**Benefits of Smoking Cessation in Long-Term Substance Use Abstinence**

The leading preventable cause of death in the United States is tobacco use, which accounts for one in five deaths each year. While smoking can lead to lung cancer, it can also cause harm to almost every other organ in the body such as blood vessels, heart, bones, eyes, skin, and the reproductive organs [1]. In 2020 the World Health Organization listed lung cancer as the number one most common cause of cancer deaths, [2] with more than 16 million adults in the US having a disease that is caused directly from smoking [3]. It is found that 80% of lung cancer and lung cancer deaths are due to smoking, along with 20% of all other cancers correlated to smoking[1]. Individuals who smoke tobacco decrease their lifespan on average 10 years in comparison to individuals who do not smoke tobacco. Smoking cigarettes also increases the risk of cancers in the mouth, larynx, pharynx, esophagus, kidney, cervix, liver, bladder, pancreas, stomach, colon and rectum. [1] In addition, many individuals will often replace cigarettes with E-cigarettes and or vaping products with the thought of it being "healthier" and hopes of improving their overall health. However, that is not necessary the truth and outcome. The effects of nicotine in the brain are still present with nicotine containing products, along with increased risk of hospitalizations due to E-cigarette or Vaping Use- Associated Lung Injury (EVALI). Recent research has shown that Vitamin E acetate, when added to THC- containing products is strongly associated with EVALI. As of the date February 2020 there have been a total of 2,807 cases or deaths related to EVALI. About 54% of these patients were using nicotine containing products and 2,022 that were hospitalized had a history of substance use [4].

It is estimated that in Oregon alone the tobacco industry spends on average $137 million dollars a year on advertisement to promote and sell their products. [5] The emphasis on advertisement and promotion ultimately overwhelms the population, which bombards them with

targeted products making challenging for people to resist giving in and purchasing tobacco. In 2018 a law passed with Oregon Administrative Rules which now states it must alter their packaging of tobacco products to be less attractive to minors. Another bill was passed in the state of Oregon which increased the age to 21 from 18 in order to purchase tobacco products.

Another topic of interest that correlates with tobacco use is addiction. It is estimated that more than 20 million individuals struggle with addiction and have some form of substance use disorder starting at the age of 12 years old. In 2017, individuals that struggled with substance abuse account for the following: 74% for alochol, 38% for illicit drugs, 12.5% for both alochol and drugs simultaneously, and overall 8.5 million individuals suffered with co-occuring disorders. The American Addiction Center states that drug abuse and addiction cost them roughly around $740 billion dollars to cover crime related expenses, healthcare costs, and workplace productivity in just one year [6].

According to the American Addiction Society, it is estimated that out of 20 million Americans with substance use disorder only 19% of these individuals received treatment, 30% will successfully graduate treatment and 70-80% of individuals will drop out of treatment by 3-6 months. There is an overall relapse rate for individuals with substance use disorder between 40-60% and only 10% of adults claiming they are in recovery [6].

With there being such a high incident rate of individuals who smoke tobacco, deaths caused by tobacco products, substance use disorders, and high relapse rates, education is key and should be provided. This is especially true among individuals who smoke cigarettes that are attempting to get sober from a substance use disorder and usually education and health promotion are the best treatment plan for long-term outcomes on one' sobriety. Healthy People 2030 have implemented a plan that targets the prevention of substance use in the population by

increasing the following: non-opiod pain management, admissions into rehabilitation centers for IV drug use, the number of referrals sent to substance use treatments after ED visits, and the rate of individuals who get medications for addiction treatment. In addition, Healthy People 2030 plan is to reduce tobacco use by increasing prices, promote health education to large audiences, provide counseling and medication to aid in cessation, as well as increase smoke-free homes and Medicaid coverage for therapies to quit smoking from a number of states and territories that are now prohibiting smoking.

Research has shown that initiating smoking cessation simultaneously when quitting substances results in a greater chance of abstinence from drugs and causes no negative impact on substance use.

Researchers investigated the impact of smoking cessation on drug abuse treatment outcome by investigating whether initiating smoking cessation after entering a drug treatment facility would influence drug use after a one-year period. A longitudinal study was performed on a total of 2,316 individuals who smoked cigarettes and were entering a drug treatment facility. After a year of self-reporting between individuals who successfully quit smoking during treatment and individuals who did not, results indicated that smoking cessation was indeed associated with increased abstinence from using substances after completing treatment [7]. Additional researchers completed a study that focused their attention on determining if there is a relationship between cigarette smoking and long-term outcomes for substance use disorder and relapse. The study examined individuals with substance use disorder who were in recovery and the association between smoking. Analyses were completed on participants through a National Epidemiologic Survey on Alochol and Related Conditions that were selected through the DSM-IV and were targeted on factors such as psychiatric and alcohol use disorders, demographics,

substance use disorder severity, and nicotine dependence. The logistic regression analyses examined multiple wave forms of participants to determine the outcomes: Wave one focused on relationships between smoking status and wave two focused on substance use and SUD relapse. Comparisons were made among the smokers in wave 1 and smokers in wave two. Results indicated that individuals who continued to smoke or initiated smoking amongst nonsmokers were at increased odds of relapse. Further research is needed to determine timing of relapse[8].

While there is a large amount of research with a great understanding that tobacco use is the number one most preventable cause of death, there has also been recent acknowledgement from researchers of the opioid epidemic currently going leading to high death rates. In recent times, researchers have identified that there is no current research or data that is attentive to co-treatment in the two substances together and the long- term benefits.

Previous research has led us to understand the biological underpinnings of nicotine and opiods which should be the layout for further investigation on how co-treatment of these two substances can be extremely beneficial not only to one's health but the long- term outcomes from substance use abstinence. The biological underpinnings have allowed us to determine that using both opioids and nicotine at the same time can enrich subjective pleasure with the high, work as a substitute when one substance is not available and reduces withdrawal symptoms. Increased difficulty abstaining from either substance when used together is due to amplified use in either each individual substance or both through cross- tolerance, reinforcement, and priming. Nicotine generates polycyclic aromatic hydrocarbons which enhances the opioid metabolism through cytochrome P-450 1A2-isoenzymes, rarely resulting in opiod toxicity with smoking cessation. In addition, using multiple substances amplifies reinforcement because nicotine and opioids comparably stimulate similar reward pathways such as cannabinoid, dopaminergic, and

nicotinic-acetylcholine system. With such relatable neural and metabolic processes of both nicotine and opiods, smoking does increase opioid use. These researchers are wanting to enhance availability of this knowledge to all individuals including healthcare workers so they can have the opportunity to co-treat both nicotine and opioid use simultaneously. This will allow healthcare workers to be able to educate their patients and inform them that smoking is a risk factor for opiod addiction and if substance use abstinence is warranted, smoking cessation alongside of stopping opiods will increase long-term abstinence outcomes [9].

With recent research indicating that there is sustained abstinence from substance use when smoking cessation is initiated as part of the treatment plan, further investigation should be initiated focusing on the most beneficial form of therapy for smoking cessation. Providing a better understanding of how nicotine and additional substance affect the brain may also aid in a better treatment plan for smoking cessation.

Nicotine affects two areas of the brain, the striatum and the habenula. The striatum contains neuronal activity related to the reward system on our brain and movements, which is a key component for addiction. The habenula receives data from the limbic system and basal ganglia through stria medullaris, which has been found to interject to negative reinforcement, also known to counteract the reward system. Once the data is received it sends the information to the midbrain which involves dopamine release. Research has found that withdrawals and cravings due to nicotine is located in the habenula and there is decreased activity in the striatum in individuals who smoke which is key to creating an effective treatment plan. [10]

Drugs work in the brain by interfering with neuron passageways and the way neurons send and receive neurotransmitters. Drugs such as heroin and marijuana have chemical structures similar to the ones in our body allowing them to impersonate the body's natural neurons causing

activation of neurotransmitters within the human body. Due to the chemical compound compensation of the drug, consequences occur by sending abnormal messages throughout the network since they are synthetic. Other drugs such as cocaine and methamphetamines, cause an abnormally large number of natural neurotransmitters to surge at once causing disruption in regular communication between neurons within the body therefore interfere with the normal feedback loop cycle. Areas of the brain that are affected by drug use include the basal ganglia, the extended amygdala and prefrontal cortex. The basal ganglia are a group of subcortical nuclei that are responsible for motor control, motivation, pleasure relating to activities such as eating, sex and socializing. The brains "reward system" is also located in this area of the brain. The extended amygdala is responsible for emotions such as anxiety and irritability. This function plays a role in individuals seeking out drugs after partial withdrawal and when an individual starts to feel the distressful emotions. The prefrontal cortex is responsible for problem solving, planning, ability to think and concentrate, decision making impulsiveness and self-control. A "euphoric" feeling is presented to individuals who use drugs by a pathway that is triggered to release a huge surge of neurotransmitters of dopamine, also known as endorphins, which reside in the basal ganglia as known as the reward system. The euphoric feeling plays a role in the addictive behavior. The euphoric feeling is triggered by the high amounts of the neurotransmitters released triggering the brain to want more of it, allowing for the opportunity of habits and drug use to form to repeat the surges of euphoric feelings [11]

It is known that quitting nicotine and any substance is hard due to the effects on the substances on the brain, the reward system, and withdrawal symptoms. Common symptoms of nicotine withdrawals include urges, cravings, and irritability; feelings of anxiety, restlessness, depression and sadness; as well as difficulties with concentrating, sleeping, and weight gain [12].

However, many other triggers have been identified as contributing to why quitting smoking is so hard. One key factor that plays into being able to successfully quit smoking is to first be able to identify why one is smoking and or have started smoking. Also, being able to identify that smoking is often associated with people, feelings, and activities, which these can all become triggers once attempting to quit occurs. One problem many individuals often face is that they are not aware other people, places, and things can be triggering factors that cause them to relapse on nicotine. Tricks have been put into place to help people avoid triggers, such as attending places that don't allow smoking, spend more time with non- smokers, keeping your hands busy, and taking deep breathes and learning to self-talk has shown to be beneficial to avoid relapse [13].

There are many steps that can be taken in order to successfully sustain from smoking. Being able to understand that quitting can be difficult can make the process easier. First step is to come up with a plan to quit. That can look like a variety of different ways but being able to formulate a plan and being able to mentally prepare for the plan can increase your chances to sticking to the plan. This allows for individuals to stay motivated, confident, and focused. Secondly, reach out for support. This can be done through support groups, friends and family who do not smoke, apps, and phone calls. Thirdly, stay busy. Keeping busy will allow you to stay focused on certain tasks and refrain from thinking about smoking and distract you from any cravings. Fourthly, avoid triggers. Being able to first identify your triggers will allow you to then be able to avoid those same triggers. Finally, stay positive. Mind over matter and choosing to remember all the reasons as to why you are quitting will help you refrain from smoking [14].

Some tips that can be implemented prior to the quit date include cutting down on how much one is smoking, cut back where and when smoking occurs, and try putting off smoking for a short period when cravings occur. On the day of quitting remember do not use, stay busy, drink

lots of water, start using nicotine replacement therapy, avoid triggers, avoid people who smoke, drink less alochol, and continuously remind yourself why you are quitting [15].

Researchers organized a study that focused on whether individuals would have more success at quitting smoking if they reduced smoking behaviors prior to their quit date in comparison to abruptly quitting. Data did conclude that there is a moderate level of evidence stating that neither abrupt quitting in comparison to reduction to quitting was more effective. However, research did show there was a slight increase of sustained smoking cessation with reduction to quit when paired with pharmacotherapy targeting smoking cessation [16].

Recent research has also shown that individuals with substance use disorder and/ or mental illnesses tend to smoke more than individuals that do not. Research was completed to determine the best method to quit smoking for these individuals and evidence-based strategies revealed that the best outcomes for long-term successes to smoking cessation in individuals who have substance use disorder and or mental illness is a combined form of medication treatment, stage-matched to readiness to quit and behavioral therapy. [17]

Additionally, research has also shown that there is evidence stating that contingency management to promote smoking abstinence with individuals who have substance use disorder is indeed effective. Contingency management is a form of behavioral therapy that focuses on "reinforced" behavior, such as reward or positive affirmation. These findings resulted in better outcomes in comparison the controlled conditions in decreasing smoking at the end of treatment.[18]

Per the CDC, there are many ways to formulate a plan to quit smoking along with many resources provided to be utilized for coping mechanisms regarding stress, cravings, and mood. Options to speak with a counselor, telephone quit line, free texting programs, and mobile apps

are all provided, in addition to options for nicotine replacement therapy, including patches, gums, lozenges, inhalers and nasal sprays which are available over the counter. Speaking to healthcare providers for medications such as varenicline and bupropion that can be prescribed to you to help aid in quitting as well [19].

With such a high prevalence of individuals who have substance use disorder and smoke simultaneously, being able to implement the data gathered from the research regarding the importance of smoking cessation early on during the substance use treatment plan increases long-term abstinence from drugs, which is extremely beneficial for long-term positive outcomes. Not only does quitting smoking help permit the number one preventable cause of death in the US, but it can also help individuals beat the high percentage rates of relapse when getting sober. As previously mentioned, many individuals already struggle with obtaining the necessary support and treatment to sustain from using substances and even the ones that do have a high percentage rate of relapsing. The research also states that the best form of treatment for smoking cessation in individuals with substance use disorder is a multifactorial treatment plan including pharmacological management, nicotine replacement therapy, behavioral therapy and contingency management provide the most beneficial long-term outcomes all together.

It is recommended to quit smoking at the time of quitting any additional form of substances and when entering a drug and alcohol treatment facility. This educational component is critical as many drug and alcohol facilities do not require smoke-free zones on the property and many drug and alochol counselors may not be aware of the extreme benefits of this co-treatment. With no encouragement and knowledge around this topic in rehabilitation facilities, our health care providers should aid in order to educate their patients with this information as well. Health care providers can assist with smoking cessation by assessing patients in the “5 A’s

model"; ask, advise, assess, assist, and arrange [20] regarding smoking, along with educating them of the benefits of smoking cessation and how valuable it may be to their long term road to sobriety.

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