SPEECH, LANGUAGE, COGNITIVE, AND MEMORY ABILITIES OF PAST OPIOID DEPENDENT ADULTS

Author: Isabelle R. Tice

Abstract

A lack of knowledge on the effects of neurological and motor processes from opioid dependency is prominent. In efforts to gain knowledge, this research team will administer tests in cognition, memory, speech, and language on a group of neurotypical individuals with no past interactions with drugs or alcohol and individuals who were neurotypical before an extensive opioid dependency. It is hypothesized that individuals, ages 22-28 years old, who were opioid dependent will have impairments in speech, language, cognition and memory compared to like individuals who have not used/abused drugs or alcohol. The process of rehabilitating an individual who had a drug addiction, is lengthy and inconsistently successful (relapses). To treat a disease effectively, the parameters of what is affected by the diseases needs to be established. The goal of this research paper is to test the extent of damage opioid dependency has on cognition, memory, speech, and language skills to improve rehabilitation treatments.

Speech, language, cognitive, and memory abilities of past opioid dependent adults

Drug abuse and dependency in the United States has increased twice over since 1999. Statistics collected by the National Institute on Drug Abuse shows that overdose deaths involving drugs have increased from just under 20,000 in 1999, to over 72,000 reported deaths in 2017 (National Institute on Drug Abuse, 2018, table 2). By
observing this expedient escalating drug crisis, a need for a higher awareness of the lasting effects and after care that may result from chronic drug abuse rises. This includes understanding if physical consequences of the abuse will be acute or chronic. In this study, there will be further investigation on the examination of the side effects of drug dependency on adults who were chronic users specifically, those who were opioid dependent.

Opioids are strong painkillers that are highly desirable for the high that they fabricate for both medical and recreational usage. The definition of opioids stated in the Reference Module in Biomedical Sciences, states that the substances are “powerful analgesics and can also produce euphoria (a ‘high’)” (Lei Yu, 2014). It is important to discern that there is a difference between opioid abuse and opioid dependency/addiction. For an individual to be considered as having the syndrome of opioid dependency or addiction, they will display continuous use of opioids despite the complications that can either stem or worsen from the use of the drugs. This happens when one’s rationale of drug induced problems become inferior to the essentiality of using opioids. Opioid abuse, however, is the repetition of significant negative consequences formed by the extended use of opioids (Hahn & Cataldo, 2012). Opioid dependency or addiction is the syndrome and opioid abuse is the action of said syndrome. It is important to keep the definitions separate because dependency has a greater influence on an individual’s chemical mechanisms than inconstant abuse has.

Opioids are a commonly abused drug for numerous reasons; including legal prescriptions to minors, length of time of a prescription, and increasingly high dosage levels. Recently observed, opioids are legally being introduced to adolescents at alarming rates. According to Chung et al., “the number of office visits with an opioid prescription for patients 15 to 19 years of age nearly doubled between 1994 and 2007, the treatment of adolescents for opioid overdose has increased, and the number of pediatric hospitalizations attributed to opioid poisoning doubled from 1997 to 2012” (2018, para 5). These drugs are commonly prescribed as pain relievers after a procedure, or to manage chronic pain to children. Contact with opioids at early, developmental years can disturb the already unstable chemicals raging in adolescents and lead to later drug abuse. Similarly, opioids are also routinely prescribed for adult patients after surgeries. Depending on an individual’s pain tolerance level, one might have an extended prescription or multiple available refills.

Drug strength is another factor on why opioids are commonly abused. Using drugs that are less stimulating creates smaller reactions within the body. Whereas, drugs that are highly stimulating cause a greater reaction and lasting impression on the body’s nervous system. Analyzing the nature of opioids, one needs to consider the fact that drugs, “usually fentanyl, an opioid 50 times more powerful than heroin – are typically included in the combination of medications given to patients for general anesthesia during surgery” (American Society of Anesthesiologists, 2017). The dosage of opioids people are being prescribed is higher than the opioids being obtained illegally. Furthermore, a direct relationship has been observed in the period of time that opioids are taken and the probability that an individual will still be taking opioids past the prescription date. This is reflected in a study observing opioid intake of patients after having an arthroplasty procedure. The group concluded that “the duration of opioid prescription a patient initially receives after surgery has a major impact on the likelihood, he or she is still taking opioids months to years later” (Schwenk, Pozek, & Viscusi, 2018). Opioids are abused for the extremely desirable high that they create and it should to be noted that the use of the term “high”, indicates the prevalence of opioids being used in an inappropriate manner. The drugs ability to create a distinct high is a large part of its identity, that it needs to be stated in the definition. The first high is always the most powerful because one’s tolerance to the drug is very low. After the first contact, all highs do not compare, forcing people
to continually buy larger doses in seek of the feeling of that initial high. Then, due to tolerance build up, an individual can never get as high as the first time they use. This inability to achieve that first high, pushes individuals to continue use at higher frequencies and dosage levels.

This is a universal problem, as the opioid crisis knows no boundaries when it comes to gender and race. When analyzing the prescription rates of opioids among non-Hispanic Whites, non-Hispanic Blacks, Hispanics or Latinos and others, a study concluded that there is “an actual narrowing of the divide in drug use with races” (Harrison, Lagisetty, Sites, Gutó, & Davis, 2018). A narrowing of opioid use among the races, means that knowledge is of precedence for those who are impacted by addiction.

**Literature Review**

There is limited research available for the relationship with an adult’s speech and language abilities secondary to drug abuse. One study that is similar in nature looked to assess a person’s ability of speech intelligibility and discriminations of sound frequencies of those who had excessive opioid drug use (Gorzelanczyk, Sęk, Wicher, Ziolkowski & Walecki, 2013). The group examined addicts who were going through treatment for opioid abuse. This study did show that there was a difference in non-users and users when it came to speech intelligibility and frequency discrimination in users. What is missing from this study is why there is lowered speech intelligibility and frequency discrimination. It could be due to a disconnect within the ear structures, the inability to perceptualize what is being heard, or the origination of the problem. There is a significant gap in the literature on opioid effect and this warrants a need to be addressed.

On the proposed topic of memory, there were two studies that held some significant information. The first study researched observed clinical testing of chronic opioid dependence on memory. Significant data showed that the drug dependency had changed the way a person’s memory worked. The change “indicates a long-term effect (sustained and internal drive) of opiate dependence on methadone maintenance that persistently provides reinforcing properties and motivational salience to heroin dependents even though they have been abstinent from heroin for a certain period” (Zhang et al., 2016). This means that there was a direct effect of drug use on memory pertaining to situations involving the drugs. In addition, an experimental study was performed by administering morphine to rats and collecting data of the brain changes via micrographs. The changes were measured by observing the changes of the mitogen-activated protein kinases (MAPKs). Which is protein modifying enzymes that are “involved in a variety of fundamental cellular processes such as proliferation, differentiation, motility, stress response, apoptosis, and survival” (Cell Signaling Technology, 2018, para 2). Upon critiquing the micrographs of the rat’s cerebrum, continued distribution of morphine had a detrimental effect on a multitude of areas in the brain and the MAPKs levels (Schulz & Hölt, 1998). This proves that opioids are the source of alterations on a molecular level. Yet, the behavioral modifications that stems from the changes are undocumented. A different study provided insight on how opioids can impact the solidification process of received information. A “lack of memory can arise on the basis of sedation where inattention to the outside world interferes with encoding of memory, from a sedation independent amnestic action, or both” (Veselis, 2018). A sedated state of mind can lead to problems, initially in receiving external information, which can eliminate one’s ability to internalize new information. This study researched memory while under sedation, in contrast, my proposed study will analyze memory after prolonged states of sedation. However, not addressed, is if there are memory problems in terms of everyday life tasks. These problems can be expressed by a person’s forgetfulness of what they went to the grocery store for, one’s ability to remember people or events prior to drug abuse, and any effects of an individual’s learning ability. Furthermore, a study performed on rats exhibited that “chronic opioids induce synaptic plasticity” and “we discovered that TSP1 protein expression was diminished upon exposure to morphine for 6 h, 2 days, or 8 days in immortalized rat cortical astrocytes” (Phamduong et
Clinically, opioids have a negative reaction on the brain of a rat starting at as little as 6 hours. A rat's brain differs dramatically from a human brain in size, but this indicates that damage can be quickly made. Bearing in mind this rapid response time to opioid stimuli, there should be questions on how quickly the changes can be reversed. Concluding from information gathered in the previously discussed studies, there is a substantial lack of knowledge that warrants further investigations of the relationship of memory and chronic opioid dependency in human adults.

The small amount of research that has already been done, treads lightly in the concerns of the effects of opioid dependence on adult memory and ability to learn. The largest lack of research lies with the scope of opioid dependence effects on speech and language skills. For my study, the aim is to determine if there is a causality factor between chronic opioid dependency, and disabilities in learning, memory, speech and language skills. For the purpose of this study, chronic is defined as happening continuously for three months or more, similar to that of a disease/disorder. The cerebration for this study is to focus on the rehabilitation of a person’s life after chronic drug dependency. Withdrawal symptoms can be very severe, by providing concise therapy techniques to manage life after an opioid dependency, individuals may have an easier time assimilating back into a typical lifestyle. If, due to chronic opioid abuse there are complications with the cognitive and physical functions that are listed above, potentially an understanding of these complications could help shorten the duration of time in one’s recovery process.

**Methodology**

A case-control study is most appropriate for this research because the data collected will be comparing cognitive scores of participants who meet the criteria of being a previous opioid dependent individual (cases) and neurotypical adults who have not been exposed to any forms of recreational drugs (controls). According to Jacobsen (2017), a case-control study “compare(s) exposure histories of people with a disease (cases) and people without that disease (controls)” (p. 50). In order to find a link between any cognitive or motor impairment caused by opioid dependency, a group of past opioid dependent persons (group A) will be compared to a group with no prior history of opioid dependency nor cognitive and motor impairments (group B).

The criteria for the participants are the following: between the ages 22 to 28, in some form of drug rehabilitation, used for over 6 months, has been drug free for more than a month and were considered neurotypical before drug use. This age range was chosen because in the United States the legal age to drink is 21. Delaying a year would allow for a larger population due to an introduction of alcohol that could lead to other substance abuse. The decision to include being 6 months drug free was made on the bias that it will weed out any participants who will go through a relapse shortly after quitting and will allow a duration of time for all drugs to be out of one’s system; making sure the body is pure of illegal substances and any effects drugs might have on test results.

All participants for group A will be recruited through the Oaklawn rehabilitation addiction services in Elkhart and St. Joseph counties. Oaklawn services were chosen because they have continuing education on relapse prevention. Expectantly, the additional services will help retention of group A members by preventing a participant being discharged from the study due to relapsing. A relapse will skew the data being collected. The criteria for group A participants are the following: between the ages 22 to 28, in a drug rehabilitation program, used opioid for over six months, and has been drug free for more than a month.

Participants for group B will be volunteers from multiple churches in the area. Exclusion factors for participants in group B include prior drug or alcohol abuse, any neurological issues that affect motor control or cognitive abilities and is outside the age range of 22 to 28. All incentives will be given at the end of the study to aid in retention and ensure resources are not be squandered. To guarantee that the sample population of groups A and B are a diverse rep-
representation, each group will have 50 participants. Furthermore, the participation groups are larger to ensure, that even with fallout, the data collected can hold significant and statistical value. At the end of the study, all subjects who completed the tests will be given a $50 Walmart Gift card.

Testing will be done in the sequential order of cognition, language, speech, and memory. The majority of the test presented are standardized, to increase reliability of the data collected. The cognitive and memory tests will be performed by four individuals who holds a doctorate degree in psychology, respectfully two per test. To test cognition, the age-adjusted standardized Wechsler Adult Intelligence Scale- Fourth Edition (WAIS-IV) test will be administered (Pearson, 2018). To test memory, the Wechsler Memory Scale- Fourth Edition (WMS-IV) test will be administered (Pearson, 2018). To assess speech and language skills, norm-referenced screenings will be administered by four certified Speech Language Pathologists (SLP). Comprehensive screenings indicate if further testing is needed, meaning that an individual’s speech and language may be impaired. These tests will tell if further testing needs to be done for a diagnosis of a speech or language disorder.

The speech screenings will be administered by two SLP’s and the language screenings will be administered by the remaining two. To eliminate bias and increase validity, randomization and double-blind methods will be utilized. All participants will be randomly assigned one of the two professions that will administer each test. All professionals administering tests, will be blind as to whom is in which group to prevent researcher/experimenter bias. The participants will not directly be informed as to which area of question is being tested. The eight professionals will received two continuing education credits for participating in the research. The tests will be administered within the timeframe of one month, with meetings lasting up to two hours once a week. Each participant will complete four meetings, one for each test. This data collection method is used to showcase differences in the test results for the two groups.

This research study is designed to help people more efficiently recover from opioid dependency, by offering information that can be integrated into current rehab programs. However, the information gathered in this research is more pertinent for the rehabilitation therapists than the users. These professionals are the specialists that can analyze the gathered data and integrate new ideas into their therapy; evolving their therapy to be more effective in a shorter amount of time. This would also affect the families of the individuals who have an opioid dependency. For the loved ones of the individuals in rehab, the stressful time of worry should shorten. A decrease in time spent in rehab will decrease cost and open opportunities for more people to partake in the rehabilitation process. As well, the collected data could be important for other professionals by highlighting deficits that could lead to further research. It is hypothesized that individuals, ages 22-28 years old, who were opioid dependent for longer than three months, have impairments in speech, language, cognition and memory compared to like individuals who have not used/abused drugs or alcohol.

**Conclusions and Future Study**

If the data showed impairments in the speech motor mechanism, further data could be on all motor planning skills. Sensory neurons and motor neurons could be examined to see if there are any differences in the two mechanisms.

Testing of new intervention that implements findings from the research could happen. Someone could use the information gathered in this research study and change addition treatment accordingly. Then test the effectiveness of the new intervention.
REFERENCES


