

Research Article

## Substance Use Disorder Autonomic Recovery

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### Abstract

We have observed that the different methods that people have used to promote recovery from Substance Use Disorders (SUD) all seem to produce a change in the Autonomic Nervous System. The person suffering from a SUD has a dominant Sympathetic Nervous System (ego, anger, fear, fight, flight). The recovering person has a more active Parasympathetic Nervous System, PSNS (serene: humility, calm lack of fear, connection, and care for others). We postulate that the underlying feature of all methods of recovery from SUD's are ways to increase the activity of the PSNS. We propose the Substance Use Disorder Autonomic Recovery (SUDAR) concept to summarize this understanding. In this paper, we provide references to observations where the SUDAR phenomena have been shown to occur.

### Introduction

The purpose of this paper is to provide evidence that recovery for a person with an active Substance Use Disorder, SUD [1] is associated with a transition in their Autonomic Nervous System, ANS [2,3] from an active Sympathetic Nervous System (SNS) to an active Parasympathetic Nervous System (PSNS). This is indicated by an increase in High-Frequency Heart Rate Variability, HF-HRV [4].

We are proposing a novel understanding of the SUD recovery process which we call the SUD Autonomic Recovery (SUDAR) concept. The principle of the SUDAR concept is that SUD treatments regulate the ANS facilitate recovery and are summarized as follows.

- Persons with an SUD which is active lives with an active SNS. When emotionally triggered, they go into fear (which may be expressed as anger, fight, or flight). Their conditioned reflexes (past experiences) show that using an addictive substance diminishes their experience of these unwanted emotions, and so the person uses and continues to stay addicted.

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Persons with an SUD but who are in recovery live with a more active PSNS which increases their ability to accept emotional triggers. When experiencing an emotional trigger, they are less likely to be triggered and more likely to go into acceptance of what is happening (as their PSNS is active). Cognitive processes can take over and evaluate the consequences of using. They are more likely to choose not to use and to stay in recovery. Eventually, this process will result in their neurons firing together wiring together and they will respond less and less to emotional triggers and experience more and more serenity.

### Where is the evidence that might validate the SUDAR concept?

Laborde et al., [4]'s comprehensive paper on the use of Heart Rate Variability and Cardiac Vagal Tone discusses the use of Heart Rate Variability measurements that have the ability to index cardiac vagal tone, the term they use for the activity of the PSNS.

### Reports show that the balance of the ANS shifts during recovery from a SUD.

Buckman et al., [5] treated 92 women for Alcohol Use Disorder, AUD [1] using Cognitive Behavioral Therapy (CBT) and observed it to "reduce sympathetic and/or enhance parasympathetic activity".

Claisse et al., [6] compared pupillary response to emotional stimuli for Alcoholics Anonymous (AA) members who experienced long and short-term sobriety. Their pupil dilation, when stimulated, decreased for AA members with long-term abstinence, which indicates that their emotional reactivity had decreased. This most probably means that their PSNS activity had been increased and they were more able to accept the stimuli and reacted less.

Claisse et al., [7] measured HF-HRV of persons with AUD and noted that "...phasic HF-HRV measures are consistent with the hypothesis of their improvement in these abilities" to regulate emotions "...after the maintenance of abstinence". This can be interpreted to mean that their PSNS activity increased after long-term abstinence because increased HF-HRV is an indicator of increased PSNS activity.

Friederich et al., [8] state that "Heart Rate Variability (HRV) studies in healthy obese individuals have shown a lowered parasympathetic tone compared to nonobese healthy controls" i.e., experiencing a food SUD lowers PSNS activity". They also state "In line with these results, body weight loss leads to an increase in parasympathetic power", i.e., recovery from the food SUD happens when/as PSNS activity increases.

Garland et al., [9] reported on factors relating to the differences between opioid users and misusers. They summarized their findings by stating that they add to the growing body of literature suggesting that the comorbidity of "...opioid misuse is linked with emotional regulation...deficits". Another way of restating their finding is that persons with active SUD have lower emotion regulation capabilities than people who are controlling their usage by virtue of the fact they

have greater emotional regulation capability. As emotion regulation increases with increasing PSNS activity (more likely to accept undesired events) and decreases with increasing SNS activity, i.e., people with Active SUD (misusers) are more likely to have active SNS while people who are not misusers (addiction free) are able to regulate their emotions because they have an active PSNS.

Libby et al., [10] measured HF-HRV for 31 smokers in a meditation-focused four-week-long smoking cessation course. They found that "... individuals exhibiting an increase in HF-HRV while meditating had better smoking outcomes 3 months later..." As HF-HRV is an indicator of PSNS activity, this means that participants who had higher levels of PSNS activity were more likely to recover from a smoking SUD.

Lo et al., [11] treated drug addicts with Abdominal Respiration (AR) and found that "... the results demonstrate the remarkable effect of 10-minute AR Zen ... boosting up the ANS functioning". They stated that "The process converts clinging brain into tranquil, detached brain." This shift can be interpreted as a transition from an active ANS to a more active PSNS.

Mayhugh et al., [12] examined the phenomenon of craving and cardiac vagal tone and stated that "...these data are particularly interesting considering that high RSA-rest is often associated with enhanced self-regulation and better psychological health". Respiratory Sinus Arrhythmia (RSA) is an indicator of increased PSNS activity so this could be interpreted as indicating that a person with high PSNS activity is less likely to drink.

Mudie [13] proposes recovery in Alcoholics Anonymous, AA [14] occurs as a result of members with active SUD alcoholism, taking the humbling actions suggested by the program of AA. These actions move the ANS from an active SNS (ego-centered state, fear, flight, anger) to a more active PSNS (serene and humble state, calm accepting, connected).

Sanyer et al., [15] stated that "Results from our mediation model suggest that trait mindfulness may facilitate self-regulation of opioid craving by enhancing autonomic control of opioid cue reactivity" They also reported in Fig 1 "Patients with high trait mindfulness displayed phasic increases in high-frequency heart rate variability (HF-HRV),... whereas patients who had low trait mindfulness displayed no phasic increases in HF-HRV..." As HF-HRV is an indicator of PSNS activity, this would imply that people who practiced trait mindfulness experienced active PSNS.

Winhall [16,17] has supported recovery from process and chemical addictions of abused women by using the FSPM (Felt Sense/Polyvagal Method) which is based on the Polyvagal Theory (PVT) of Porges and Dana [2,3,18]. Winhall achieves this by educating her clients about the PVT and supporting them in activating herself and her clients to access the Ventral Vagal Branch of the PSNS during a counseling session. She primarily uses body focusing and slow deep breathing techniques, supported by various other methods of felt sensing.

Witkiewitz et al., [19] reported that Mindfulness-Based Relapse Prevention (MBRP) was successful in preventing relapsing from alcohol and also suggests that those who completed MBRP are engaging with stress, but perhaps in a more adaptive, flexible manner. Given that negative emotions are an important component of relapse, these results lend further support to say that mindfulness may be

helpful for those with substance use disorder. MBRP is associated with higher cardiac vagal control and lower stress/anxious reactivity. As increased acceptance happens when the PSNS is active, it can be inferred that the Acceptance-Based Treatment was actually increasing the activity of the PSNS of the people being treated.

## Discussion

We have shown that several commonly used SUD recovery techniques ALL result in a change in a shift of activity of the ANS from an active SNS to a more active PSNS as the person with SUD recovers. When a person with SUD is using, they have an active SNS. When an undesirable event occurs, they are triggered and feel anger and fear, they want to fight or flee. Their ego is manifesting. They have learned that if they used/drunk/snorted/gambled, they could reduce the intensity of these undesirable emotions, and so they "use" with obviously very undesirable long-term consequences.

But if they have experienced successful treatment for their SUD, they are far more likely to have an active PSNS. In this state of serenity, they are less likely to feel fear when the undesired event occurs. They will become more accepting that the unwanted event has occurred (no fighting) and remain calm and peaceful. They, therefore, have less need to suppress unwanted emotions. In addition, as their amygdala has not been activated, their cognitive processes can operate more successfully and they can "THINK, THINK, THINK" [14] more successfully about the consequences of using.

The implications of this understanding, that recovery happens for a person with AUD when their ANS moves from an active SNS state to more active PSNS, are profound. Any approach that shifts ANS activity towards the PSNS should support recovery. Slow Deep Breathing is also likely to support recovery from SUD as slow deep breathing has been shown to activate the PSNS [20].

## Conclusion

The evidence above indicates that there may be a transition of the ANS of a person with an SUD from an active SNS when addicted to a more active PSNS when in recovery.

**More studies concerning any transitions in the ANS that may happen during recovery from a SUD are clearly needed.**

This transition is most probably caused by encouraging the person with SUD to take humbling actions that reduce the ego (SNS active) and increase humility and acceptance, serenity, and connection with others (PSNS active). Other techniques, not commonly used in recovery are also available that support the transition of the ANS and may be beneficial in supporting recovery from SUD.

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