs slow down the brain and body. They are called central nervous system (CNS) depressants because they reduce the speed of signals between brain cells, which makes people feel calm, relaxed, and sleepy. In small doses, depressants can lower anxiety, relax muscles, and help with sleep. In higher doses, they can cause confusion, poor coordination, slurred speech, memory problems, and slow breathing. The most common depressants are alcohol, benzodiazepines (like diazepam/Valium and alprazolam/Xanax), barbiturates (older sleeping medicines like phenobarbital), Z-drugs (sleep medicines like zolpidem), and substances such as

GHB and kava. Doctors use some depressants for medical reasons: benzodiazepines for anxiety, panic attacks, muscle spasms, and seizures; barbiturates for certain types of epilepsy and anaesthesia; Z-drugs for short-term insomnia; and alcohol is not prescribed but widely used socially. These drugs mainly work by boosting the effect of a natural calming chemical in the brain called GABA (gamma-aminobutyric acid). GABA acts like a “brake” for brain activity. When depressants increase GABA’s action, brain cells fire less often, leading to calmness, reduced anxiety, and sedation. Alcohol also affects GABA and other chemicals like glutamate (which is excitatory), so it reduces inhibition and judgment while slowing reactions. In simple words: depressants turn down the brain’s volume, which is helpful for anxiety and sleep when used correctly, but harmful if

overused. Benzodiazepines attach to the GABA-A receptor to make GABA work better, while barbiturates open the same receptor's channel for longer, which is why barbiturates can be stronger and riskier. Z-drugs (like zolpidem) target sleep-related parts of the GABA-A receptor, which is why they help with falling asleep but can still cause sedation and memory issues. The DSM-5 explains that, while depressants can be effective medicines, they also have a clear risk for misuse, dependence, and withdrawal if taken for long periods or at high doses.[26] The main problem with depressants is misuse and dependence. When people take more than prescribed, take them for longer than advised, or mix them with alcohol or opioids, the risk of overdose rises sharply because breathing can slow down too much. With alcohol, short-term problems include poor judgment, accidents, and blackouts, and long-term heavy use can lead to liver disease, high blood pressure, cancers, and brain and memory problems. With benzodiazepines, short-term use can help anxiety and sleep, but long-term use can lead to tolerance (needing more for the same effect), dependence (feeling unwell without the drug), and withdrawal (which can include rebound anxiety, insomnia, tremor, and in severe cases, seizures). Barbiturates carry an especially high risk of overdose, which is why they are used far less now. Z-drugs can cause sleepwalking, memory gaps, and next-day

drowsiness, especially if taken late at night or mixed with alcohol. GHB can cause deep sleep, coma, and dangerous breathing suppression; its dose range between "relaxing" and "dangerous" is narrow. From a safety perspective, mixing depressants is particularly risky: alcohol plus benzodiazepines, or benzodiazepines plus opioids, can compound effects and lead to life-threatening respiratory depression. Medically, doctors try to use the lowest effective dose for the shortest time, avoid mixing with alcohol, and plan for tapering if a medicine is needed beyond a short period. Withdrawal from depressants must be handled carefully: sudden stopping, especially after long use, can be dangerous. In clinical practice, supervised tapering and support are used. Behaviour therapies, sleep hygiene for insomnia, and non-drug treatments for anxiety (like cognitive behavioural therapy) can reduce the need for long-term depressant use. In plain language: depressants can be helpful tools when used correctly, but they can also become traps if misused, making people rely on them to feel normal. Understanding what they do slowing brain signals, calming the mind, and relaxing the body helps explain why they work and why caution is needed. Reliable books and journals agree depressants are powerful, useful, and risky, and careful prescribing, patient education, and regular review are key to staying safe.[4]

Tab 2.2 classification of depressants their uses misuses and medicines

Type of Depressant	How They Work (Simple Mechanism)	Medical Use	Common Misuse	Examples / Medicines
Alcohol (natural)	Boosts the brain's calming chemical (GABA) and slows signals	No medical use, used socially	Heavy drinking → accidents, liver damage, addiction	Beer, wine, spirits
Benzodiazepines (synthetic)	Make GABA stronger → relaxes brain and body	Anxiety, panic attacks, seizures, muscle spasms, insomnia	Long-term use → dependence, memory problems	Valium (diazepam), Xanax (alprazolam), Ativan (lorazepam)

Barbiturates (synthetic)	Keep calming channels open longer → strong sedation	Epilepsy, anaesthesia	High overdose risk, addiction	Phenobarbital, Thiopental
Z-drugs (synthetic)	Target sleep-related calming receptors → help fall asleep	Short-term insomnia treatment	Sleepwalking, memory gaps, next-day drowsiness	Zolpidem (Ambien), Zopiclone
GHB (synthetic)	Acts like a natural sleep chemical → deep sedation	Rare use for narcolepsy	Recreational misuse → coma, breathing problems	GHB (illegal in most cases, rare prescription)
Kava (natural)	Mildly boosts calming brain chemicals → relaxation	Herbal remedy for anxiety	Heavy use → liver damage	Kava root, kava tea

On basis of this table clearly understood types of depressants, however we further study working mechanism of drugs in detail

2.3 Opioids: Opioids are a group of drugs that are mainly used to relieve pain, but they also produce feelings of relaxation and euphoria. They work by attaching to special proteins in the brain, spinal cord, and other parts of the body called opioid receptors. When opioids bind to these receptors, they block pain signals and release dopamine, the brain's "feel-good" chemical, which creates a sense of pleasure and calm. This is why opioids are very effective for treating severe pain, such as after surgery, during cancer treatment, or for serious injuries. Common prescription opioids include morphine, codeine, oxycodone, hydrocodone, fentanyl, and methadone, while heroin is an illegal opioid made from morphine. Opioids are among the most powerful painkillers in medicine, but they also carry a high risk of misuse and dependence. In small, controlled doses, opioids slow breathing, reduce anxiety, and relieve pain. However, when taken in larger amounts or without medical supervision, they can cause drowsiness, confusion, constipation, nausea, and dangerously slow breathing.[26] Opioids can lead to "opioid use disorder," a condition where people become dependent on the drug and continue using it

despite harmful consequences. Historically, opioids have been used for thousands of years, starting with opium from the poppy plant in ancient civilizations. Modern medicine has refined these substances into both natural and synthetic forms, but the basic effect remains the same: powerful pain relief combined with a high potential for addiction.[4] Opioids act in the brain's reward system, which is why they are so addictive over time, the brain adapts and reduces its natural dopamine production, making it hard for people to feel normal without the drug. The problem with opioids is not only medical but also social and global. Misuse of opioids has led to what is often called the "opioid crisis", especially in countries like the United States, where prescription opioids were widely given in the 1990s and 2000s. Many patients who started with legal prescriptions later developed dependence and, in some cases, turned to illegal opioids like heroin or synthetic fentanyl, which is far stronger and more dangerous. millions of people worldwide misuse opioids, and opioid overdoses are a leading cause of drug-related deaths. Long-term misuse can cause tolerance (needing more of the drug for the same effect), dependence (feeling sick without it), and addiction (compulsive use despite harm). Withdrawal symptoms include sweating, shaking, anxiety, muscle pain, and insomnia, which make it

very hard to stop without help. Treatment for opioid addiction often combines medications and behavioural therapy. Medicines like methadone, buprenorphine, and naltrexone are used to reduce cravings and withdrawal symptoms, helping people recover safely. Behavioural therapies such as cognitive behavioural therapy (CBT) and support groups also play an important role [24]. Opioid addiction is a chronic brain disease, not just a lack of willpower, and requires long-term treatment and support. Socially, opioid misuse leads to family breakdown, unemployment, crime, and huge healthcare costs. Medically, it causes overdoses, infections (such as HIV and hepatitis

from needle sharing), and long-term organ damage. Yet, opioids remain essential medicines when used correctly. The challenge is to balance their medical benefits with strict control to prevent misuse. In conclusion, opioids are a double-edged sword: they are life-saving painkillers in hospitals but can be life-threatening when abused. Understanding how they work, their benefits, and their risks is crucial for both doctors and patients.[2] Opioids must always be prescribed with caution, monitored carefully, and combined with education and prevention strategies to reduce harm.[26]

Tab 2.3classification of Opioids their uses misuses and medicines

Type of Opioid	How They Work (Simple Mechanism)	Medical Use	Common Misuse	Examples / Medicines
Morphine (natural)	Attaches to opioid receptors → blocks pain signals, releases “feel-good” dopamine	Severe pain (cancer, surgery, trauma)	High doses → euphoria, addiction	Morphine injections, tablets
Codeine (natural)	Converts to morphine in body → mild pain relief, cough suppression	Mild pain, cough medicine	Overuse → drowsiness, dependence	Codeine syrup, tablets
Oxycodone (semi-synthetic)	Strong binding to opioid receptors → powerful pain relief	Moderate to severe pain	Crushed or injected → intense high, addiction	OxyContin, Percocet
Hydrocodone (semi-synthetic)	Blocks pain signals, causes sedation and euphoria	Pain relief, cough suppression	Overuse → addiction, liver damage (when mixed with acetaminophen)	Vicodin, Norco
Fentanyl (synthetic)	Extremely strong binding → very rapid and powerful pain relief	Severe pain, anaesthesia, cancer pain	Tiny amounts → overdose, death	Fentanyl patches, lozenges
Methadone (synthetic)	Long-acting opioid → prevents withdrawal, reduces cravings	Treatment of opioid addiction, chronic pain	Misuse or overdose if not supervised	Methadone tablets, liquid
Heroin (illegal)	Quickly turns into morphine in brain → intense euphoria	No legal medical use	Injected or smoked → high addiction, overdose risk	Heroin (illegal street drug)

On basis of this table clearly understood types of Opioids, however we further study working mechanism of drugs in detail.

2.4 Hallucinogens: Hallucinogens are a group of drugs that change the way people see, hear, feel, and think. They are called *psychedelics* or *hallucinogens* because they cause hallucinations



experiences where a person sees or hears things that are not there, or experiences reality in a very different way. These drugs affect the brain's chemical systems, especially serotonin, which controls mood, thinking, and perception. Common hallucinogens include LSD (lysergic acid diethylamide), psilocybin (magic mushrooms), mescaline (from the peyote cactus), DMT (dimethyltryptamine), and PCP (phencyclidine). Some are natural, like mushrooms and cacti, while others are synthetic, like LSD and PCP. Hallucinogens do not usually cause physical dependence like opioids or alcohol, but they can cause strong psychological effects and risky behaviour. When someone takes a hallucinogen, their senses become distorted: colours may look brighter, sounds may seem sharper, and time may feel slower or faster. People may feel spiritual or mystical experiences, which is why some cultures have used hallucinogens in religious rituals for centuries. For example, psilocybin mushrooms have been used in Central America for spiritual ceremonies, and mescaline from peyote has been used by Native American groups. In modern times, researchers have studied hallucinogens for possible medical uses, such as treating depression, anxiety, and post-traumatic stress disorder (PTSD).[27] Psilocybin and LSD may help “reset” brain networks in people with depression, giving them new perspectives and reducing negative thought patterns. However, these studies are still experimental, and hallucinogens remain illegal in most countries. The risks of hallucinogens are also important to understand. In the short term, they can cause panic, confusion, paranoia, and dangerous behaviour because people may not know what is

real. For example, someone on LSD may believe they can fly or walk into traffic without realizing the danger. PCP can cause violent behaviour, numbness, and memory loss. Long-term risks include flashbacks (sudden re-experiencing of hallucinations days or weeks later), persistent psychosis, and worsening of mental health problems in vulnerable people.[28] “hallucinogen use disorder” as a condition where people continue to use these drugs despite harm. Unlike stimulants or opioids, hallucinogens are not usually addictive in the physical sense, but people may become psychologically dependent on the experiences. Socially, misuse of hallucinogens can lead to accidents, injuries, and legal problems. Medically, there is growing interest in using controlled doses of psilocybin or MDMA (which has both stimulant and hallucinogenic effects) for therapy, but this must be done under strict supervision.[4] Hallucinogens work by strongly activating serotonin 5-HT_{2A} receptors in the brain, which disrupts normal communication between brain regions and creates unusual patterns of thought and perception. This explains both the mystical experiences and the confusion they cause. In conclusion, hallucinogens are powerful substances that can profoundly change perception and thinking. They have been used for centuries in cultural and spiritual contexts, and modern science is exploring their possible medical benefits. But they also carry serious risks, especially when misused without guidance.[29], Hallucinogens are not safe recreational drugs, but they may hold promise as carefully controlled medicines in the future. Society must balance curiosity about their benefits with caution about their dangers.[26][27]

Tab 2.5 classification of Hallucinogens their uses misuses and medicines

Type of Hallucinogen	How They Work (Simple Mechanism)	Medical Use	Common Misuse	Examples / Substances
LSD (synthetic)	Strongly changes serotonin signals →	Studied for depression, anxiety, PTSD	Recreational “trips” → hallucinations,	LSD blotter paper, liquid



	alters mood, senses, and thinking	(not approved yet)	confusion, risky behavior	
Psilocybin (natural)	Activates serotonin receptors → changes thoughts, emotions, and perception	Research for depression, anxiety, addiction	Taken as “magic mushrooms” → panic, flashbacks	Psilocybin mushrooms
Mescaline (natural)	Alters serotonin and dopamine → causes vivid visual hallucinations	Traditional spiritual use, studied for mental health	Recreational use → nausea, confusion	Peyote cactus, San Pedro cactus
DMT (natural/synthetic)	Strong serotonin activation → very intense, short hallucinations	Studied for depression and spiritual therapy	Misuse for short, powerful “trips” → disorientation	Ayahuasca brew, synthetic DMT
PCP (synthetic)	Blocks NMDA receptors → disconnects brain from reality	Rarely used as anesthetic in past	Misuse → aggression, memory loss, psychosis	PCP powder, tablets (“angel dust”)
MDMA (synthetic, stimulant + hallucinogen)	Boosts serotonin, dopamine, norepinephrine → emotional warmth, sensory changes	Studied for PTSD therapy	Party drug → dehydration, overheating, anxiety	Ecstasy pills, Molly

On basis of this table clearly understood types of Hallucinogens, however we further study working mechanism of drugs in detail.

2.5 Dissociatives: Dissociative drugs are substances that make a person feel disconnected from reality, their surroundings, and sometimes even from their own body and thoughts. In simple words, they can create a “split” between what the body senses and how the mind experiences it. People often describe this as feeling detached, numb, or like they are watching themselves from outside. The most well-known dissociative include ketamine, phencyclidine (PCP), dextromethorphan (DXM, found in some cough syrups), and nitrous oxide (“laughing gas”). Some are medicines, and some are misused for their mind-altering effects. Dissociative mainly work by blocking a specific receptor in the brain called the NMDA receptor, which normally helps with learning, memory, pain perception, and the smooth flow of signals between brain cells. By blocking

NMDA, dissociative disrupt normal brain communication, which is why they can dull pain, cause unusual thoughts, and change how sights and sounds are processed. Ketamine, used in hospitals and clinics, can quickly reduce pain and provide anaesthesia, and in low, controlled doses it can rapidly improve severe depression in some patients. PCP was originally developed as an anaesthetic but was stopped due to strong psychological side effects; it is now an illegal drug. DXM is safe at normal cough-suppressing doses but can become a dissociative at high doses, leading to confusion and hallucinations. Nitrous oxide is used by dentists and anaesthetists for short procedures because it reduces pain and anxiety, but it can be misused recreationally. In everyday terms, dissociative turn down the brain’s “connection switch,” which can be useful in surgery or severe pain but risky when taken without medical supervision. Ketamine and PCP are “NMDA antagonists,” and this single action helps explain most of their effects: less pain,

altered perception, and changes in mood and memory. Research also shows these drugs influence other brain systems, like glutamate (the main excitatory transmitter), GABA (the calming transmitter), and dopamine pathways, which can add to their unique mix of effects anaesthesia, euphoria, or, in some cases, agitation and psychosis-like symptoms. The benefits and risks of dissociative depend strongly on dose, setting, and supervision.[26][27] In medicine, ketamine is valued because it does not dangerously suppress breathing at typical anaesthetic doses, making it useful in emergency care and for patients with asthma or trauma. In controlled settings, low-dose ketamine infusions or nasal sprays (ketamine) can help people with treatment-resistant depression by quickly lifting mood within hours, though the effect may fade and careful monitoring is essential. Nitrous oxide can safely reduce pain and anxiety during dental work when given with oxygen and professional monitoring. However, misuse outside medical care brings significant dangers. High doses of dissociative can cause severe confusion, panic, paranoia, memory loss, poor coordination, and risky behaviour because judgment and awareness of danger are impaired. PCP misuse is particularly concerning it can lead to violent agitation, psychosis like episodes, numbness, and accidents. DXM misuse in large amounts can cause hallucinations, a detached or “robotic” feeling, high blood pressure, rapid heartbeat, and in some cases serotonin syndrome if mixed with certain antidepressants. Nitrous oxide misuse can lead to oxygen deprivation, falls, and, with

repeated heavy use, vitamin B12 depletion that may damage nerves and cause numbness or weakness. Long term risks across dissociative include persistent memory problems, mood changes, and in vulnerable individuals, worsening of mental health conditions. Mixing dissociative with other substances raises risks further: combining with alcohol, benzodiazepines, or opioids can dangerously impair coordination and breathing; mixing with stimulants can cause agitation, high blood pressure, or heart strain. From a legal and social view, ketamine is a controlled medicine used in hospitals and some clinics; PCP is illegal in most countries; DXM is available over the counter in many places, but misuse is monitored; nitrous oxide is legal for medical and food uses but recreational misuse is restricted. Clinicians aim to use the lowest effective dose for the shortest time, with monitoring and clear safety plans. For people struggling with misuse, support includes counselling, harm-reduction education, and addressing co-occurring mental health issues. In short, dissociative are powerful tools that can help doctors manage pain and anaesthesia and, in some cases, quickly improve severe depression, but they can also be dangerous when misused, confusing the mind, impairing judgment, and leading to injuries or lasting harm. Understanding their core action blocking NMDA receptors and disrupting brain signalling makes their mixed profile easier to grasp useful in care, risky in recreation, and always requiring respect and caution.[26][27][29]

Tab 2.5 classification of dissociative their uses misuses and medicines

Type of Dissociative	How They Work (Simple Mechanism)	Medical Use	Common Misuse	Examples / Medicines
Ketamine (synthetic)	Blocks NMDA receptors → disconnects brain signals, reduces pain	Anaesthesia, emergency pain relief, treatment-resistant depression (ketamine)	Recreational use → confusion, memory loss, risky behaviour	Ketamine injection, Ketamine nasal spray



PCP (Phencyclidine) (synthetic)	Blocks NMDA receptors → alters perception, detaches mind from body	Originally used as anaesthetic (now discontinued)	Misuse → aggression, paranoia, psychosis	PCP powder, tablets (“angel dust”)
DXM (Dextromethorphan) (synthetic)	At high doses blocks NMDA receptors → causes dissociation and hallucinations	Cough suppressant in syrups	Misuse of cough syrups → hallucinations, confusion, serotonin syndrome	Robitussin, other OTC cough syrups
Nitrous Oxide (gas)	Affects NMDA and GABA systems → reduces pain, creates euphoria	Dental anaesthesia, short surgical procedures	Recreational inhalation (“whippets”) → oxygen deprivation, nerve damage	Nitrous oxide gas (“laughing gas”)
Salvia divinorum (natural)	Activates kappa opioid receptors → intense, short-lasting dissociation	No approved medical use	Recreational “trips” → disorientation, fear, loss of control	Salvia leaves, extracts

2.6 Cannabis: Cannabis, also known as *Cannabis sativa L.*, is a plant that humans have used for thousands of years in many ways. Ancient records show that hemp, a type of cannabis, was grown in Asia as early as 8000 BCE for making ropes, clothes, and oil from its seeds (Small, 2016). What makes cannabis special is the group of chemicals it produces called cannabinoids. The two most important are THC (tetrahydrocannabinol) and CBD (cannabidiol). THC is the part that makes people feel “high,” while CBD does not cause intoxication but is being studied for possible medical benefits [30]. These chemicals work by connecting with the body’s endocannabinoid system, which is like a network of switches that help control pain, mood, appetite, memory, and even the immune system [31]. Because of this, cannabis has been tested as a medicine for many conditions. Research shows it can help reduce chronic pain, nausea caused by chemotherapy, and muscle stiffness in multiple sclerosis [32]. Some cannabis-based medicines, like nabiximols and dronabinol, are already approved in certain

countries. But cannabis also has risks. Using it heavily, especially at a young age, can affect brain development, cause problems with memory and learning, and in some people increase the risk of mental health issues like psychosis [2]. It can also lead to dependence in some users. This means cannabis is both a plant with great medical promise and one that requires careful, responsible use. The story of cannabis is not only about science but also about society and politics. In the early 1900s, many countries banned cannabis, often because of fear, prejudice, and political pressure rather than strong scientific evidence [33]. This made it very hard for scientists to study the plant for many decades. In recent years, however, attitudes have changed. Countries like Canada, Uruguay, and several U.S. states have legalized cannabis for medical or recreational use, creating new debates about health, safety, and economics [34]. The legal cannabis industry is now worth billions of dollars worldwide, with uses not only in medicine but also in food, textiles, cosmetics, and eco-friendly building materials/. At the same time, scientists are

using modern tools like genetics and biotechnology to create cannabis strains with specific levels of THC, CBD, and other compounds called terpenes, which may allow doctors to design more personalized treatments. Still, experts warn that we need more long-term studies to fully understand how cannabis affects

the brain, heart, and mental health [32]. In simple words, cannabis is both an ancient plant with deep cultural roots and a modern scientific frontier. Its future will depend on how well society balances its benefits and risks, how carefully it is regulated, and how much more we learn through research.

Tab 2.6 classification of Cannabis their uses misuses and medicines

Type of Cannabis Product	How They Work (Simple Mechanism)	Medical Use	Common Misuse	Examples / Forms
Marijuana (dried plant)	THC activates cannabinoid receptors → changes mood, memory, and coordination	Pain relief, nausea control (esp. in cancer/chemotherapy), appetite stimulation	Recreational smoking → impaired memory, poor coordination, reduced motivation	Joints, blunts, dried flower
Hashish (resin)	Higher THC concentration → stronger brain effects	Like marijuana, sometimes used in smaller doses	Stronger high → anxiety, paranoia, dependence	Hash blocks, resin
Cannabis Oil / Concentrates	THC and/or CBD absorbed quickly → affects mood, pain, inflammation	Chronic pain, epilepsy, anxiety, cancer-related symptoms	Overuse → drowsiness, confusion, dependency	THC oil, CBD oil, vape cartridges
Edibles (infused food/drink)	THC absorbed through digestion → delayed but longer-lasting effects	Pain relief, sleep aid, anxiety	Overconsumption → long-lasting high, panic, nausea	Gummies, brownies, chocolates
CBD Products (non-intoxicating)	CBD modulates brain signals without causing a “high”	Epilepsy, anxiety, inflammation, sleep disorders	Rare misuse, but unregulated products may be mislabelled	CBD oil, capsules, creams
Synthetic Cannabinoids (lab-made)	Bind strongly to cannabinoid receptors → unpredictable effects	No approved medical use (some studied for pain)	Recreational misuse → severe anxiety, psychosis, organ damage	“Spice,” “K2” (illegal street products)

2.7 Inhalants: Inhalants are a group of substances that people breathe in through the nose or mouth to feel a quick “high” or altered state of mind. Unlike other drugs that are swallowed, injected, or smoked, inhalants are usually everyday household or industrial products that give off chemical vapours. These include solvents (like glue, paint thinner, nail polish remover, gasoline), aerosols (like spray paints, deodorants, cooking sprays), gases (like butane lighters, propane, nitrous oxide

or “laughing gas”), and nitrites (like amyl nitrite, sometimes called “poppers”). When inhaled, these chemicals quickly enter the lungs, pass into the bloodstream, and reach the brain within seconds, producing effects such as dizziness, euphoria, relaxation, and hallucinations. Because the high is short-lived, lasting only a few minutes, people often inhale repeatedly over a short period, which increases the risk of harm. Inhalants mainly affect the central nervous system by depressing brain

activity, like alcohol or sedatives, but in a more unpredictable way. They interfere with brain chemicals like GABA and glutamate, which regulate mood, coordination, and memory. This explains why users may feel light-headed, lose coordination, or have slurred speech. Inhalants are especially dangerous because they are cheap, easy to find, and often used by young people who may not realize the risks [26]. “Inhalant Use Disorder” as a condition where repeated misuse leads to health, social, and psychological problems. Historically, nitrous oxide was discovered in the 18th century and used medically for anaesthesia, but recreational misuse soon followed. Today, while some inhalants like nitrous oxide still have medical uses, most substances inhaled recreationally are not drugs at all, but toxic chemicals never meant for human consumption. The dangers of inhalants are severe and wide-ranging. In the short term, inhalants can cause nausea, vomiting, dizziness, confusion, and risky behaviour. Because they reduce oxygen supply to the brain, they can cause fainting, suffocation, or sudden death, a phenomenon known as “sudden sniffing death syndrome”, often due to heart failure. Long-term misuse damages the brain, liver, kidneys, and nerves. Chronic users may develop memory loss, poor coordination,

hearing loss, and muscle weakness.[4] Repeated inhalant exposure can cause permanent brain damage because many solvents dissolve the fatty tissue that protects nerve cells. Nitrous oxide misuse can lead to vitamin B12 deficiency, which damages the spinal cord and nerves. Socially, inhalant misuse is linked to school failure, accidents, and family problems. Because inhalants are legal products, controlling their misuse is difficult. Prevention relies on education, awareness, and community programs to warn young people about the risks. Treatment for inhalant addiction is challenging because there are no specific medications to reverse dependence; instead, therapy, counselling, and support groups are used [35]. Inhalant misuse is a global issue, especially in low-income communities where access to other drugs is limited but household chemicals are easy to obtain. In conclusion, inhalants are among the most dangerous substances because they are toxic, unpredictable, and often misused by vulnerable groups like adolescents. They provide only a brief high but can cause lifelong harm or sudden death [24]. inhalants are not safe recreational drugs; they are poisons that damage the brain and body. Society must address this problem through education, regulation, and support for those affected.[27]

Tab 2.7 Classification of Inhalants their uses misuses and medicines

Type of Inhalant	How They Work (Simple Mechanism)	Medical Use	Common Misuse	Examples / Products
Solvents	Vapours slow brain activity → cause dizziness, euphoria	No medical use for inhalation	Sniffing → brain damage, sudden death	Glue, paint thinner, nail polish remover, gasoline
Aerosols	Chemicals disrupt brain signals → short high, confusion	No medical use for inhalation	Spraying into mouth/bag → suffocation, risky behaviour	Spray paint, deodorant, cooking spray
Gases	Reduce oxygen and affect brain → sedation, euphoria	Nitrous oxide used in anaesthesia	Inhaling → oxygen deprivation, nerve damage	Butane lighters, propane tanks, nitrous oxide (“laughing gas”)
Nitrites	Dilate blood vessels → brief head rush, relaxation	Rare use for heart conditions	Recreational use → risky sexual behaviour, headaches	Amyl nitrite “poppers”

Cleaning Agents	Vapours depress brain function → sedation, confusion	No medical use for inhalation	Inhaling → nausea, unconsciousness, long-term organ damage	Air fresheners, disinfectant sprays
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3.First time hijacking of drugs: The first time a person consumes an addictive drug is often described as a powerful and memorable experience because it introduces the brain and body to a substance that can change mood, perception, and behaviour in dramatic ways. In simple terms, addictive drugs “hijack” the brain’s natural reward system. Normally, when we do something enjoyable like eating, exercising, or spending time with loved ones—the brain releases a chemical called **dopamine**, which makes us feel good and motivates us to repeat the activity. But when someone takes an addictive drug for the first time, the drug causes a much stronger and faster release of dopamine than natural rewards ever could. This sudden flood of pleasure can feel overwhelming, producing sensations of euphoria, relaxation, energy, or altered perception depending on the drug. For example, stimulants like cocaine or amphetamines create a rush of energy and confidence, opioids like heroin or morphine produce deep relaxation and pain relief, depressants like alcohol or benzodiazepines calm anxiety, and hallucinogens like LSD or psilocybin distort reality. This intense dopamine surge is what

makes the first encounter so powerful: the brain quickly learns to associate the drug with pleasure, laying the foundation for future cravings [23]. Addictive drugs act on specific receptors in the brain: opioid receptors, cannabinoid receptors, GABA receptors, or serotonin receptors depending on the substance. But the common thread is that they all overstimulate the brain’s reward circuits. For many people, the first use may feel harmless or even positive: a way to relax, fit in socially, or escape stress. Ancient societies experienced this too when the Sumerians first used opium around 3400 BCE, or when early civilizations brewed alcohol; they discovered both the pleasurable and the risky sides of these substances. The first-time experience can also be shaped by context: taking a drug in a safe, ritual setting may feel different from taking it impulsively at a party. Yet, regardless of setting, the brain’s biology responds in the same way: it records the drug as a powerful source of reward, which is why even one use can leave a lasting impression.[26]

3.1 First time consumption vs body response (Cocaine):

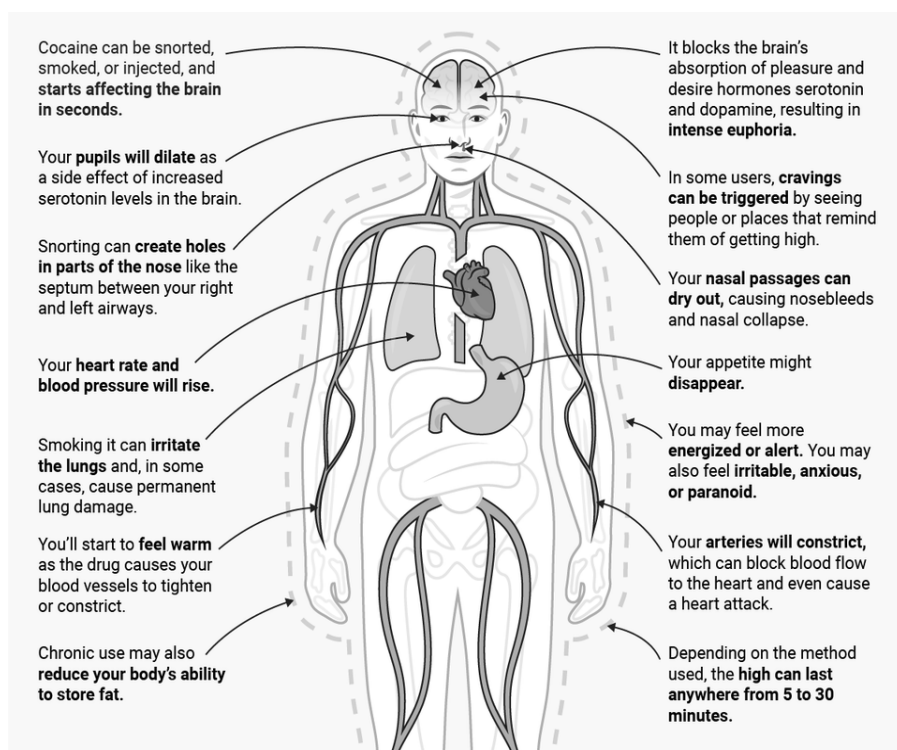


Fig.3.1 first time consumption of Cocaine vs body response

Cocaine is a stimulant drug that acts very quickly on the brain and body, which is why people often describe its effects as intense but short-lived. When someone snorts, smokes, or injects cocaine, it enters the bloodstream and reaches the brain in seconds. Once there, it interferes with the way nerve cells communicate by blocking the reuptake of key neurotransmitters **dopamine, serotonin, and norepinephrine**. Normally, these chemicals are released and then recycled, but cocaine prevents their recycling, causing them to build up in the brain. This creates a surge of euphoria, alertness, and energy. However, this artificial “high” comes at a cost: the brain’s reward system becomes overstimulated and, over time, less responsive to natural pleasures like food, relationships, or hobbies. As repeated use leads to long-term changes in the brain’s ability to feel pleasure, which is why cravings and compulsive drug-seeking behaviour develop. Users may also experience psychological effects such as paranoia, anxiety, or hallucinations, especially with heavy or

prolonged use. Even environmental cues like seeing someone else use cocaine can trigger powerful cravings, showing how deeply the drug rewires the brain’s motivational circuits.[36] The effects on the body are equally damaging. Cocaine causes **vasoconstriction**, meaning it tightens blood vessels, which raises blood pressure and heart rate. This makes the heart work harder and increases the risk of heart attack, stroke, or sudden cardiac death. Pupils dilate, body temperature rises, and users often feel flushed or sweaty. Smoking cocaine can irritate and scar the lungs, sometimes leading to permanent tissue damage. Snorting it damages the nasal passages, causing nosebleeds, congestion, and in severe cases, holes in the nasal septum due to restricted blood flow. These cardiovascular and respiratory risks are among the leading causes of cocaine-related medical emergencies. The arteries that supply blood to the brain and heart can become so constricted that oxygen flow is blocked, leading to strokes or fatal arrhythmias. These dangers are not limited to long-term users sudden death can occur

even after a single dose, especially if combined with alcohol or other drugs. The short-lived high (often less than 30 minutes) tempts users to take repeated doses in a short time, which further strains the heart and increases overdose risk [1]. Cocaine also disrupts basic body functions like appetite, sleep, and metabolism. Many users report a **loss of appetite**, which can lead to rapid weight loss and malnutrition. Chronic use reduces the body's ability to store fat, making it harder to maintain healthy energy reserves. The drug also interferes with sleep cycles, causing insomnia, restlessness, and fatigue. Over time, this combination of poor nutrition, lack of rest, and constant stress weakens the immune system, leaving the body more vulnerable to infections. Cocaine use is linked to impaired immune responses, which may explain why users often suffer from frequent illnesses. Cocaine also affects sexual health: while some believe it enhances pleasure, [37] It often reduces libido, disrupts arousal, and leads to long-term sexual dysfunction. These physical consequences highlight how cocaine undermines not just immediate health but also the body's long-term ability to function normally.[38] Finally, the social and psychological consequences of cocaine use are profound. Addiction often leads to broken relationships, financial problems, and legal troubles. Users may experience depression, anxiety, and a distorted sense of identity. researchers argue that addiction reshapes how individuals see themselves and how society perceives them, creating a cycle of stigma and isolation. Recovery is difficult because there are no FDA-approved medications specifically for cocaine addiction, but behavioural therapies such as cognitive-behavioural therapy (CBT) and contingency management have shown promise. Treatment requires not only medical and psychological support but also social reintegration, as users often struggle with unemployment,

discrimination, and fractured family ties. Education and prevention are crucial: by understanding the full scope of cocaine's effects on the brain, body, and society we can better support those at risk and reduce the harm caused by this drug. Infographics like the one you shared are useful starting points, but it is the deeper, evidence-based understanding from research and lived experience that helps build effective responses to addiction.[39]

3.2 First time consumption vs body response

(LSD): The first time someone consumes LSD (lysergic acid diethylamide), the body and brain undergo a series of rapid changes. These include altered perception of time and space, intensified sensory experiences, changes in mood, and physical effects such as dilated pupils, increased heart rate, and sometimes nausea or dizziness. The reaction is not the same for everyone, but it typically begins within 30–60 minutes of ingestion and can last 8–12 hours. LSD is a psychedelic drug that primarily affects the brain's serotonin system. Serotonin is a neurotransmitter that regulates mood, perception, and cognition. LSD binds strongly to serotonin 5-HT_{2A} receptors, especially in the cerebral cortex, which is responsible for processing sensory information and higher thinking. By overstimulating these receptors, LSD disrupts normal communication between brain regions. This leads to hallucinations, altered sense of reality, and changes in thought patterns. For a first-time user, this can feel overwhelming: colours may appear brighter, sounds more intense, and time may seem to slow down or speed up. According to Sidney Cohen's early clinical studies in the 1950s [36], even small doses could produce profound changes in consciousness without loss of awareness, which is why LSD was once studied as a model for psychosis [40].



Alongside psychological effects, LSD produces noticeable physical reactions. Within the first hour, pupils dilate, heart rate and blood pressure rise, and body temperature may fluctuate. Some people experience sweating, chills, or tremors. Others may feel nausea or dizziness, especially if the dose is high. These effects occur because LSD also influences the autonomic nervous system, which controls involuntary functions like heartbeat and digestion. Unlike stimulants such as cocaine, LSD does not usually cause dangerous cardiovascular strain, but the intensity of the experience can lead to anxiety or panic, which in turn raises stress hormones like adrenaline. First-time users often report a mix of fascination and fear, since the drug alters not only perception but also the sense of self.

The hallmark of LSD is the “trip” a long-lasting alteration of consciousness. For a first-time user, this can include visual hallucinations (patterns, trails of light, distorted shapes), heightened emotions, and a sense of connection or detachment from reality. Some describe feelings of unity with the environment, while others may feel paranoid or anxious. The outcome depends heavily on set and setting the user’s mindset and the environment in which the drug is taken. LSD does not cause physical dependence, but the unpredictability of its psychological effects makes it risky, especially for inexperienced users. [1]

The effects of LSD usually last 8–12 hours, with the peak occurring around 2–5 hours after ingestion. After the trip, users may feel tired, emotionally drained, or reflective. Some report lingering changes in perception, such as visual “trails” or flashes of colour, known as hallucinogen persisting perception disorder (HPPD), though this is rare. For most first-time users, the aftereffects are mild, but the intensity of the experience can leave a lasting impression.[40].

3.3 First time consumption vs body response (Psilocybin Magic Mushrooms): When psilocybin mushrooms are consumed for the first time, the body converts the active compound psilocybin into psilocin, which is the chemical that directly affects the brain. Psilocin has a structure like serotonin, the neurotransmitter that regulates mood, perception, and cognition. Because of this similarity, psilocin binds strongly to serotonin 5-HT_{2A} receptors in the brain, especially in the cerebral cortex (the part of the brain responsible for thought, perception, and decision-making). This binding disrupts normal communication between brain regions, leading to unusual patterns of activity. For example, areas of the brain that do not normally communicate directly may begin to “talk” to each other, creating visual hallucinations, altered sense of time, and feelings of interconnectedness. For a first-time user, this can feel overwhelming. Colours may appear brighter, sounds may seem sharper, and ordinary objects may look distorted or alive. Time may feel slowed down or sped up. Psilocybin’s action on serotonin receptors is what produces these profound changes in consciousness [41]. Brain imaging studies psilocybin reduces activity in the default mode network (DMN), a brain system linked to self-reflection and ego. This explains why many first-time users report a sense of “ego dissolution,” or feeling as though the boundaries between themselves and the outside world have dissolved. While this can be positive and spiritual for some, it can also be frightening if the person is unprepared [28].

Alongside these psychological effects, psilocybin mushrooms also produce physical changes in the body. Within the first hour, pupils dilate noticeably, which is one of the most common signs of psychedelic use. Heart rate and blood pressure may increase slightly, and body temperature can fluctuate, leading to sweating or chills. Some users



experience nausea, stomach discomfort, or even vomiting, especially if the mushrooms are eaten raw. This is partly due to the body reacting to fungal material and partly due to psilocybin's stimulation of serotonin receptors in the gut, since serotonin also plays a role in digestion.

Other physical effects include muscle weakness, dizziness, or tremors. However, unlike stimulants such as cocaine or amphetamines, psilocybin does not usually place dangerous strain on the heart or lungs. Psilocybin is considered physiologically safe at typical doses, with very low risk of toxicity. The main risks are psychological rather than physical. Still, for a first-time user, the combination of nausea, dilated pupils, and altered perception can feel intense and confusing. These effects usually peak within 2–3 hours and then gradually fade over the next several hours [42].

The most striking part of a first psilocybin experience is the psychological journey. Users often report vivid visual hallucinations, such as geometric patterns, trails of light, or shifting shapes. Emotions can swing rapidly, from joy and wonder to anxiety or fear. Many describe a sense of connection to nature, other people, or the universe. This is why psilocybin has been used in spiritual and religious rituals for centuries, especially among indigenous groups in Mexico [43]

However, the experience is highly dependent on set and setting the user's mindset and the environment in which the mushrooms are taken. In a calm, supportive environment, a first-time user may have a positive, even life-changing experience. In a stressful or unsafe environment, the same dose can lead to paranoia, panic, or what is often called a "bad trip." even challenging experiences can sometimes lead to long-term positive changes in personality, such as increased openness and appreciation for life. But in the

moment, a first-time user may feel overwhelmed by the intensity of the altered state [42].

The effects of psilocybin mushrooms usually last 4–6 hours, with the peak around 2–3 hours after ingestion. After the peak, the intensity gradually decreases, and users may feel tired, reflective, or emotionally sensitive. Some report lingering visual effects, such as seeing faint patterns or trails, for a few hours after the main trip ends. In rare cases, people may experience hallucinogen persisting perception disorder (HPPD), where visual distortions continue for days or weeks, though this is uncommon.

For most first-time users, the aftereffects are mild and may include fatigue or a sense of emotional release. Importantly, psilocybin does not cause physical dependence or withdrawal symptoms, unlike drugs such as cocaine or opioids. Psilocybin is not considered addictive, though tolerance can develop quickly if it is used repeatedly over a short period. Modern clinical research (e.g., studies at Johns Hopkins University) has shown that psilocybin, when used in controlled settings, can have therapeutic benefits for depression, anxiety, and addiction. However, outside of clinical supervision, the unpredictability of a first trip makes it risky, especially for individuals with a personal or family history of mental illness.[1]

3.3 First time consumption vs body response (DMT dimethyltryptamine): The first time someone consumes DMT (dimethyltryptamine), the body and brain respond with an extremely rapid and intense psychedelic experience. Unlike psilocybin or LSD, which last for hours, smoked or vaporized DMT produces effects within seconds and lasts only 10–30 minutes. The experience includes vivid visual hallucinations, altered sense of self, and physical changes such as increased heart rate, dilated pupils, and sometimes trembling or nausea.



DMT is a naturally occurring psychedelic compound found in certain plants and produced in small amounts in the human body. When consumed (most commonly by smoking or vaporizing), it enters the bloodstream and reaches the brain almost instantly. Chemically, DMT is a tryptamine, structurally like serotonin, which allows it to bind strongly to serotonin 5-HT_{2A} receptors in the brain. This binding disrupts normal patterns of communication between brain regions, creating intense visual and auditory hallucinations. Brain imaging studies suggest that DMT, like psilocybin, reduces activity in the default mode network (DMN), which is linked to self-awareness and ego. For a first-time user, this often produces a sensation of “ego dissolution,” where the boundaries between self and environment disappear. Unlike LSD or psilocybin, the onset is almost immediate within 30 seconds, and the intensity can be overwhelming. Users often describe entering an entirely different “realm” filled with geometric patterns, entities, or a sense of leaving the body [44].

Alongside these psychological effects, DMT produces noticeable physical reactions. Within moments of inhalation, pupils dilate, heart rate and blood pressure rise, and the body may tremble or shake. Some users experience nausea, especially when DMT is consumed orally in the traditional Amazonian brew ayahuasca (which combines DMT-containing plants with MAO inhibitors to make it orally active). Sweating, chills, and changes in body temperature are also common. Intravenous doses of DMT caused rapid increases in blood pressure and heart rate, though these effects subsided as the psychedelic experience ended. Importantly, while DMT is not considered physically addictive and has low toxicity, the intensity of the first experience can be psychologically overwhelming. The short duration (10–30 minutes when smoked, 4–6 hours in

ayahuasca) makes it unique among psychedelics, but the body’s immediate stress response racing heart, adrenaline release, and sensory overload can feel extreme for first-time users [45].

The hallmark of a first DMT experience is the sudden and immersive psychological journey. Users often report vivid hallucinations of geometric patterns, bright colours, or even encounters with what they describe as “entities” or “beings.” Time perception is radically altered minutes may feel like hours, or time may seem irrelevant altogether. Many describe a sense of leaving their body or entering another dimension. This is why DMT is sometimes called the “spirit molecule.” For a first-time user, this can be awe-inspiring but also frightening, depending on mindset and environment. As with psilocybin, set and setting play a crucial role: a calm, supportive environment can make the experience meaningful, while a chaotic or unsafe setting can lead to panic or confusion. Many users report long-term positive changes in mood and outlook after a single DMT experience, though others may struggle with integrating the intensity of what they saw or felt [46].

The effects of smoked or vaporized DMT are short but intense, usually lasting 10–30 minutes. In contrast, ayahuasca ceremonies last 4–6 hours due to the slower absorption of DMT in combination with MAO inhibitors. After the peak, users often feel emotionally drained but reflective. Some report lingering visual effects, such as faint patterns or flashes of light, for a short time afterward. Unlike addictive drugs, DMT does not cause physical dependence or withdrawal. DMT is not considered addictive, though tolerance can develop with repeated use. The main risks are psychological: the overwhelming intensity of the first experience can trigger anxiety, confusion, or, in rare cases, lasting perceptual disturbances. Still,



modern clinical research (e.g., trials at Imperial College London) suggests that DMT, when used in controlled settings, may have therapeutic potential for depression and trauma. For a first-time user, however, the unpredictability and intensity of the experience mean that preparation, mindset, and environment are critical [1].

3.4 First time consumption vs body response (Marijuana, Ganja):

The first time someone consumes marijuana (cannabis/Ganja), the body and brain respond with a mix of physical and psychological changes. These include relaxation, altered perception of time, heightened sensory awareness, dry mouth, red eyes, increased appetite, and sometimes anxiety or paranoia. The effects usually begin within minutes if smoked and last 2–4 hours.

When marijuana is consumed for the first time whether smoked, vaped, or eaten the main psychoactive compound THC (delta-9-tetrahydrocannabinol) enters the bloodstream and quickly reaches the brain. THC mimics the body's natural endocannabinoids, which are chemicals that regulate mood, memory, appetite, and pain. It binds to CB1 receptors in the brain, especially in areas like the hippocampus (memory), cerebellum (coordination), and prefrontal cortex (decision-making). This binding disrupts normal communication between neurons, leading to altered perception and mood changes. For a first-time user, this may feel like a sense of relaxation, euphoria, or laughter, but it can also cause confusion or anxiety. THC's action on CB1 receptors explains both the pleasurable effects and the short-term memory problems often reported by new users. Unlike psychedelics such as LSD or psilocybin, marijuana does not usually cause hallucinations at typical doses, but it can distort time perception and intensify sensory experiences [47].

The body also reacts strongly to marijuana during first-time use. Pupil dilation is less pronounced than with LSD or psilocybin, but blood vessels in the eyes expand, causing the classic “red eyes.” Heart rate increases by 20–50%, which can make some users feel jittery or anxious. The mouth and throat often feel dry (“cottonmouth”), and coordination may be impaired due to THC's effect on the cerebellum. Appetite is stimulated commonly called “the munchies” because THC activates brain regions that regulate hunger. Marijuana also affects reaction time and motor skills, which is why driving under its influence is dangerous. For some first-time users, especially those sensitive to THC, the experience can include dizziness, nausea, or even mild panic. These effects usually peak within 30–60 minutes when smoked and last 2–4 hours, though edibles can last much longer (6–8 hours) because THC is absorbed more slowly through digestion [48]

The psychological effects of marijuana vary widely depending on dose, strain, and individual sensitivity. Many first-time users report enhanced sensory perception music may sound richer, food may taste better, and colours may appear more vivid. Time often feels slowed down, with minutes seeming like hours. Mood changes are common: some feel relaxed and happy, while others may feel anxious, paranoid, or self-conscious THC disrupts short-term memory and attention, which explains why users may lose track of conversations or forget what they were doing. Unlike DMT or psilocybin, marijuana rarely causes complete ego dissolution, but it can still alter thought patterns and create a sense of detachment. For a first-time user, the unpredictability of these effects can be surprising what feels pleasant to one person may feel uncomfortable to another.[49]



The effects of marijuana typically last 2–4 hours when smoked and longer when eaten. After the high fades, first-time users may feel drowsy, hungry, or simply relaxed. Unlike alcohol or opioids, marijuana does not cause fatal overdose, but it can impair judgment and coordination, leading to accidents. Repeated use can lead to tolerance, where more THC is needed to achieve the same effect. While marijuana is not as

physically addictive as opioids or nicotine, about 9% of users develop cannabis use disorder, characterized by cravings, withdrawal symptoms, and difficulty controlling use. For first-time users, the main risks are psychological panic, paranoia, or impaired judgment especially in unfamiliar or unsafe environments. However, in controlled settings, many report the experience as mild and enjoyable [50].

Tab 3.1 most consumed drugs and their effects

Drugs	Natural / Synthetic	Onset peak time	Duration	Typical Effects	Common Route(s)
Alcohol	Natural (fermentation)	10–30 min	2–6 hrs	Relaxation, lowered inhibitions, impaired coordination	Oral (drinking)
Nicotine (Tobacco)	Natural (tobacco plant)	Seconds (inhaled)	1–2 hrs	Stimulation, alertness, high addiction potential	Smoking, vaping, chewing
Caffeine	Natural (coffee, tea, cacao)	15–45 min	3–6 hrs	Alertness, reduced fatigue	Oral (drinks, pills)
Cannabis (Ganja, Marijuana)	Natural (plant)	5–10 min (smoked), 30–60 min (edible)	2–6 hrs (smoked), up to 12 hrs (edible)	Relaxation, altered perception, appetite increase	Smoking, vaping, edibles
Opium / Morphine	Natural (opium poppy)	15–60 min	3–6 hrs	Pain relief, euphoria, sedation	Oral, injection, smoking
Heroin	Semi-synthetic (from morphine)	Seconds–minutes (injected/smoked)	3–6 hrs	Intense euphoria, sedation, high overdose risk	Injection, smoking, snorting
Cocaine	Natural (coca plant)	Seconds (smoked), minutes (snorted)	20–60 min (snorted), 5–15 min (smoked)	Intense euphoria, energy, alertness	Snorting, smoking, injection
Methamphetamine	Synthetic	Seconds (smoked/injected), 20–30 min (oral)	6–12 hrs	Intense stimulation, hyperfocus, high addiction risk	Smoked, snorted, injected, oral pills
MDMA (Ecstasy)	Synthetic	30–60 min	4–6 hrs	Euphoria, empathy,	Oral (pills, powder)

				sensory enhancement	
LSD	Synthetic (from ergot derivative)	20–60 min	8–12 hrs	Hallucinations, altered time perception, synaesthesia	Blotter paper tabs, liquid drops, gelatine squares
Psilocybin (Magic Mushrooms)	Natural (fungi)	20–40 min	4–6 hrs	Visual distortions, altered perception, spiritual experiences	Eaten raw/dried, brewed as tea, capsules
Mescaline (Peyote, San Pedro cactus)	Natural (cactus)	45–120 min	8–12 hrs	Visual hallucinations, altered consciousness	Chewed raw cactus, dried powder, tea
Ketamine	Synthetic (medical anaesthetic)	Minutes (injected), 10–20 min (oral/nasal)	30 min–2 hrs	Dissociation, hallucinations, pain relief	Injection, nasal spray, oral

4. Abuse to addiction: When a person first experiments with drugs, the most immediate changes occur in the brain's reward system. This system is a network of brain regions that evolved to reinforce behaviours necessary for survival, such as eating, drinking, social bonding, and reproduction. At the centre of this system is a chemical messenger called dopamine, which acts like a signal of pleasure and motivation. Under normal conditions, dopamine is released in moderate amounts when we do something rewarding eating a favourite meal, laughing with friends, or achieving a goal. This release not only makes us feel good but also teaches the brain to remember and repeat the behaviour [2]. Drugs of abuse, however, hijack this natural system. Substances like cocaine, heroin, nicotine, and alcohol cause dopamine to be released in much larger amounts than natural rewards ever could. For example, cocaine blocks the reuptake of dopamine, meaning it lingers in the brain's synapses and creates an intense, prolonged high. Opioids like heroin mimic the brain's natural endorphins, binding to opioid receptors and producing powerful feelings of euphoria and pain

relief. Nicotine stimulates receptors that indirectly increase dopamine release, while alcohol has a more complex effect, enhancing the activity of calming neurotransmitters like GABA while also boosting dopamine [1]. The result is a flood of pleasure signals that the brain interprets as something of extreme importance. To the brain, this surge is stronger than the satisfaction of food, water, or social connection. The hippocampus, which stores memories, and the amygdala, which processes emotions, quickly link the drug experience with the environment in which it occurred. This means that even after the drug wears off, cues like a certain place, a group of friends, or even a smell associated with drug use can trigger powerful cravings [51]. At this early stage, drug use is often voluntary and recreational, but the brain is already being reshaped. The person may not realize it, but the groundwork for competitive use is being laid. As drug use continues, the brain begins to adapt to the unnatural stimulation. Because it is being overwhelmed by dopamine surges, the brain tries to restore balance. It does this by reducing the number of dopamine receptors or making them

less sensitive. This process is known as tolerance. The same dose of the drug no longer produces the same effect, so the person needs to take more to feel the same high [52]. This is why someone who starts with one pill, one drink, or one line may eventually escalate to much larger amounts. Alongside tolerance, dependence develops. Dependence means the brain and body have adjusted to the drug's constant presence, and without it, normal functioning is disrupted. This is why withdrawal symptoms occur when someone stops using. The symptoms vary depending on the drug: opioids can cause muscle pain, nausea, and anxiety; alcohol withdrawal can cause tremors, sweating, and in severe cases, seizures; stimulants like cocaine may lead to fatigue, depression, and irritability [53]. These symptoms are not just psychological they are the body's way of reacting to the sudden absence of a chemical it has come to rely on.

Other neurotransmitter systems are also affected. For example, alcohol enhances the calming effects of GABA while suppressing the excitatory effects of glutamate. Over time, the brain compensates by reducing GABA sensitivity and increasing glutamate activity. This explains why alcohol withdrawal can cause hyperexcitability, restlessness, and even life-threatening seizures. Similarly, chronic stimulant use disrupts serotonin and norepinephrine systems, leading to mood swings, sleep problems, and anxiety. These changes show that drug abuse is not just about dopamine it disrupts the entire chemical balance of the brain.

At this stage, drug use is no longer just about chasing pleasure. It becomes about avoiding pain. The person may continue using not to feel euphoric but simply to feel "normal" and to keep withdrawal symptoms at bay. This shift marks a critical turning point: the brain is no longer

functioning as it once did, and the drug has become central to maintaining balance. The transition from abuse to addiction involves deeper and more lasting changes in brain circuitry. Addiction is defined not just by heavy use but by compulsive drug-seeking and use despite harmful consequences. This compulsion arises because the brain regions responsible for judgment, decision-making, and self-control are impaired. The prefrontal cortex, located at the front of the brain, is crucial for weighing risks and benefits, controlling impulses, and planning. In people with addiction, imaging studies show reduced activity in this region. This means they struggle to resist urges, even when they know the drug is damaging their health, relationships, or career [54]. The brain's stress circuits, including the amygdala, also become overactive. This makes withdrawal and negative emotions more intense, driving the person to seek drugs to escape discomfort. Meanwhile, the basal ganglia, which normally regulate habits and motivation, are rewired to prioritize drug-related behaviours. Over time, drug use shifts from being a conscious choice to an automatic habit. This explains why people often relapse even after long periods of abstinence: the brain has been reprogrammed to treat drug cues as urgent survival signals [2].

Genetic and environmental factors also play a role. Some people may inherit genes that make them more sensitive to the rewarding effects of drugs or less sensitive to their negative effects. Others may grow up in environments where stress, trauma, or peer pressure increase the likelihood of drug use. These factors interact with brain changes to make some individuals more vulnerable to addiction than others [55]. Importantly, addiction is not a sign of weakness it is the result of complex interactions between biology, environment, and behaviour.



Because these brain changes can last for years, addiction is now recognized as a chronic brain disease. This does not mean it is hopeless, but it does mean that recovery is not as simple as deciding to stop. Relapse is common, not because people lack willpower, but because the brain circuits that drive cravings and habits remain altered [1]. Even after long periods of abstinence, stress, environmental cues, or even a small dose of the drug can reactivate these circuits. Research also shows that drugs can cause epigenetic changes chemical modifications to DNA that affect how genes are expressed without altering the genetic code itself. These changes can influence how the brain responds to stress, reward, and learning, making the effects of drug use long-lasting. In some cases, these changes may even be passed down to future generations, though this area of research is still developing. Despite these challenges, the brain also has plasticity, meaning it can adapt and heal. Recovery often requires a

combination of approaches. Medications like methadone or buprenorphine for opioids, or naltrexone for alcohol, can help stabilize brain chemistry and reduce cravings. Behavioural therapies, such as cognitive-behavioural therapy (CBT), help retrain the brain's control systems and teach new coping strategies. Supportive environments, peer groups, and family involvement also play a crucial role in reinforcing recovery. Importantly, recovery is not just about stopping drug use it is about rebuilding a life. This includes restoring relationships, finding purpose, and developing healthy routines. Many people in recovery describe it as a lifelong journey rather than a one-time event. The fact that the brain can change in response to both drugs and therapy is a reminder of its resilience. Addiction may alter the brain, but with time, support, and treatment, healing is possible.

4.1 Cycle of addiction:

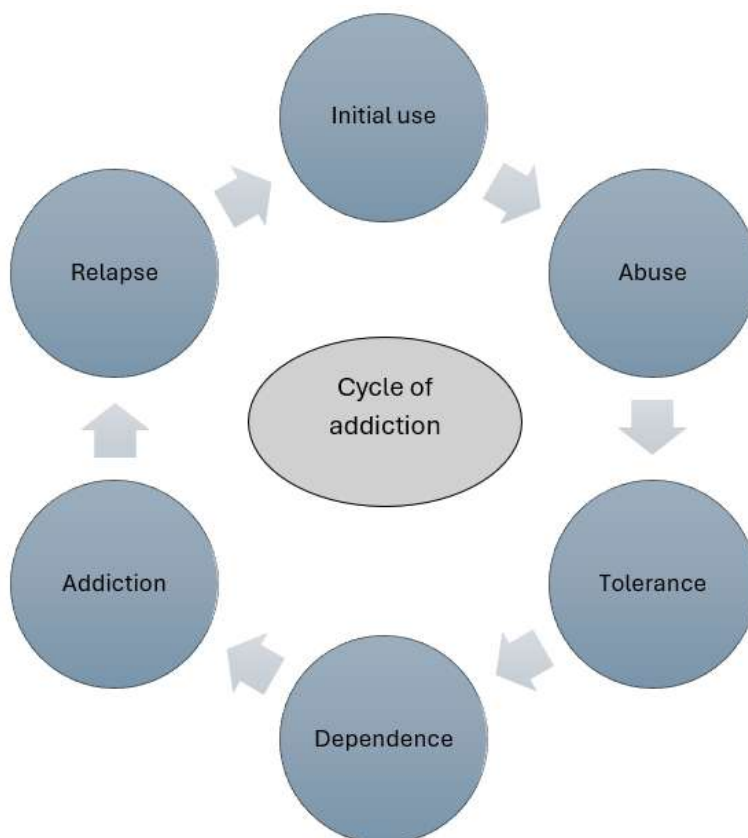


Fig 4.1 Cycle of drug addiction

1. Initial use: Initial use means the first time a person tries a drug. This can be alcohol at a party, a puff of a cigarette or vape, a hit of marijuana (cannabis), a line of cocaine, painkillers after surgery, or a pill for anxiety. At this point, people usually think it's small and harmless, and many times it feels casual or social. But the very first use is important because it introduces a strong new signal to the brain. Our brain has a reward system that helps us learn which things feel good and should be repeated like eating tasty food, spending time with people we love, playing sports, listening to music, or completing a goal. This reward system uses a chemical messenger called dopamine. Dopamine tells us "This was good do it again." Natural activities raise dopamine in a balanced way. Drugs raise dopamine much higher or keep it high for longer [1][2]. Different drugs work in different ways. Cocaine stops dopamine from being cleared away, so dopamine stays in the brain's "message space" longer and gives a fast, strong high, but it fades quickly and can be followed by a "crash" of tiredness and low mood [2]. Marijuana's main chemical (THC) connects to special receptors in the brain called CB1, which changes mood, memory, and how we experience time; it can make things feel funny or chilled, but it also makes short-term memory worse and attention weaker [56]. Nicotine from cigarettes or vapes stimulates receptors that increase dopamine, which is why smoking or vaping can feel instantly calming or focusing [57]. Alcohol affects many systems at once: it boosts calming signals (called GABA), reduces excitatory signals (called glutamate), and raises dopamine, so a drink can feel warm and relaxed but also slows thinking and reaction time [58]. Opioids (like oxycodone or heroin) act like the body's own pain-relieving chemicals (endorphins), cutting pain and creating a pleasant "glow," while also tapping into the reward system [1]. The brain does more than feel good it learns. Two parts of the brain help with this

learning: the hippocampus (which stores memories) and the amygdala (which tags emotions). Together, they link the drug's feeling with the situation where it happened: the room, the friends, the music, the smell, the stress level, even the time of day. This is why later, even after the drug is gone, seeing the same place or people can bring back strong urges to use again [51]. Initial use is shaped by many things. Social life matters. If friends use, if parties make heavy drinking seem normal, or if people think marijuana is harmless, trying becomes more likely. Availability also matters. Alcohol and cigarettes are legal and common; marijuana may be easy to find; some pills can be taken from home medicine cabinets; cocaine might appear in party circles; vapes are easy to carry and hide. Stress and trauma push people toward drugs because drugs can quickly numb anxiety, help sleep, or create a temporary escape. Curiosity is natural people want to know how it feels. Biology matters too. Some people's brains are more sensitive to dopamine, so the first use feels extra strong, and the brain marks it as important. The age of first use is a big factor. Teen brains are still developing, especially the part that helps with self-control and planning (the prefrontal cortex). In teenagers, the reward system is more sensitive, and control systems are less mature. So early use can more quickly build habits and stronger connections between cues and drug effects [59].

2. Abuse: Abuse means drug use has become risky or harmful. It is no longer just trying something occasionally. It becomes a pattern: using more often, using bigger amounts, or using in unsafe situations (like drinking before driving, or mixing multiple drugs). The person may start using drugs not only for fun, but to get through the day. This is the stage where the brain's learning and reward systems turn use into a routine. Each time someone uses a drug, the brain strengthens



the link between a feeling (like stress or boredom), a cue (like a place or time), and the drug. Over time, the person starts using to solve daily problems: alcohol to relax after work, marijuana to sleep or “switch off,” nicotine to deal with worry, cocaine to stay alert or talkative, opioids to ease pain or sad feelings. The “loop” becomes familiar: buy or prepare the drug, use it, feel better for a while. The brain likes familiar routines and quick payoffs, so this loop becomes more automatic [2]. Abuse is where tolerance usually starts to show. Repeated large dopamine spikes lead the brain to reduce receptor availability or sensitivity to keep balance. That means the same dose increasingly produces less effect. A person who once felt relaxed after one beer now needs three; one joint becomes several; one line of cocaine becomes multiple lines; one pill becomes two. With nicotine, the time between puffs shortens; with cannabis, potency creeps upward toward high-THC concentrates; with alcohol, drinking shifts from weekends to most nights. This is the classic slide: you don’t necessarily intend to escalate, but the brain’s adaptation quietly moves the goalposts [52]. Another key engine of abuse is negative reinforcement. At first, substances are used for positive effects (pleasure, energy, creativity, social ease). With repeated use, uncomfortable states appear when the drug is not in the system—irritability, anxiety, low mood, poor sleep, headache, restlessness. They may be mild at first, so they’re easy to rationalize: “I had a tough day,” “I deserve to relax,” “I need to focus.” But the pattern is the same the person uses to remove discomfort. This shift from seeking pleasure to avoiding pain drives frequency upward. As abuse progresses, scope widens and risks escalate. Use spreads to new contexts: alone rather than only socially; before work or classes; while driving; early in the day rather than late. Polysubstance use increases danger alcohol plus benzodiazepines dangerously suppress breathing

and judgment; cocaine plus alcohol forms coca ethylene, which adds cardiovascular risk. Potency often increases moving from beer to spirits, from cannabis flower to high-THC dabs, from prescription opioids to illicit powders. Faster-onset forms (like smoking or injecting) teach the brain more quickly because the reward arrives faster. Health impacts start to show alcohol abuse damages the liver, raises blood pressure, increases cancer risk; cannabis abuse affects attention, memory, and motivation; cocaine abuse stresses the heart and can cause anxiety or paranoia; nicotine increases cardiovascular and respiratory disease risk; opioids elevate overdose risk, especially with fentanyl contamination. Abuse is the most responsive stage to early intervention. Simple questions help: Is my use increasing? Am I using to avoid feeling bad? Is it affecting sleep, money, work, or relationships? Am I seeking stronger products or mixing drugs? If the answers nudge yes, small changes can make large differences setting limits, changing environments, reducing cues, taking breaks, and seeking professional guidance to address pain, sleep, anxiety, or attention with safer, evidence-based strategies [1][56][54]

3. Tolerance: Tolerance is the stage when the body and brain get used to a drug. In the beginning, when someone first drinks alcohol, smokes marijuana, takes cocaine, or uses nicotine or opioids, the effect feels strong. One beer might make them feel relaxed, one puff of marijuana might make them laugh and feel calm, one cigarette might take away stress, or one line of cocaine might make them feel full of energy. But after using the drug many times, the brain starts to adjust. The same amount of the drug no longer feels as strong as before. This is called tolerance.

The brain has a reward system that works with a chemical called dopamine. Dopamine is released



when we do things that feel good, like eating, exercising, or spending time with friends. Drugs cause a much bigger release of dopamine than normal activities. At first, this feels exciting. But the brain does not like being overstimulated all the time. To protect itself, it reduces the number of dopamine receptors or makes them less sensitive. This means the same dose of the drug now produces a weaker effect [1][2].

For example, A person who once felt relaxed after one beer may now need three or four beers. Someone who once felt high after one joint of marijuana may now need several joints or stronger cannabis products. A smoker who once felt calm after one cigarette may now need a whole pack in a day. A person who once felt energized after one line of cocaine may now need many lines in one night. Someone who once felt pain relief from one opioid pill may now need two or three. This is how tolerance pushes people to use more. Tolerance can happen in different ways, **Brain tolerance (pharmacodynamic)** The brain's receptors become less sensitive to the drug. **Body tolerance (pharmacokinetic)** The body, especially the liver, gets better at breaking down the drug, so less of it reaches the brain. This often happens with alcohol. **Learned tolerance (behavioural):** People learn to act more "normal" even when they are under the influence. For example, a heavy drinker may not look drunk even though their blood alcohol level is high. Tolerance is dangerous because it makes people take larger doses. This increases the risk of accidents, health damage, and overdose. For example, people with opioid tolerance may take very high doses to feel relief. If they stop for a while and then return to the same high dose, their body may not handle it, leading to overdose. With alcohol, tolerance can lead to daily heavy drinking, which damages the liver, heart, and brain. With cocaine, tolerance can lead to binge use, which raises the risk of heart attack or stroke. With

marijuana, tolerance can lead to heavy daily use, which affects memory, motivation, and mental health [56]

Tolerance also changes the reason people use drugs. At first, they use drugs for pleasure. But later, they use more just to feel "normal." The drug no longer gives the same high it only prevents discomfort or withdrawal. This is why tolerance is a key step toward dependence and addiction [2]. Different drugs build tolerance at different speeds. Nicotine tolerance can develop in just days or weeks, which is why smokers quickly go from occasional use to daily use. Alcohol tolerance may take months or years, but once it develops, drinking levels can rise a lot. Marijuana tolerance varies, but heavy daily users often report needing much more to feel the same effects. Cocaine tolerance can develop quickly, leading to repeated doses in one session. Opioid tolerance is especially dangerous because it develops fast and pushes people toward higher doses that can stop breathing. In simple words, tolerance is the brain and body saying: "I've seen this drug too often. I'm not going to react as strongly anymore." But this makes the person chase higher doses, which increases risks and pulls them deeper into the cycle of addiction.

Physiology of tolerance

A. Receptor Downregulation: When a person uses a drug repeatedly, the brain's nerve cells (neurons) try to protect themselves from being overstimulated. Drugs like cocaine, marijuana, opioids, alcohol, and nicotine all cause a surge of neurotransmitters such as dopamine. At first, this feels very strong and rewarding. But if the brain keeps receiving these strong signals, it adapts by reducing the number of receptors on the cell surface or by making them less sensitive. This is called receptor downregulation or desensitization. For example, chronic cannabis use reduces the



density of CB1 receptors in the hippocampus and prefrontal cortex, which explains why heavy users often report weaker effects over time [56]. Similarly, long-term cocaine use reduces the sensitivity of dopamine D2 receptors, so the same dose produces less euphoria [2]. With opioids, repeated exposure reduces the responsiveness of μ -opioid receptors, which explains why patients with chronic pain often need higher doses for the same relief. In simple terms: the brain “turns down the volume” on its receptors, so the drug feels weaker.

B. Enhanced Metabolism: Tolerance also develops outside the brain, in the body’s metabolism. The liver plays a key role here. Many drugs are broken down by enzymes in the liver, especially the cytochrome P450 family. With repeated drug use, the liver produces more of these enzymes, which means the drug is broken down faster and less of it reaches the brain. This is called pharmacokinetic tolerance. For example, chronic alcohol use induces enzymes like CYP2E1, which speeds up alcohol clearance [58]. Smokers show faster nicotine metabolism because of increased activity of CYP2A6 [57]. Barbiturates and some benzodiazepines also induce their own metabolism, meaning the body clears them more quickly with long-term use. The result is that the same dose of the drug produces weaker effects, not because the brain has changed, but because the body is removing the drug more efficiently. This is why long-term users often take larger or more frequent doses.

C. Pharmacodynamic Adaptation: Beyond receptor changes, the brain also makes deeper adjustments in its signalling systems. This is called pharmacodynamic adaptation. It means the brain changes how its neurotransmitters and pathways work to balance the constant presence of the drug. For example, with alcohol, chronic use reduces the

sensitivity of GABA-A receptors (which normally calm the brain) and increases the activity of NMDA glutamate receptors (which excite the brain). This explains why alcohol withdrawal can cause anxiety, tremors, and even seizures the brain has become hyperactive without alcohol’s calming effect. With opioids, the brain reduces its own natural endorphin release and alters receptor signalling, so the drug feels weaker and withdrawal feels painful. With stimulants like cocaine and amphetamines, the dopamine transporters and receptors adapt, reducing the “high” and making the crash worse. These adaptations are the brain’s way of keeping balance, but they make the drug less rewarding and withdrawal more severe. [58]

Tolerance is not just one process it is a combination of receptor changes, faster metabolism, and brain adaptations. At first, drugs feel powerful because they flood the brain with dopamine and other neurotransmitters. But with repeated use, the brain reduces receptor numbers, the liver clears the drug faster, and neurotransmitter systems adapt. The result is that the same dose feels weaker, so the person takes more. Over time, this cycle leads to dependence, where the drug is needed just to feel “normal.” Tolerance is therefore a key step in the progression from casual use to addiction.

4. Dependence: Dependence is one of the most important stages in the cycle of addiction. It develops after tolerance, when the brain and body have already adjusted to the constant presence of a drug. At first, people use drugs like alcohol, marijuana, nicotine, cocaine, or opioids for pleasure, curiosity, or relief from stress. Over time, tolerance builds, meaning the same dose feels weaker. To overcome this, people take more. Eventually, the brain and body adapt so strongly that they cannot function normally without the

drug. This is dependence. In this stage, the drug is no longer about getting “high” or feeling extra pleasure. Instead, it becomes necessary just to feel *normal*. If the person stops using, they experience withdrawal symptoms, which can be physical (like sweating, shaking, nausea, or pain) and psychological (like anxiety, depression, or irritability). The brain’s reward system plays a central role in dependence. Normally, dopamine is released in moderate amounts when we do things that are rewarding, like eating, exercising, or socializing. Drugs cause much larger dopamine surges, which the brain interprets as highly important. With repeated use, the brain reduces its natural dopamine production and decreases the sensitivity of dopamine receptors [2]. This means that without the drug, dopamine levels are too low, and the person feels flat, unmotivated, or depressed. This is why people in dependence often say they no longer feel joy in everyday life. They need the drug just to restore dopamine to a normal level. Dependence also involves the stress system of the brain. The amygdala, which processes fear and stress, becomes overactive with repeated drug use. Stress hormones like corticotropin-releasing factor (CRF) are released in higher amounts. This makes withdrawal feel even worse, with strong anxiety, restlessness, and irritability [51]. The combination of low dopamine and high stress chemicals creates a powerful drive to keep using the drug.

Different drugs cause dependence through different neurotransmitter systems. With alcohol, the brain adapts by reducing the calming effect of GABA receptors and increasing the excitatory effect of glutamate receptors. When alcohol is suddenly stopped, the brain becomes hyperactive, leading to tremors, sweating, anxiety, and in severe cases, seizures. With opioids, the brain reduces its natural endorphin release and changes opioid receptor signalling. Without opioids, the

person feels muscle pain, nausea, diarrhoea, and intense restlessness. With nicotine, the brain increases the number of acetylcholine receptors. When nicotine is absent, the person feels irritable, unfocused, and anxious. With cocaine and stimulants, dopamine transporters and receptors adapt, so without the drug, the person feels extreme fatigue, low mood, and lack of motivation. With marijuana, heavy use reduces CB1 receptor activity, so stopping can cause irritability, poor sleep, and low. Dependence does not only affect the brain. The autonomic nervous system, which controls heart rate, digestion, and sweating, is also disrupted. This explains why opioid withdrawal causes sweating, diarrhoea, and rapid heartbeat. The sleep cycle is disturbed, so many dependent users cannot sleep without the drug. Hormonal systems are also affected, making the body weaker and more stressed during withdrawal. One of the most dangerous aspects of dependence is that withdrawal symptoms can be severe or even life-threatening. Alcohol and benzodiazepine withdrawal can cause seizures and must be managed with medical supervision. Opioid withdrawal is not usually fatal but is extremely painful, which drives many people back to using. Nicotine withdrawal is less dangerous physically but causes strong cravings and irritability, making quitting very difficult. Cocaine withdrawal causes deep depression and fatigue, which can also lead to relapse. It is important to understand the difference between dependence and addiction. Dependence means the body and brain need the drug to function normally. Addiction means compulsive drug-seeking and use despite harm. A person can be dependent without being addicted for example, patients on long-term pain medication may be physically dependent but not addicted if they use the drug as prescribed. However, in cases of drug abuse, dependence usually leads to addiction because the person begins to crave the drug and loses control



over its use. Dependence also has a strong psychological side. People in dependence often feel that they cannot cope with stress, sadness, or daily life without the drug. This is partly due to brain changes, but also due to learned behaviour. The brain has linked the drug with relief, so in moments of stress or discomfort, the craving becomes automatic. Environmental cues like certain places, people, or routines can trigger strong urges because the brain has learned to expect the drug in those situations. In simple terms, dependence is the stage where the drug has taken over the body's balance. The brain has rewired itself to expect the drug, the body has adjusted its systems to function with the drug, and the person feels unwell without it. This is why dependence is such a powerful force in the cycle of addiction. It explains why quitting is so hard, and why medical and psychological support are often needed.[53][54]

5. Addiction: Addiction is the final stage in the cycle of drug use. It goes beyond tolerance and dependence. In tolerance, the drug feels weaker, so the person takes more. In dependence, the body and brain need the drug to feel normal and stopping causes withdrawal. In addition, drug use becomes compulsive. The person cannot stop even when they know it is harming their health, relationships, or work. Addiction is now understood as a chronic brain disease, not just a bad habit, because repeated drug use changes the brain's structure and function in lasting ways. The brain has a natural reward system that motivates us to do things important for survival, like eating, exercising, or socializing. This system uses a chemical called dopamine, which is released in areas such as the nucleus accumbens and the ventral tegmental area (VTA). Normally, dopamine is released in moderate amounts, giving us pleasure and motivation. Drugs like cocaine, opioids, nicotine, alcohol, and marijuana release

far more dopamine than natural rewards. At first, this feels powerful and exciting. But with repeated use, the brain adapts. It reduces the number of dopamine receptors and lowers natural dopamine production. Everyday pleasures like food, hobbies, or relationships feel less rewarding, while the drug becomes the main source of pleasure. This explains why addicted people often lose interest in normal life activities. Addiction is not only about chasing pleasure. It is also about escaping pain. The brain's stress circuits, especially the amygdala, become overactive with repeated drug use. Stress chemicals like corticotropin-releasing factor (CRF) increase. This makes withdrawal and daily stress feel worse. The person uses drugs not just to feel good, but to avoid feeling bad. This creates a cycle: stress leads to craving, craving leads to drug use, drug use gives temporary relief, and then stress returns even stronger. Over time, the balance shifts from "using for pleasure" to "using to escape suffering." Another key change in addiction happens in the prefrontal cortex, the part of the brain responsible for decision-making, planning, and self-control. Brain scans show that in addicted people, this region is less active. This means that even if someone wants to quit, their ability to resist cravings is weakened. The reward and stress systems overpower the control system. This is why addiction is not simply about willpower. It is about brain circuits being rewired so that the drug becomes the top priority, even above health, family, or work. Addiction also involves powerful memory and learning systems. The hippocampus and amygdala store strong memories of drug use linked to people, places, and emotions. For example, a smoker may crave cigarettes when drinking coffee, or a former heroin user may feel cravings when passing a place where they once used. These cues can trigger intense cravings even after months or years of abstinence. This is why relapse is so common. The brain has learned that the drug is the fastest way to feel



relief, and those memories are hard to erase [1][2] [54]

6.Relapse: Relapse is one of the most difficult parts of addiction. Even after someone has stopped using drugs for weeks, months, or even years, they may return to drug use. This does not mean that treatment has failed. Instead, it shows that addiction is a chronic, relapsing brain disease (Volkow et al., 2016). Relapse happens because the brain changes caused by drugs do not disappear quickly. The brain's reward system, stress system, and memory system remain altered, and these changes make cravings and triggers very powerful. The reward system is at the centre of relapse. Normally, dopamine is released in the brain when we do things that are enjoyable, like eating or spending time with friends. Drugs release much more dopamine than natural rewards. Over time, the brain adapts by reducing dopamine receptors and lowering natural dopamine production. This means that normal life feels less rewarding, while the drug remains strongly linked to pleasure. Even after quitting, the brain remembers the drug as the fastest way to feel good. When a person sees a trigger like a bar, a lighter, or old friends who use drugs the brain releases dopamine in anticipation. This creates a powerful craving that can lead to relapse [2]. Relapse is also strongly linked to the stress system. The amygdala, which controls fear and stress, becomes overactive in addiction. Stress hormones like corticotropin-releasing factor (CRF) increase. This makes withdrawal and daily stress feel worse. During stressful times, the brain remembers that drugs once relieved these feelings. Stress can therefore push a person back to using. This is called stress-induced relapse [51]. Another important factor is the memory and learning system. The hippocampus and amygdala store strong memories of drug use. These memories are tied to sights, smells, people, and places. Even after long abstinence, these cues can trigger

cravings. For example, a smoker may crave cigarettes when drinking coffee, or a former heroin user may feel urges when passing a place where they once used. This is called cue-induced relapse. These memories are very powerful because the brain has learned that the drug is linked to relief and pleasure. The prefrontal cortex, which controls decision-making and self-control, is also weakened in addiction. Brain scans show that this region is less active in addicted people [54]. This means that even if someone wants to stay sober, their ability to resist cravings is reduced. The reward and stress systems overpower the control system. This explains why relapse often happens even when people are motivated to quit. There are three main types of relapse triggers. Stress-induced relapse happens when anxiety, trauma, or daily stress push someone back to drug use. Cue-induced relapse happens when reminders of drug use, like people, places, or objects, trigger cravings. Drug-induced relapse happens when even a small dose of the drug restarts the cycle. For example, a single drink can trigger full relapse in someone recovering from alcohol addiction. Relapse is common because addiction changes the brain for a long time. Recovery is not a straight line it often involves multiple attempts. Each relapse is a chance to learn more about triggers and strengthen coping strategies. With time, therapy, and support, the brain can rewire itself toward healthier habits. Treatments that combine medication, counselling, and stress management are most effective. For example, medications like methadone or buprenorphine can reduce cravings in opioid addiction, while behavioural therapies help people manage stress and avoid triggers [1]. In simple terms, relapse happens because the brain has been rewired to expect the drug. The reward system remembers the pleasure, the stress system makes withdrawal painful, and the memory system stores powerful cues. The control system is weakened, so resisting cravings is difficult. This



combination makes relapse a normal part of recovery for many people. It shows why addiction is a chronic disease and why long-term support is needed.

5. Breaking the cycle: Breaking the cycle of drug abuse to addiction means stopping the pattern where occasional use slowly turns into dependence and then full addiction. At first, people may use drugs to feel pleasure, reduce stress, or escape problems. Over time, the brain adapts, and the same amount of drug no longer gives the same effect, leading to tolerance. This makes the person take more, which increases the risk of dependence.

Dependence means the body and mind start to rely on the drug, and stopping it causes withdrawal symptoms like anxiety, pain, or cravings. Addiction is when drug use becomes uncontrollable, even when it harms health, relationships, and daily life. Breaking this cycle requires early awareness, strong support from family and friends, healthy coping strategies like exercise or hobbies, and professional help such as counselling or rehabilitation programs. It is not easy, but with determination, guidance, and a safe environment, people can regain control of their lives and move toward recovery.

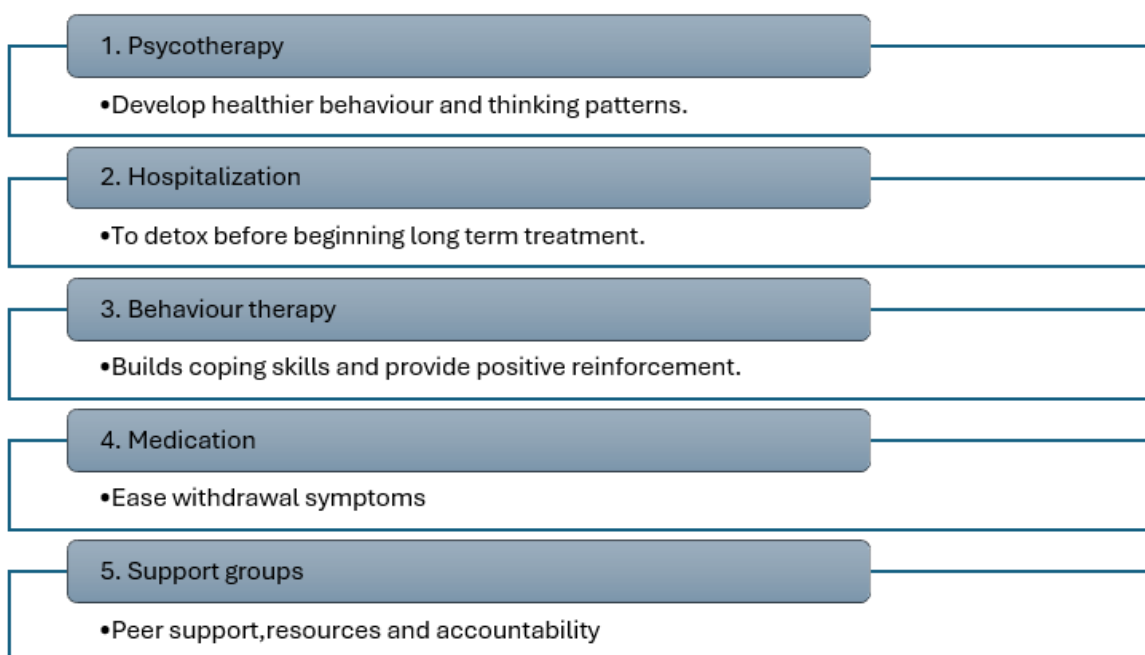


fig 5.1. Various sources to break the cycle of abuse to addiction

5.1. Psychotherapy: Drug addiction is not just a physical problem—it's deeply psychological. People often begin using substances like nicotine, alcohol, opioids, or stimulants to escape emotional pain, stress, trauma, or social pressure. Over time, this use becomes habitual, and the brain adapts, leading to tolerance and dependence. Eventually, the person feels compelled to use the drug just to feel normal. This is the cycle of addiction. Psychotherapy helps break this cycle by targeting the underlying thoughts, emotions, and behaviours

that fuel drug use. One of the most widely used forms of psychotherapy in addiction treatment is Cognitive Behavioural Therapy (CBT). CBT helps individuals recognize and change negative thought patterns that lead to drug use. For example, someone might think, "I can't handle stress without drinking." CBT challenges this belief and teaches alternative coping strategies. Thoughts, feelings, and behaviours are interconnected, and changing one can influence the others. This approach is especially effective in helping people

identify triggers situations, emotions, or people that make them want to use drugs and develop healthier responses. Another powerful approach is Motivational Interviewing (MI). MI is a client-centered therapy that helps individuals explore their own reasons for change. Instead of confronting the person, the therapist uses empathy and open-ended questions to help them reflect on their goals and values. This is important because many people with addiction feel ambivalent, they want to quit but also fear withdrawal or losing their coping mechanism. MI helps resolve this ambivalence and strengthens the person's motivation to change. Studies show that MI is particularly effective in early stages of treatment when individuals are still unsure about quitting. Mindfulness-Based Relapse Prevention (MBRP) is another psychotherapeutic method that combines mindfulness meditation with cognitive strategies. It teaches individuals to observe their cravings and emotions without reacting impulsively. For example, instead of immediately smoking when stressed, a person learns to sit with the discomfort and let the craving pass.[60], MBRP has shown promise in reducing relapse rates by improving emotional regulation and self-awareness. Psychodynamic therapy takes a deeper approach by exploring unconscious conflicts, childhood experiences, and emotional wounds that may contribute to addiction. For instance, unresolved trauma or feelings of abandonment might lead someone to use drugs as a form of self-soothing. Psychodynamic therapy helps individuals understand these patterns and develop healthier ways of relating to themselves and others. While it's a longer-term approach, it can be especially helpful for people with complex emotional histories. Group therapy and mutual support therapies like 12-step programs (e.g., Alcoholics Anonymous or Narcotics Anonymous) also play a vital role. These therapies provide a sense of community, accountability, and shared

experience. People often feel isolated in addiction, and group therapy helps them realize they're not alone.[61] Mutual support therapies encourage individuals to accept responsibility for their behaviour and rely on peer support to maintain sobriety. Systems-based therapy involves the person's family or social network in treatment. Addiction doesn't happen in isolation—it affects and is affected by relationships. Systems therapy helps families understand addiction, improve communication, and support recovery. For example, if a person lives in a household where others use drugs, recovery becomes harder. Therapy can help restructure the environment to support sobriety. Importantly, psychotherapy is not a one-size-fits-all solution. Treatment must be tailored to the individual's needs, personality, and stage of recovery. Some people benefit from short-term behavioural interventions, while others need long-term emotional healing.[60] Psychotherapy can be integrated with medical treatments like detox or medication-assisted therapy (e.g., methadone for opioid addiction) to enhance outcomes. Psychotherapy also helps in relapse prevention, which is crucial because addiction is a chronic condition. Even after quitting, people may face cravings, stress, or emotional triggers that tempt them to use again. Therapists help individuals develop relapse prevention plans, which include recognizing warning signs, building support systems, and practicing coping skills. For example, someone might learn to call a friend, go for a walk, or write in a journal instead of using drugs when feeling overwhelmed. In addition to individual therapy, psychoeducation is often part of the process. This involves teaching individuals about the nature of addiction, how it affects the brain, and what recovery looks like. Understanding that addiction is a disease not a moral failure can reduce shame and increase willingness to seek help. Emerging therapies are also being explored. For example, Eye Movement



Desensitization and Reprocessing (EMDR) is used to treat trauma-related addiction. EMDR helps individuals process traumatic memories that may be driving substance use. Neuroimaging studies suggest that psychotherapy can even change brain activity patterns, improving emotional regulation and decision making [60]

5.2. Hospitalization: Drug addiction is a complex condition that affects the brain, body, and behaviour. People caught in the cycle of drug abuse often struggle with physical dependence, emotional distress, and social instability. When the addiction becomes severe leading to overdose, withdrawal complications, or psychiatric crises hospitalization becomes necessary. It provides immediate medical care and begins the process of recovery in a controlled, supportive setting. The first and most urgent role of hospitalization is medical stabilization. Many drugs, such as alcohol, opioids, benzodiazepines, and stimulants, can cause dangerous withdrawal symptoms. For example, alcohol withdrawal may lead to seizures or delirium tremens, while opioid withdrawal causes intense pain, vomiting, and anxiety. In a hospital, doctors can monitor vital signs, manage symptoms with medications, and prevent life-threatening complications. This phase is known as detoxification, and while it doesn't treat addiction itself, it prepares the body for further therapy. Detox is only the first step in a continuum of care, and hospitalization ensures it is done safely and effectively. Hospitalization also provides a unique opportunity for psychological assessment. Many individuals with substance use disorders (SUDs) have co-occurring mental health conditions like depression, anxiety, bipolar disorder, or trauma-related disorders. These conditions often fuel drug use and make recovery harder. In the hospital, psychiatrists and psychologists can evaluate the patient's mental state, diagnose underlying issues, and begin treatment. This dual approach treating

both addiction and mental illness is known as integrated care, and it significantly improves long-term outcomes.[62] Hospitalization allows for early identification of psychiatric comorbidities and timely intervention. Another key benefit of hospitalization is the interruption of the drug-use environment. Many people use drugs in unsafe or triggering settings—such as homes with other users, streets, or places of trauma. Hospitalization removes them from these environments and offers a calm, drug-free space. This break can reduce cravings, improve sleep, and allow the brain to begin healing. It also gives patients time to reflect on their situation and consider change. As one study titled *“They Don't Just Need a Handshake or a Handoff, They Need a Hug”* puts it, patients often need emotional support and human connection during this vulnerable time. Hospitalization also serves as a gateway to long-term treatment. While the hospital stay may last only a few days or weeks, it can connect patients to outpatient programs, residential rehab, or community support. Discharge planning is a crucial part of this process. Social workers and addiction specialists help patients find follow-up care, arrange transportation, and coordinate with family or housing services. Without this transition support, many patients relapse shortly after discharge.[63][64] In some cases, hospitalization is needed for complications caused by drug use. For example, injecting drugs can lead to infections like endocarditis or abscesses, while chronic alcohol use may cause liver failure. These medical issues require specialized treatment and monitoring. During the hospital stay, doctors can educate patients about the health risks of continued use and motivate them toward recovery. This is known as motivational enhancement, and it's often more effective when patients are facing the real consequences of addiction.[64] Hospitals also offer access to medications that support recovery. For opioid addiction, drugs like methadone,



buprenorphine, or naltrexone can reduce cravings and prevent relapse. These medications are known as medication-assisted treatment (MAT) and are most effective when started early. Hospitalization allows doctors to begin MAT in a safe setting and monitor its effects. Similarly, for alcohol use disorder, medications like acamprostate or disulfiram may be introduced. According to ASAM guidelines, initiating MAT during hospitalization increases the likelihood of continued engagement in treatment. Importantly, hospitalization can help rebuild trust and hope. Many individuals with addiction feel ashamed, isolated, or hopeless. Being treated with dignity and compassion in a hospital setting can restore their sense of worth. Nurses, doctors, and counsellors play a vital role in this emotional healing. They listen, validate, and encourage patients to take the first steps toward recovery. Patients often describe hospital staff as the first people who truly cared about their well-being. However, hospitalization alone is not enough. Without proper follow-up, many patients return to drug use. That's why hospitals must work closely with community programs, outpatient clinics, and peer support networks. The concept of continuity of care is essential. It means that recovery doesn't end at discharge it continues through therapy, medication, social support, and lifestyle changes. The 2024 review by Incze et al. stresses the importance of care transition strategies, such as scheduling follow-up appointments before discharge and involving peer recovery coaches [63][64]

5.3. Behaviour therapy: Drug addiction is not just a chemical problem it's a behavioural one. People often fall into patterns of using drugs to escape pain, feel pleasure, or cope with stress. Over time, these patterns become automatic. For example, someone might reach for alcohol every time they feel anxious, or smoke when they're

bored. These behaviours are learned, repeated, and reinforced. Behaviour therapy works by helping people *unlearn* these habits and *replace* them with healthier ones.

A. Cognitive Behaviour Therapy (CBT): One of the most widely used forms of behaviours therapy in addiction treatment is Cognitive Behavioural Therapy (CBT). CBT helps individuals understand the connection between their thoughts, feelings, and actions. For example, a person might think, "I can't handle life without drugs," which leads to feelings of hopelessness and the behaviours of using. CBT teaches them to challenge this thought and replace it with something more realistic, like "I've handled stress before without drugs. CBT is especially effective in preventing relapse because it helps people recognize triggers and develop coping strategies.[65]

B. Contingency Management (CM): Another important method is Contingency Management (CM). This therapy uses rewards to encourage positive behaviours. For example, a person might receive vouchers or small prizes for attending therapy sessions or passing drug tests. These rewards help reinforce sobriety and make recovery feel more achievable. CM is based on the principle of operant conditioning behaviours that is rewarded is more likely to be repeated. Studies show that CM is particularly effective for stimulant addiction, such as cocaine or methamphetamine.

C. Motivational Enhancement Therapy (MET): Is a behaviours-based approach that helps people find their own reasons to change. Instead of telling someone what to do, the therapist helps them explore their values, goals, and ambivalence. For example, a person might say, "I want to quit drugs, but I'm scared of withdrawal." MET helps them weigh the pros and cons and build motivation from within. This therapy is especially useful in early



stages of recovery when people are unsure about quitting.

D. Behavioural couples therapy (BCT): Is another approach used when addiction affects relationships. Often, drug use leads to conflict, mistrust, and emotional distance. This therapy helps couples improve communication, rebuild trust, and support each other's recovery. Involving partners in therapy can reduce relapse and improve emotional stability.[66]

E. Aversion therapy: Is a more traditional behavioural method that pairs drug use with unpleasant experiences. For example, a person might take a medication that causes nausea when they drink alcohol. Over time, the brain associates drinking with discomfort, reducing the desire to use. While this method is less common today, it has been used in treating alcohol and nicotine dependence.

Mindfulness based behavioural therapies are gaining popularity. These approaches teach individuals to observe their thoughts and cravings without reacting. For example, instead of immediately using drugs when stressed, a person learns to sit with the discomfort and let the craving pass. This builds emotional resilience and reduces impulsive behaviours. Mindfulness is often combined with CBT or relapse prevention strategies.

Relapse prevention training is a core part of behaviours therapy. It teaches individuals how to identify high-risk situations like parties, arguments, or loneliness and plan. For example, someone might learn to call a friend, go for a walk, or use breathing exercises instead of using drugs. These skills are practiced repeatedly until they become automatic. Relapse prevention is most effective when combined with other behavioural strategies.

Behaviour therapy also helps individuals rebuild their daily routines. Addiction often disrupts sleep, work, relationships, and self-care. Therapists help patients set goals, create schedules, and develop healthy habits. For example, someone might learn to wake up early, exercise, eat balanced meals, and attend support meetings. These changes improve mood, reduce cravings, and strengthen recovery.[66] Importantly, behaviour therapy is collaborative and practical. It doesn't just talk about problems it helps people act. Therapists work with patients to set small, achievable goals and track progress. For example, a goal might be "Stay sober for one week" or "Practice relaxation every day." Success builds confidence and momentum. Behaviour therapy is also adaptable. It can be used in individual sessions, group therapy, family settings, or residential programs. It works for many types of addiction alcohol, nicotine, opioids, stimulants, and more. It can also be combined with medication, medical care, or other therapies for a holistic approach. One of the strengths of behaviour therapy is that it teaches skills for life. Even after treatment ends, individuals can use these tools to manage stress, avoid relapse, and build a meaningful life. For example, someone who learns to cope with anxiety through breathing exercises or journaling can use that skill forever. However, behaviour therapy is not a quick fix. It requires time, effort, and commitment. People may face setbacks, cravings, or emotional challenges. That's why ongoing support is important. Many programs offer booster sessions, peer support, or follow-up care to maintain progress.

5.4. Support groups: Drug addiction often isolates people. It damages relationships, creates shame, and makes individuals feel misunderstood. Many people caught in the cycle of drug abuse feel like no one truly understands what they're going through. This isolation can deepen the addiction



and make recovery harder. Support groups break this isolation. They bring together people who have faced similar struggles, creating a safe space where individuals can share their stories, listen to others, and build hope. Support groups come in many forms. Some are peer-led, like *Alcoholics Anonymous (AA)* or *Narcotics Anonymous (NA)*. Others are professionally facilitated, often run by counsellors or social workers. Some are community-based, while others are part of hospitals or rehabilitation centres. Regardless of the format, the goal is the same: to provide ongoing emotional and social support for people trying to overcome addiction. One of the most important benefits of support groups is shared experience. When someone hears another person talk about their cravings, relapses, or guilt, they often feel a sense of relief: "I'm not the only one." This connection reduces shame and builds empathy. Peer support helps individuals feel accepted and valued, which increases their motivation to change. Support groups also offer practical advice. Members share tips on how to handle cravings, avoid triggers, deal with stress, and rebuild relationships. For example, someone might suggest a breathing technique that helped them during withdrawal or recommend a local therapist. This kind of advice is grounded in real-life experience, making it more relatable and useful than textbook solutions. Another key benefit is accountability. In many support groups, members check in regularly, share progress, and encourage each other to stay sober. This creates a sense of responsibility not just to oneself, but to the group. Knowing that others care and are watching can help someone resist the urge to use drugs.[67] Peer recovery support services significantly improve treatment engagement and reduce relapse rates. Support groups also help with emotional healing. Addiction is often linked to trauma, depression, anxiety, or loss. Talking about these issues in a supportive environment can be

deeply therapeutic. Members learn to express their feelings, listen without judgment, and offer comfort. This emotional support is especially important for people who don't have strong family or social networks. In many cases, support groups become a lifeline. They offer stability during difficult times, such as after a relapse, during withdrawal, or when facing legal or financial problems. Members often say that their group is the only place where they feel truly understood. This sense of belonging can be a powerful force in recovery. Support groups also promote long-term recovery. While medical treatment and therapy are essential, they often last only a few weeks or months. Support groups, on the other hand, can continue for years. They help individuals stay connected, motivated, and focused on their goals.[68] Community-based support systems like AA and NA provide ongoing companionship and guidance, which are crucial for sustained recovery. Importantly, support groups are accessible and low-cost. Many are free and open to anyone. This makes them especially valuable in areas where professional treatment is limited or expensive. They also reduce the burden on healthcare systems by offering informal but effective care. Support groups can also be tailored to specific needs. For example, there are groups for women, LGBTQ+ individuals, veterans, young adults, and people with co-occurring mental health conditions. This specialization helps members feel more comfortable and understood. Despite their benefits, support groups are not a cure-all. They work best when combined with other treatments, such as psychotherapy, medication, and medical care. Some people may need professional help to deal with severe withdrawal symptoms, trauma, or psychiatric disorders. However, support groups can complement these treatments and provide the social and emotional support that medical care often lacks.[69]



5.5. Medications: Medication plays a very important role in breaking the cycle of drug abuse to addiction because it helps people manage withdrawal, reduce cravings, and stabilize their brain and body so they can focus on recovery. Addiction is not only a psychological condition but also a biological one. Long-term drug use changes the way the brain's reward system works, making it difficult for people to stop using even when they want to. Medications are designed to correct or balance these changes, giving individuals a better chance to regain control of their lives. When combined with counselling, behaviour therapy, and social support, medication becomes a powerful tool in the journey toward recovery. For opioid addiction, three main medications are widely used: methadone, buprenorphine, and naltrexone. Methadone is a long-acting opioid agonist that prevents withdrawal symptoms and reduces cravings without producing the same intense high as drugs like heroin. Buprenorphine is a partial agonist, meaning it activates opioid receptors but to a lesser degree, which helps stabilize brain chemistry and lowers the risk of misuse. Naltrexone, on the other hand, is an antagonist it blocks opioid receptors entirely, preventing any high if the person relapses. These medications are supported by strong evidence and are recommended by the *American Society of Addiction Medicine (ASAM)* as part of medication-assisted treatment (MAT). For alcohol use disorder, medications such as naltrexone, acamprosate, and disulfiram is commonly prescribed. Naltrexone reduces the pleasurable effects of alcohol, making drinking less rewarding. Acamprosate helps restore the balance of brain chemicals disrupted by long-term alcohol use, reducing symptoms like anxiety and insomnia that often trigger relapse. Disulfiram works differently it causes unpleasant reactions (such as nausea and flushing) if alcohol is consumed, acting as a deterrent. These

medications significantly improve abstinence rates when combined with counselling and support groups. For nicotine dependence, medications include nicotine replacement therapy (NRT) patches, gums, lozenges, and inhalers as well as non-nicotine medications like bupropion and varenicline. NRT provides controlled doses of nicotine without the harmful chemicals in cigarettes, helping ease withdrawal. Bupropion is an antidepressant that reduces cravings and withdrawal symptoms, while varenicline partially stimulates nicotine receptors, reducing both cravings and the rewarding effects of smoking.[70] Varenicline is one of the most effective medications for smoking cessation. Medication is also being explored for stimulant addiction (such as cocaine and methamphetamine) and cannabis use disorder, though no drugs are yet officially approved. Some studies suggest that medications like bupropion, modafinil, or topiramate may help reduce cravings for stimulants, but more research is needed. Even when no specific medication exists, doctors can still prescribe medicines to treat withdrawal-related symptoms like anxiety, depression, or sleep problems, which makes recovery more manageable. The main advantage of medication is that it reduces the risk of relapse. Withdrawal symptoms and cravings are often the biggest reasons people return to drug use. By easing these symptoms, medication gives individuals the stability they need to engage in therapy, rebuild relationships, and develop healthier routines. It also lowers the risk of overdose, especially in opioid addiction, where methadone and buprenorphine have been shown to reduce death rates significantly. However, medication alone is not enough. It works best when combined with psychotherapy, behaviour therapy, and support groups. Counselling helps people understand their triggers and develop coping strategies, while peer support provides encouragement and



accountability. Medication provides the biological stability, and therapy provides the psychological and social tools needed for lasting recovery.[71]

Nicotine Replacement therapy: Nicotine is the addictive substance in cigarettes, but the real danger comes from the thousands of toxic chemicals released when tobacco is burned. These chemicals cause cancer, heart disease, and lung problems. When people try to quit smoking, they often face strong withdrawal symptoms such as irritability, anxiety, difficulty concentrating, and intense cravings. These symptoms make quitting very difficult and often lead to relapse. Nicotine Replacement Therapy (NRT) was developed to solve this problem by delivering nicotine in safer forms such as patches, gums, lozenges, nasal sprays, or inhalers without exposing the body to smoke and tar. The idea behind NRT is simple: instead of quitting nicotine suddenly, which can be overwhelming, the person receives smaller, cleaner doses of nicotine that reduce withdrawal symptoms. Over time, the dose is lowered until the person no longer needs nicotine at all. This gradual process makes quitting more manageable and increases the chances of success. According to the Cochrane Database of Systematic, there is *high-certainty evidence* that NRT significantly improves long-term smoking abstinence compared to quitting without any support. There are several forms of NRT, each with its own advantages. Nicotine patches provide a steady release of nicotine through the skin, helping control cravings throughout the day. Nicotine gum and lozenges allow users to manage sudden urges by chewing or dissolving them when cravings strike. Nasal sprays and inhalers deliver nicotine more quickly, mimicking the fast relief smokers get from cigarettes. Research shows that combining

different forms for example, using a patch for steady control and gum for sudden cravings can be even more effective than using one method alone. NRT not only reduces withdrawal symptoms but also helps people break the psychological link between smoking and daily routines. Many smokers associate cigarettes with activities like drinking coffee, socializing, or dealing with stress. By replacing cigarettes with NRT products, individuals can begin to separate nicotine use from these habits. Over time, this weakens the behavioural triggers that sustain addiction.[72] NRT is most effective when combined with counselling and behavioural support, since it addresses both the physical and psychological aspects of dependence. The science behind NRT lies in how nicotine interacts with the brain. Nicotine stimulates receptors that release dopamine, the “pleasure” chemical. Smoking floods the brain with nicotine quickly, creating strong reinforcement. NRT delivers nicotine more slowly and at lower levels, reducing the reinforcement while still calming withdrawal. This makes it easier for the brain to adjust to life without cigarettes. A recent review in the American Journal of Translational Research (Patidar et al., 2025) explains that NRT works by stabilizing the nicotine receptor pathway, helping the brain gradually reset its reward system. Importantly, NRT is considered safe for most adults. Unlike smoking, it does not expose the lungs to harmful tar or carbon monoxide. Side effects are usually mild, such as skin irritation from patches or mouth soreness from gum. Doctors often recommend NRT as a first-line treatment for smoking cessation, especially for people who smoke heavily or have tried quitting before without success.[73][74]



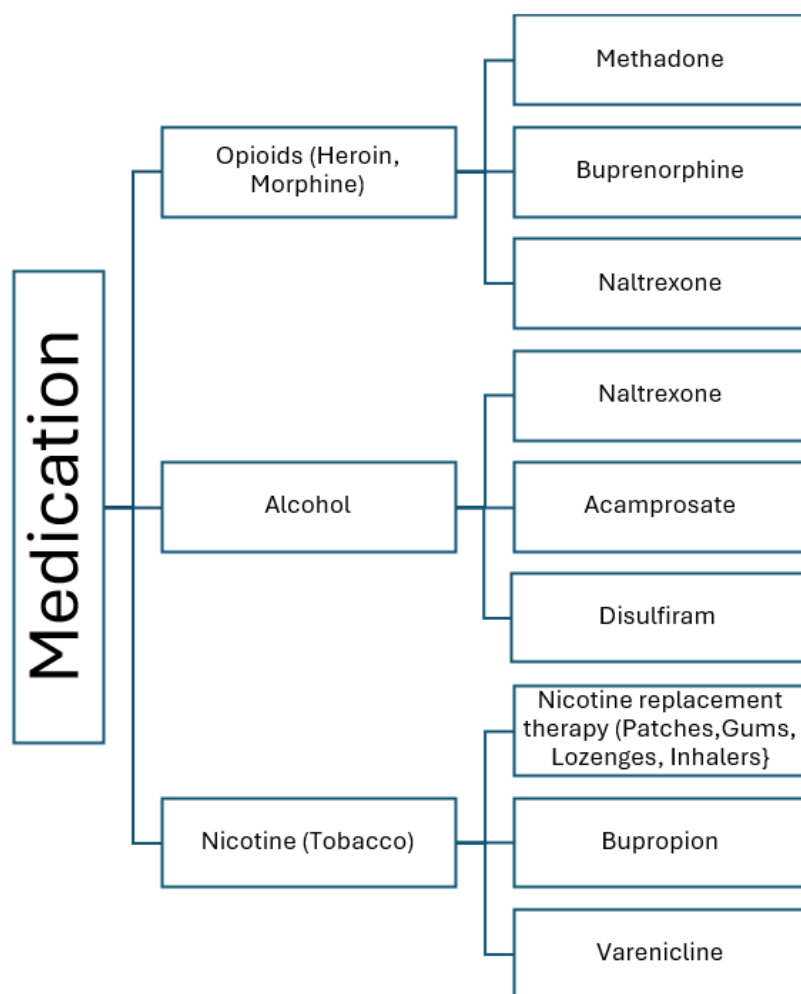


Fig no 5.2. Various medications for different drug substances

Tab no 5.1 medications and their working

Sr no	Medication	Working
1	Methadone	Full opioid agonist prevents withdrawal and reduces cravings by stabilizing opioid receptors without producing intense highs.
2	Buprenorphine	Partial opioid agonist attaches strongly to opioid receptors, reduces cravings and withdrawal, with lower risk of misuse.
3	Naltrexone	Opioid antagonist: blocks opioid receptors, preventing any euphoric effect if opioids are used again.
4	Naltrexone	Reduces the pleasurable effects of alcohol, making drinking less rewarding.
5	Acamprosate	Restores balance of brain chemicals (glutamate and GABA) disrupted by alcohol, reducing anxiety and insomnia after quitting.
6	Disulfiram	Causes unpleasant reactions (nausea, flushing) if alcohol is consumed, acting as a deterrent.
7	Nicotine Replacement Therapy (patches, gums, lozenges, inhalers)	Provides controlled doses of nicotine to ease withdrawal and cravings without harmful smoke toxins.

8	Bupropion	Antidepressant that reduces cravings and withdrawal symptoms by affecting dopamine and norepinephrine.
9	Varenicline	Partial agonist at nicotine receptors; reduces cravings and blocks rewarding effects of smoking.

6. Body response after breaking the cycle: Drug addiction is one of the most powerful challenges a human body and mind can face. When someone becomes addicted, their brain, organs, and emotions all adapt to the constant presence of the drug. The body learns to depend on it, and life begins to revolve around using it. But when a person decides to stop when they break the cycle of addiction the body begins a long and complex journey of healing. This journey is not quick, and it is not easy, but it is deeply meaningful. In this essay, I will explain in simple language how the body responds after breaking free from drugs, moving step by step through withdrawal, brain repair, stress regulation, physical healing, emotional recovery, and long-term adaptation.

Following process after breaking the cycle:

A. Withdrawal: The First Battle: The very first response the body has after stopping drugs is withdrawal. Withdrawal is the body's way of showing that it has become used to the drug and now struggles without it. For example, opioids like heroin or morphine slow down pain signals and create feelings of calm. When the drug is suddenly removed, the body reacts with pain, sweating, nausea, and restlessness. Stimulants like cocaine or methamphetamine, which flood the brain with dopamine, leave the person feeling exhausted, depressed, and craving more. Withdrawal is the body's attempt to restore balance, or homeostasis, after being disrupted by long-term drug use. The symptoms can last for days or weeks, depending on the drug and the person's history. This stage is often the hardest, because cravings are intense and the body feels deeply uncomfortable.[75]

B. Repairing the Brain's Reward System: After withdrawal begins to ease, the brain starts repairing itself. Drug addiction changes the brain's reward system, especially the dopamine pathway. Dopamine is the chemical that makes us feel pleasure and motivation. Normally, dopamine is released when we eat good food, spend time with loved ones, or achieve something. But drugs hijack this system, flooding the brain with dopamine in unnatural amounts. Over time, the brain reduces its natural dopamine production and becomes less sensitive to everyday pleasures. When the drug is removed, the brain slowly begins to restore its natural balance. This process takes weeks, months, or even years. During this time, people may feel depressed or unmotivated, because normal activities do not yet bring pleasure. But gradually, the brain relearns how to enjoy natural rewards. Recovery involves not only abstinence but also building supportive environments that help the brain relearn healthy reward patterns.[76]

C. Stress and Hormone Regulation: Another major response after breaking addiction is the change in the stress system. The hypothalamic-pituitary-adrenal (HPA) axis controls stress hormones like cortisol. During addiction, this system becomes overactive. Drugs are often used to escape stress, but they also make the stress system unstable. When the drug is removed, cortisol levels may rise sharply. This can cause anxiety, irritability, and difficulty sleeping. The person may feel overwhelmed by stress, which increases the risk of relapse. Over time, however, the body learns to regulate stress without drugs. Practices like mindfulness, therapy, and exercise help normalize cortisol rhythms. Recovery as a

form of post-traumatic growth, where the body gradually learns healthier ways to handle stress. Healing the Organs Drug addiction affects almost every organ in the body. Once the drug is removed, the body begins a process of repair Liver Alcohol and opioids can damage the liver. After quitting, the liver starts regenerating cells, though severe damage may take longer to heal. Heart: Stimulants like cocaine strain the heart and raise blood pressure. With abstinence, blood pressure stabilizes and heart function improves. Lungs Smoking drugs damages the lungs. Quitting allows gradual improvement in breathing and lung capacity. Immune system: Drugs weaken immunity, making infections more likely. Recovery strengthens immune responses.[77]

D. Emotional and Psychological Recovery:

Breaking addiction is not only about the body it is also about the mind. In the early stages, people often feel sadness, emptiness, or depression. This happens because the brain is no longer flooded with artificial pleasure. But over time, emotional stability improves. Importance of self-esteem and social well-being in recovery. As people rebuild confidence and relationships, their mental health strengthens. Emotional resilience becomes a key factor in staying drug-free.[78]

E. Social and Behavioural Changes: Recovery also involves social transformation. The body's healing is supported by changes in lifestyle and

environment. People in recovery often rebuild trust with family and friends, establish healthy routines like exercise and good sleep, and avoid triggers that remind them of drug use. This aligns with the "whole person recovery". Recovery is sustained when biological healing is reinforced by supportive social contexts.[76]

F. Long-Term Adaptations and Relapse Prevention:

Even after months or years of abstinence, the body retains a memory of addiction. This is why relapse is common. Environmental cues like seeing drug paraphernalia or revisiting old neighbourhoods can trigger cravings. Neuroscience research shows that the prefrontal cortex, which controls decision-making and impulse control, takes time to fully recover. Strengthening this brain region through therapy, meditation, and cognitive exercises helps prevent relapse.

G. Growth and Identity Transformation:

Recovery is often described as a journey of post-traumatic growth. Addiction is a traumatic experience, but overcoming it can lead to new strengths, such as empathy, resilience, and purpose. Recovery parallels psychological growth models, where individuals reconstruct their identity and find meaning beyond addiction.[77]

6.1. Body response: A timelapse after quitting Smoking:



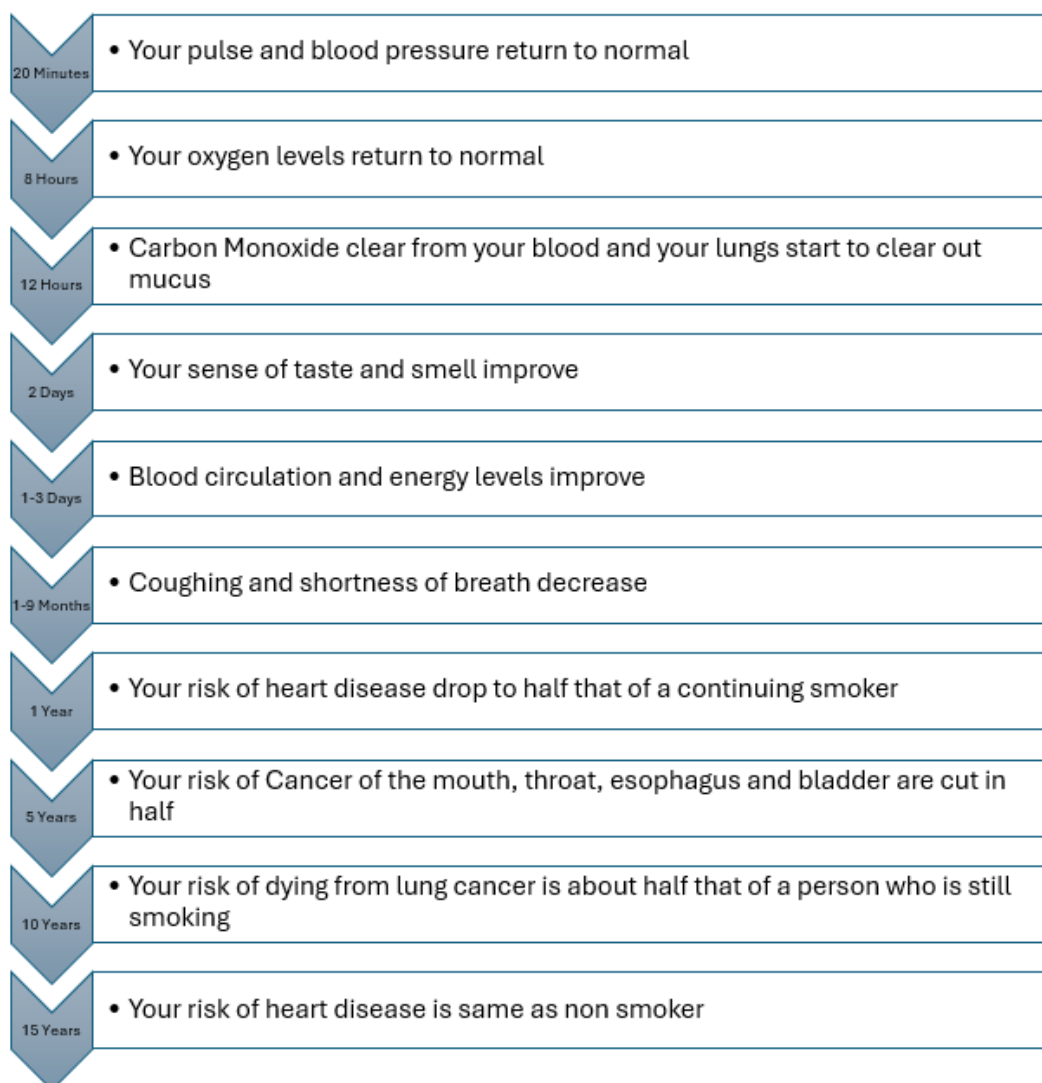


fig.no 6.1 Timlapse of body response after quitting smoking.

Quitting smoking is one of the most powerful decisions a person can make for their health. Cigarettes contain thousands of chemicals, including nicotine, tar, and carbon monoxide, which damage nearly every organ in the body. Over time, smoking increases the risk of heart disease, lung cancer, stroke, and many other illnesses. But the body is remarkably resilient. Once smoking stops, healing begins almost immediately, and the benefits continue to grow over months and years. The timeline of recovery from minutes to decades shows how the body responds step by step, gradually repairing itself and reducing the risks of disease. Just twenty

minutes after quitting smoking, the body begins to show signs of recovery. The pulse and blood pressure, which are often elevated in smokers due to nicotine's stimulating effects, start to return to normal. Nicotine activates the sympathetic nervous system, increasing heart rate and constricting blood vessels. This puts strain on the cardiovascular system. When nicotine is removed, blood vessels relax, and the heart rate slows.[79] Nicotine's effects on the cardiovascular system are immediate but reversible. This explains why such a short time after quitting, the body already begins to stabilize. Eight Hours: Oxygen Levels Improve Within eight hours, oxygen levels in the blood

return to normal. Smoking introduces carbon monoxide, a poisonous gas, into the bloodstream. Carbon monoxide binds to haemoglobin more strongly than oxygen, reducing the blood's ability to carry oxygen to tissues. This is why smokers often feel fatigued or short of breath. When smoking stops, carbon monoxide levels drop, and oxygen can once again bind to haemoglobin effectively. This improves energy and reduces strain on the heart. Oxygen restoration is one of the earliest measurable benefits of quitting. By twelve hours, carbon monoxide is cleared from the blood, and the lungs begin to clear out mucus. Smoking paralyzes the cilia tiny hair-like structures in the lungs that sweep out mucus and debris. When smoking stops, cilia gradually regain function, allowing the lungs to clean themselves. This reduces coughing and lowers the risk of infections.[80] Cilia are damaged by smoking but can recover with abstinence, improving lung function over time. After two days, the senses of taste and smell begin to improve. Smoking dulls these senses because chemicals in tobacco damage nerve endings in the nose and tongue. Once smoking stops, these nerves start to regenerate. Food tastes richer, and smells become more vivid. This improvement is not only pleasant but also encourages healthier eating habits.[81] Smokers often report reduced enjoyment of food, which reverses after quitting. Between one and three months, blood circulation improves, and energy levels rise. Smoking damages blood vessels and reduces oxygen delivery to muscles. With abstinence, blood flow becomes more efficient, and physical endurance increases. People often notice they can walk or exercise more easily without becoming short of breath.[82] Quitting smoking rapidly improves vascular function, reducing the risk of clot formation and stroke. Over the next nine months, coughing and shortness of breath decrease. The lungs continue to heal as cilia regain full function. Infections like bronchitis

become less frequent, and breathing becomes easier. Many former smokers notice they no longer wake up with a "smoker's cough." The lung function improves steadily during the first year, with significant reductions in respiratory symptoms. After one year, the risk of heart disease drops to half that of a continuing smoker. Smoking damages the arteries, promotes plaque buildup, and increases clotting, all of which contribute to heart attacks. Quitting allows the cardiovascular system to repair itself, reducing these risks. Smoking cessation dramatically lowers heart disease risk, even within the first year. By five years, the risk of cancers of the mouth, throat, oesophagus, and bladder is cut in half. Tobacco smoke contains carcinogens that damage DNA and promote cancer growth. Once smoking stops, the body's repair mechanisms reduce the risk of mutations leading to cancer. Smoking cessation significantly reduces cancer risk, especially in tissues directly exposed to smoke. After ten years, the risk of dying from lung cancer is about half that of a continuing smoker. Lung cancer is the leading cause of death among smokers, but quitting allows damaged cells to be replaced by healthy ones. Although the risk never returns completely to that of a non-smoker, it is reduced. Carcinogen exposure decreases after quitting, lowering cancer risk over time. Finally, after fifteen years, the risk of heart disease is the same as that of a non-smoker. This shows the remarkable ability of the body to heal. The cardiovascular system, once heavily damaged by smoking, can fully recover with long-term abstinence. Long-term cessation eliminates most of the excess risk associated with smoking. Beyond physical healing, quitting smoking also brings psychological and social benefits. People often feel a sense of pride and empowerment, knowing they have overcome addiction. Financial savings are significant, and relationships improve as loved ones no longer worry about smoking-related health risks.



Recovery from smoking as a form of post-traumatic growth, where individuals not only regain health but also develop resilience and new meaning in life.[77]

7. Global impact: Drug addiction, also called substance use disorder, is one of the most pressing health and social problems worldwide. It is not only a medical condition but also a social and economic challenge that affects millions of people across all regions of the world. Drug addiction is defined as the compulsive use of psychoactive substances despite harmful consequences. These substances include opioids such as heroin and prescription painkillers, stimulants like cocaine and methamphetamine, cannabis, hallucinogens, and newer synthetic drugs such as fentanyl. Addiction is a chronic condition that alters brain circuits related to reward, stress, and self-control, making it difficult for individuals to stop using drugs even when they want to. Addiction is a brain disease because it changes the way the brain functions, leading to compulsive behaviour. From an epidemiological perspective, drug addiction is measured in terms of prevalence (how many people are affected at a given time) and incidence (how many new cases occur over a period).[3] More than 300 million people worldwide used drugs in the past year, and about 36 million suffered from drug use disorders. This shows that drug use is widespread, but only a fraction of users develop addiction.[84] Drug use disorders contribute significantly to disability-adjusted life years (DALYs), especially among young adults aged 15–39 years. This means that drug addiction not only causes death but also long-term disability that reduces quality of life. Age is one of the most crucial factors in the epidemiology of drug addiction. Adolescents and young adults are more likely to experiment with drugs due to curiosity, peer pressure, and risk-taking behaviour. High rates of cannabis and vaping among teenagers.

Globally, young people are disproportionately affected, which threatens future generations by reducing educational achievement and workforce participation. Gender also plays a role. Men have higher rates of drug use, but women progress more quickly from initial use to addiction a phenomenon known as the “telescoping effect. Women face unique risks, including pregnancy complications and greater stigma. Women are also more likely to suffer from co-occurring mental health disorders such as depression and anxiety, which complicates treatment. Socioeconomic status is another key determinant. Poverty, unemployment, and social inequality increase vulnerability to drug addiction. Communities with limited opportunities often experience higher rates of drug use. Cultural attitudes also shape patterns: in some societies, cannabis use is normalized, while in others, even minor drug use is heavily stigmatized. family environment parental substance use, domestic violence, neglect—plays a key role in shaping addiction risk.[84] Regional epidemiology shows that drug addiction patterns differ across the world. In North America, the opioid crisis dominates, with synthetic opioids like fentanyl causing record overdose deaths. The *Centers for Disease Control and Prevention (CDC)* reported over 100,000 overdose deaths in 2021, most linked to opioids. In Europe, cannabis remains the most used illicit drug, but cocaine use is increasing, according to the *European Monitoring Centre for Drugs and Drug Addiction (EMCDDA)*. In Asia, methamphetamine use is widespread, especially in Southeast Asia, where countries like Myanmar and Thailand are major producers. In Africa, cannabis and tramadol misuse are major concerns, while in Latin America, cocaine production and trafficking create regional instability. Trends over time show how drug addiction evolves with social, economic, and technological changes. In the 1970s and 1980s, heroin epidemics affected the United States and Europe. In the 1990s and 2000s, prescription



opioid misuse rose sharply. In the 2010s and 2020s, synthetic drugs such as fentanyl and methamphetamine became dominant. prohibition policies have shaped these trends, often worsening the problem by driving drug markets underground. Risk factors identified by epidemiology include biological, psychological, social, and environmental influences. Biological factors include genetic predisposition and brain chemistry. Psychological factors include trauma and mental illness. Social factors include peer pressure, poverty, and family dysfunction. Environmental factors include availability of drugs and urbanization.[85] Addiction rewires brain circuits, making recovery difficult. The consequences of these epidemiological patterns are severe. Health burdens include overdoses, infectious diseases such as HIV and hepatitis C, and chronic illnesses affecting the liver, kidneys, and lungs. Social burdens include family breakdown, crime, and stigma. Economic burdens include lost productivity, healthcare costs, and law enforcement expenses. Political burdens include drug trafficking that destabilizes nations and finances terrorism. Future projections are worrying.[3] Drug use disorders will continue to rise until at least 2046, driven by synthetic drugs and global instability. Without stronger prevention and treatment, the burden will worsen, especially in vulnerable regions the epidemiology of drug addiction shows that this is not just an individual problem it is a global crisis. By studying prevalence, incidence, risk factors, and regional differences, epidemiology provides the evidence needed to design effective interventions. Addiction must be addressed through comprehensive, compassionate, and evidence-based strategies.

8.CONCLUSION: Drug abuse and addiction have been part of human history for thousands of years, but their impact has grown with changing

societies, technologies, and medical practices. From the sacred use of soma in ancient India to the widespread availability of morphine and cocaine in the industrial era, each period shows how substances that were once valued for healing or ritual could also bring harm when misused. The journey from experimentation to abuse and finally to addiction is gradual, shaped by the brain's chemistry, personal circumstances, and social environment. Addiction is not simply a matter of weak willpower; it is a chronic health condition that alters brain function and traps people in cycles of craving, withdrawal, and relapse. The patient care era marked a turning point, as modern science recognized addiction as a disease and developed treatments such as medication-assisted therapy, cognitive behavioural therapy, and community support programs. This shift from punishment to compassion reflects progress in how societies view and respond to addiction. Yet challenges remain stigma, poverty, unemployment, and easy access to drugs continue to fuel the cycle. Recovery is possible, but it requires more than stopping drug use it demands rebuilding lives with dignity, purpose, and support. Prevention and harm reduction strategies are equally vital, helping people avoid falling into addiction or reducing risks when quitting is not immediately possible. Looking at history reminds us that addiction has always been a part of human life, but it also shows that societies can learn, adapt, and create better responses. Breaking the cycle of addiction is not easy, but with science, compassion, and strong communities, individuals can recover and societies can reduce the burden. Addiction is a challenge, but it is not the end of the story it is a condition that can be overcome.

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