1.0 INTRODUCTION

Substance Use Disorder (SUD) is a serious health issue that has underlying societal and health consequences (Grant et al., 2017). The Diagnostic and Statistical Manual of Mental Disorder (DSM-V) diagnoses a person suffering from SUD as having patterns of symptoms caused by the continual use of a substance, despite its resulting functional and clinical impairment (American Psychiatric Association, 2013). The DSM-IV defined abuse and dependence as two separate disorders. However, the most recent edition of the DSM-V no longer creates this distinction. There are ten classes of drugs that come under SUD: alcohol, caffeine, cannabis, hallucinogens, inhalants, opioids, sedatives, hypnotics or anxiolytics, tobacco and other unknown substances.

The following criteria of the DSM-V are used for diagnosing an individual with SUD :

- Taking the substance in larger amounts or for longer than meant to.
- Wanting to cut down or stop using the substance but not managing to.
- Spending a lot of time getting, using, or recovering from use of the substance.
- Cravings and urges to use the substance.
- Not managing to do what one should at work, home, or school because of substance use.
- Continuing to use even when it causes problems in relationships.
- Giving up important social, occupational, or recreational activities because of substance use.
- Using substances again and again even when it puts one in danger.
- Continuing to use even when one knows one has a physical or psychological problem that could have been caused or made worse by the substance.

- Needing more of the substance to get the effect wanted (tolerance).
- Development of withdrawal symptoms, which can be relieved by taking more of the substance

Two or three criteria indicate mild SUD, four to five moderate and six or more severe SUD (commonly called addiction). In addiction the individual experiences significant loss of self-control by taking the drug out of compulsion despite not wanting to (American Psychiatric Association, 2013).

1.1 PREVALENCE OF SUD

According to the 2023 World Drug Report, the 2021 global prevalence of drug use is 5.6% and 0.62% of the world population has drug use disorder (World Drug Report, 2023). In 2020 there has been a 26% influx in drug use among people aged between 15-64 years as compared to the previous decade.(United Nations Office on Drugs and Crime [UNODC], 2023) Drug use is associated with the other issues like HIV/AIDS, suicide, overdose death, cardiovascular diseases and tuberculosis (UNODC, 2018). Most research suggests that early adolescence (12–14 years old) to late adolescence (15–17 years old) is a critical risk period, where there is initiation to substance use. Substance use may then peak among young people aged 18–25 years. In Western Countries, drug use among the older generation (aged 40 years and older) has been increasing at a faster rate than among those who are younger (UNODC, 2018). Women who use drugs typically begin using substances later than men. Once they have initiated substance use, women tend to increase their rate of consumption of alcohol, cannabis, cocaine and opioids more rapidly than men (UNODC, 2018). The adverse medical, psychiatric, and functional consequences related to SUDs tend to be more severe in women. However, men and women do not substantially differ with respect to SUD treatment outcomes (McHugh, Votaw, Sugarman, & Greenfield, 2018).

Mauritius has been combating the challenges of illicit drug trafficking and its use over the past years (Ministry of Health and Quality of Life, 2022) and the government reported that the drug situation in the country is of concern, specifically in terms of health, social and economic implications (Rambaree, 2018; Ministry of Health and Quality of Life, 2018). According to a 2021 survey, people with use of drugs in Mauritius account for 7.4% of the population between the ages of 18 and 59 (Ministry of Health and Quality of Life, 2018). Out of the 5,268 reported drug-related offences in Mauritius in 2020, the majority were related to cannabis (45.7%) and heroin (32.5%). Moreover, 19.4% of drug offences were primarily related to synthetic cannabinoids, methadone, and hashish. Sedatives/tranquillisers were responsible for 2% of drug-related offences, while buprenorphine accounted for 0.4% (Ministry of Health and Quality of Life, 2022). A high relapse rate of 92% was observed among male addicts within the first year of abstinence, with social pressure being a primary factor (Ramsewak et al., 2020). The country faces growing concerns related to HIV/AIDS, Hepatitis B and C among substance abusers, as well as increasing substance abuse among women and adolescents (Rassool & Sulliman, 2005). Drug abuse in Mauritius reflects a global issue, contributing to violence, crime, and social collapse (Lakhanpal & Agnihotri, 2007).

In order to understand the issue of SUD, it is important to understand the changes in the brain structure and functioning to formulate better treatment plan which are more relevant for the prevention and treatment of SUD.

1.2 NEUROBIOLOGICAL MECHANISM OF SUD

Well-supported scientific evidence explains SUD as a chronic brain disease with recurring cycle involving neuroplasticity changes in reward, motivation, stress, memory, and cognitive

control systems (Fang et al., 2022). Neuroimaging has revealed abnormal activity in various brain regions during different stages of addiction, including the ventral tegmental area (VTA), nucleus accumbens (NAc), and prefrontal cortex (PFc) (Fang et al., 2022).

The VTA is a crucial part of the brain's reward system. It is located in the midbrain and serves as the origin of the mesolimbic dopamine pathway. The VTA contains dopaminergic neurons that project to various brain regions, including the nucleus accumbens and the prefrontal cortex. During the initial stages of substance use, the VTA is activated, leading to the release of dopamine in the NAc and PFC. This release contributes to the pleasurable effects of the drug, reinforcing the behaviour and encouraging repeated use. Dysregulation of the VTA's dopaminergic signalling is associated with the transition from voluntary drug use to compulsive addiction (Koob & Volkow, 2016).

The NAc is a key component of the reward circuitry and is heavily involved in the processing of reward and reinforcement. It receives dopaminergic input from the VTA, and its activation is associated with the experience of pleasure and reward. In addiction, repeated drug use leads to neuroadaptive changes in the NAc, including alterations in dopamine receptor availability and signalling pathways. This results in a heightened response to drug-related cues and increased craving, even in the absence of the drug. The NAc's role in the development of tolerance and the persistence of drug-seeking behaviour underscores its importance in the addictive process (Volkow et al., 2016).

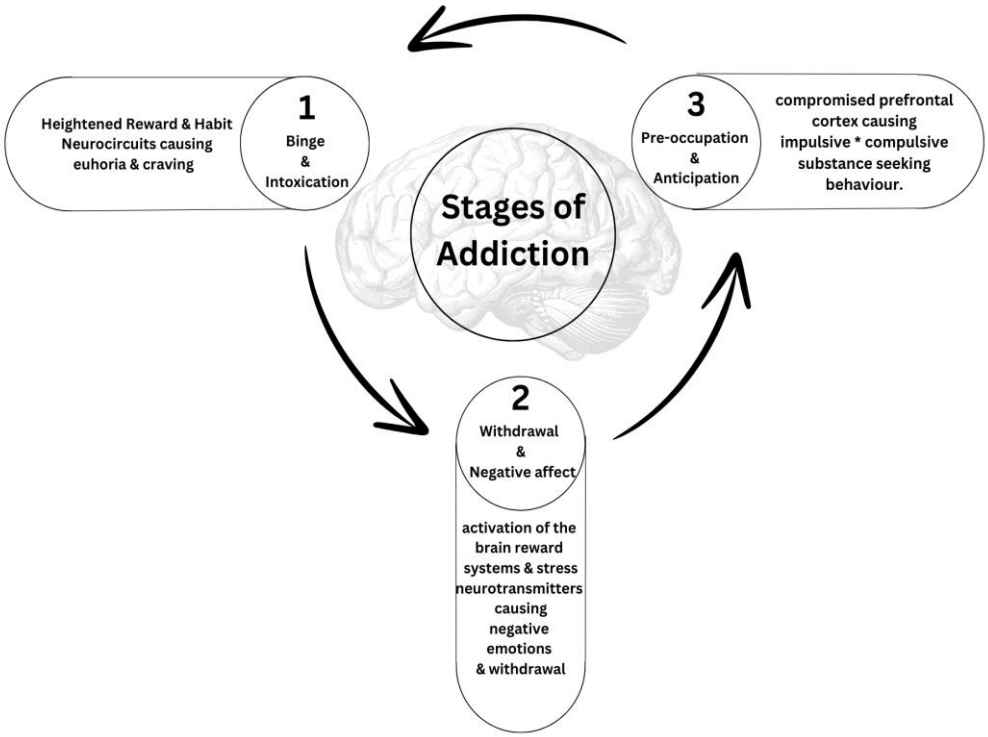
The PFC is involved in higher-order cognitive functions such as decision-making, impulse control, and executive functioning. In addiction, the PFC’s ability to regulate behaviour and manage impulses is compromised. This dysfunction is attributed to the impact of chronic drug use on the PFC’s neural circuits. Reduced activity in the PFC during addiction is associated with impaired decision-making and a diminished capacity to exert self-control. As a result,

individuals may engage in compulsive drug-seeking behaviours despite negative consequences. The PFC's role in integrating reward information and regulating responses to cravings is crucial in understanding the persistence of addiction and the challenges associated with recovery (Fang et al., 2022).

Together, these brain regions interact within a complex network that governs reward processing, behavioral control, and addiction. Neuroimaging studies have highlighted the disruptions in these areas, providing insight into the neurobiological basis of addiction and informing potential therapeutic strategies to address these imbalances.(Fang et al., 2022).

Addiction to a substance can be classified in three stages: binge and intoxication, withdrawal and lastly preoccupation and anticipation. (Volkow, Koob, & McLellan, 2016) This is well explained in the brain disease model of addiction (Figure 1).

Figure 1: Illustration of the stages of addiction based on Volkow's brain disease model of addiction. (Volkow, Koob, & McLellan, 2016)



Volkow's model, while similar in recognizing these stages, places a strong emphasis on the changes in cognitive control and reward pathways. During the intoxication stage, the drug activates the brain's reward system, which can become conditioned to the drug and its associated stimuli. This conditioning contributes to craving and relapse, as seen in the preoccupation and anticipation stage. Volkow highlights the impairment in the prefrontal cortex's ability to regulate impulses and decision-making, contributing to the compulsive nature of addiction (Volkow et al., 2016).

Koob's model describes addiction as a progression from initial use to a state of compulsive drug-seeking. It emphasises the role of neuroadaptive changes and stress dysregulation

throughout these stages. During the initial use and binge stages, the reward system is highly activated, leading to intense euphoria. In the regular use and dependence stages, neuroplastic changes create a state of tolerance and withdrawal symptoms, characterised by a shift from positive reinforcement to stress-induced negative mood (Koob & Le Moal, 2001; Koob & Volkow, 2016).

Both models describe the neurobiological mechanisms underlying withdrawal and craving. Koob's framework focuses on the 'anti-reward' system and stress-related neurotransmitter imbalances during withdrawal. In contrast, Volkow's model emphasises the role of disrupted cognitive control and persistent activation of reward pathways. This convergence in understanding highlights the complexity of addiction and underscores the importance of addressing both neurobiological and behavioural aspects in treatment programs (Volkow et al., 2006).

The interplay between genetic factors and environmental influences also plays a substantial role in SUD, influencing the dopaminergic system and gene-environment interactions (Prom-Wormley et al., 2017). Understanding these mechanisms, along with other contributing factors, is essential for developing more effective treatment programs (Campbell & Lobo, 2023).

1.3 PROTECTIVE AND RISK FACTORS OF SUD

There are multiple factors that contribute to SUD. These often escalate into relapse and remitting chronic diseases. Socioeconomic inequalities, poverty, limited education and marginalization, contribute to the risk of developing drug use disorders and aggravate its consequences (UNODC, 2020). Other factors like unemployment, rapid economic growth and urbanization, increase in drug availability, community disorganization and low social capital, family history of drug use, genetic predisposition and exposure to drugs at an early age all have distinct contributions to drug usage. Moreover, adverse life events, stress, lack of support

networks, limited access to health care resources as well as mental health problems, trauma, negative school climate, sensation seeking behaviours add up to risk factors favouring SUD (UNODC, 2020).

To counter these, there are several protective factors to deal with substance use. These are the level of involvement and monitoring by caregivers, development of coping skills and emotion regulation. Other important aspects are safe neighbourhood, physical safety and social inclusion of the person with drug history (UNODC, 2020). By taking into consideration how these multiple aspects can contribute to substance use, health workers may address the issue from the appropriate angle in order to reduce substance dependence and subsequently relapse prevention.

1.4 Psychotherapies for SUD

1.4.1 Counselling approach

In the field of Psychology, different psychotherapy models have been devised in order to deal with addiction and SUD. Cognitive Behaviour Therapy (CBT) is one such example. It was originally used as an adjunct to treatment of SUD and evolved as a stand-alone mode of treatment. This model helps the individual to identify situational, social, affective and cognitive triggers which provoke substance use (Witkiewitz, Marlatt, & Walker, 2005). These identified maladaptive behaviours can help one abstain from substance use, reduce the frequency of intake or reduced the dosage of substance use. This is achieved by learning coping strategies for the maladaptive behaviours which help increase self-efficacy and reduce substance craving. This model has its downfall whereby if an individual selects the wrong coping strategies, the individual may have reduced self-efficacy and may increase their substance consumption. After the first lapse of substance use the person's self-perception of the "abstinence violation effect" may have a positive or negative impact. If the lapse is viewed as a minor mistake, there are

chances of going back to the pre-relapse stage. However, if it is viewed with guilt and failure, substance relapse is probable (Witkiewitz et al., 2005).

1.4.2 Twelve step method

Twelve step method is based on the philosophies of Alcoholic Anonymous (AA) which was established by Bill Wilson and Dr. Robert Holbrook Smith (American Addiction Centers, 2024) Different self-help programs like Narcotics Anonymous and Cocaine Anonymous have stemmed from the Twelve step method. The main focus in this form of treatment is on sobriety and application of the Twelve step philosophies. Experienced AA members also act as sponsors by guiding and helping other members in times of crisis when the relapse becomes overwhelming (SAMSHA, 1999). Depending on the substance, there are mild changes in the steps as shown below:

1. "We admitted we were powerless over alcohol (our addiction)-that our lives had become unmanageable."
2. "We came to believe that a Power greater than ourselves could restore us to sanity."
3. "We made a decision to turn our will and our lives over to the care of God as we understood Him."
4. "We made a searching and fearless moral inventory of ourselves."
5. "We admitted to God, to ourselves, and to another human being the exact nature of our wrongs."
6. "We were entirely ready to have God remove all these defects of character."
7. "We humbly asked Him to remove our shortcomings."

8. “We made a list of all persons we had harmed and became willing to make amends to them all.”

9. “We made direct amends to such people wherever possible, except when to do so would injure them or others.”

10. “We continued to take a personal inventory and when we were wrong promptly, admitted it.”

11. “We sought through prayer and meditation to improve our conscious contact with God as we understood Him, praying only for knowledge of His will for us and the power to carry that out.”

12. “Having had a spiritual awakening as the result of these steps, we tried to carry this message to alcoholics (addicts) and to practice these principles in all our affairs.” (SAMSHA, 1999).

In a study on 3,018 participants which compared different SUD treatment modalities, the researchers found that those belonging to the Twelve-step program were more likely to be abstinent. At the 1-year follow-up, Twelve -step, Cognitive Behaviour (C-B) model, and combined Twelve Step and C-B treatment programs equally reduced substance use and improved most other areas of functioning (Ouimette, Finney, & Moos, 1997). The Twelve step method also helps individuals to learn from other’s experience and become aware that recovery is not impossible. They also feel that they are not being judged, not alone ad safe (SAMSHA, 1999). However the Twelve step method has been criticized for its “one size fit all” aspect (Solomon, 2005) , participant’s difficulty to believe in a higher power (Bowen, Chawla, & Witkiewitz, 2014) and the strict need for complete abstinence.

1.4.3 Mindfulness based relapse prevention

Mindfulness-based Relapse Prevention (MBRP), developed by G. Marlatt was intended for persons recovering from addiction. It integrates mindfulness practices with cognitive and behavioural-based relapse prevention techniques. The target is to avoid relapse of substance use (Penberthy et al., 2015). MBRP can help increase the individual's awareness of potentially triggering situations and cues and decrease the probability and severity of relapse (Bowen, et al., 2014). Interestingly, relapse is seen as an opportunity to recognize the power of thoughts. The individual identifies the self-judgement that arises following the substance lapse, and the tendency to switch to autopilot (Bowen & Chawla, et al., 2014). Following lapses, clients return to the group and examine together the chain of environmental and internal events that caused the lapse, and the pattern of thoughts, emotions, and behaviours that followed the lapse (Bowen, Chawla, et al., 2014). Studies have shown that MBRP reduces facets of trait impulsivity in treatment-seeking individuals with SUD (Davis et al., 2019) and at 12-month follow-up, MBRP participants reported significantly lesser days of substance use and significantly decreased heavy drinking compared to the other treatment program (Bowen, Witkiewitz, et al., 2014).

1.4.4 Yoga Therapy

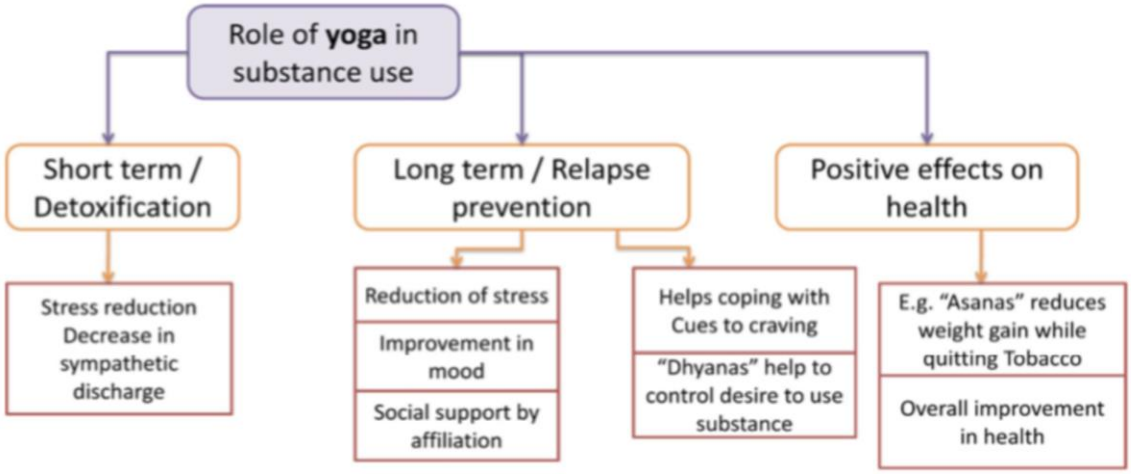
Yoga, in Sanskrit, means the union of the individual self with the Supreme self and was originally practiced to achieve spiritual goals (International Association of Yoga Therapists, 2024). With the influence of modern medicine and research-based evidence, yoga has emerged as a non-pharmacological form of treatment to manage various non-communicable diseases (International Association of Yoga Therapists, 2024). Yoga therapy or yoga *chikitsa*, involves using the principles and practices of yoga in a therapeutic setting to promote health and well-being (Khanna & Greeson, 2013). It encompasses customized evaluation, establishing goals,

lifestyle management, and adapting yoga practices suitable for individuals or small groups (International Association of Yoga Therapists, 2024). The skills, insights, and self-awareness acquired through yoga and mindfulness practices can target multiple psychological, physiological, and behavioural processes linked with addiction and relapse. (Khanna & Greeson, 2013)

There are eight elements of yoga which grossly consist of ethical principles and practices for living a meaningful, purposeful, moral and self-disciplined life. Yogic principles involve the practice of relaxation techniques through controlled breathing, focused attention and mindfulness (Hallgren, Romberg, Bakshi, & Andréasson, 2014). The stress intensity, increased heart rate and blood pressure experienced post detoxification can be managed through the practice of yogic breathing exercises (Sarkar & Varshney, 2017). At a behavioural level, yoga as a pro-social activity when practised in group may provide additional social supports for participants with SUD (Sarkar & Varshney, 2017). In a study with 48 participants suffering from SUD, add-on yoga enhanced their cognitive functions (Gaihre & Rajesh, 2018). According to Khalsa et. al., comprehensive spiritual lifestyle interventions may be effective in the treatment of SUD (Bir et al., 2008). Yoga and mindfulness are seen as complementary therapies not just for the treatment but also for the prevention of addictive behaviours (Khanna & Greeson, 2013). Another study covered buprenorphine use and found that the participants in the meditation condition had better odds of remaining abstinent than participants in the treatment as usual and relaxation conditions (Mallik, Bowen, Yang, Perkins, & Sandoz, 2019). Scientific evidence points at the reduction in sympathetic tone and increase in parasympathetic tone in Sudharshan kriya practitioners, thus reducing stress via autonomic nervous system and the HPA axis (Brown & Gerbarg, 2005). Yoga interventions for SUD management comprised of Hatha yoga, Sudarshan Kriya yoga, Kripalu-based Hatha yoga,Iyengar yoga,Vinyasa yoga,

Kundalini yoga,breathing exercises and meditation (Posadzki, 2014). These evidences point out the different ways in which yoga can manage the negative consequences of SUD.

Figure 2: Yoga in Substance use management (Sarkar & Varshney, 2017)



Yoga based-counselling (YBC) is a component within the Integrated Approach to Yoga Therapy (IAYT) which aims at promoting well-being in a holistic approach by correcting the imbalances at physical, mental, and emotional levels. In the traditional yogic literature, Indian philosophy has epitomised several circumstances where psychotherapeutic counselling structures were at play with stories of Varuna and Brighu or Lord Krishna and Arjuna. Similar to modern psychology, *gurus* played the role of a counsellor in the ancient yoga tradition. The theoretical basis of YBC is underlined by the psychological traits: *sattvic guna* (equilibrium), *rajasic guna* (dynamic), and *tamasic guna* (inertia), the physical constitution (*doshas*) as well as the theory of the five levels of existence (*pancha kosha* model). These five *koshas* are *annamaya* kosha (physical field), *pranayama* kosha (bioenergy field), *mamonaya* kosha (mind field), *vignanamaya* kosha (intellectual field), and the *anandamaya* kosha (bliss field). Imbalances in the *gunas* or the *koshas* can disrupt an individual's physical and psychological

well-being.The goal of YBC is to provide comprehensive care for an individual by utilising targeted yoga techniques to address each of the five levels of their being, taking into account their physical and mental makeup. An individualised plan, with practices specific to each of these five levels, such as incorporating dietary changes, performing *asanas*, practicing *pranayama*, engaging in cognitive and behavioural practices that promote self-reflection, mindfulness, and other philosophical concepts rooted in yoga philosophy, is required.

YBC according to Coster, has the clue that modern psychology needs if the method and theory of psychotherapy is to reach its fullest scope. Salvation, is seen as the security of genuine happiness and determination of a person's own inner life. Self-knowledge of the analytic kind of the West and the Eastern kind may support and complement each other (Shankar, 2016). In psychoanalysis the practitioner is an analyst and in yoga we have a Guru (teacher) and both differ in the degree of their directiveness. The latter tends to be more direct than the former. Moreover a key component of Yoga-based counselling is that the therapist does not merely have knowledge of Yoga philosophies and its relation to life but also integrates these aspects in the personal practices (Satish, 2019). There are various scriptures like *Puranas* and *Itihāsa* in which sages engage with afflicted persons to provide solutions for human misery and to overcome conflicts or gain clarity. Such examples are sage *Vasiṣṭha* and Lord *Rāma*, *Jambavān* and *Hanumān,* Lord *Kṛṣṇa* and *Arjuna*, sage *Nārada* and sage *Bhagīratha*. In these instances, the seekers of counsel have the resources in their capacity but with confusion a guide is needed who has the ability to elicit the latent abilities (Satish, 2019).

1.4.5 Limitations of Modern psychotherapy

Modern psychotherapy, while effective for many mental health conditions, has certain limitations in the context of SUD. Traditional psychotherapeutic approaches tend to focus on cognitive and behavioural aspects while overlooking the deeper, underlying issues such as

emotional and spiritual imbalances, ethnic/aboriginal backgrounds that may contribute to addiction and its treatment. Additionally, the efficacy of psychotherapy can be limited by factors like the therapeutic alliance, patient motivation, and the chronic nature of SUDs. Moreover, the integration of psychotherapeutic approaches with pharmacological treatments sometimes leads to incomplete recovery, as these methods do not fully address the holistic needs of the individual, including the mind-body connection that is often disrupted in SUDs.

1.4.5 Treatment gap

The treatment gap in addressing substance use disorders (SUDs) remains significant. Despite the availability of various therapeutic interventions as mentioned above, the majority of individuals with SUD do not receive the treatment they need. This gap is multifactorial. These include stigmas, lack of access to healthcare services, insufficient mental health resources, and the high cost of treatment. Furthermore, even when treatment is accessible, the success rates remain low due to issues such as relapse and non-adherence to therapy. Addressing these treatment gap is critical to reducing the global burden of SUDs and improving the overall well-being of affected individuals.