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Salient Beliefs and Social Influence on Intentions to Misuse Prescription Opioid Pain Relieving Drugs for Recreational Purposes: An Application of the Theory of Planned Behavior

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SALIENT BELIEFS AND SOCIAL INFLUENCE ON INTENTIONS TO MISUSE PRESCRIPTION OPIOID PAIN RELIEVING DRUGS FOR RECREATIONAL PURPOSES: AN APPLICATION OF THE THEORY OF PLANNED BEHAVIOR

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ABSTRACT

Purpose: The purpose of the proposed study was to evaluate the utility of the Theory of Planned Behavior (TPB) in predicting intentions to use prescription opioid pain relieving drugs for recreational purposes among a sample of college students, while identifying salient beliefs that underlie recreational use in order to inform future intervention efforts among this population. **Methodology:** A cross-sectional electronic survey design was used to evaluate the direct measures of TPB constructs, salient beliefs, substance use, and individual characteristics of a random sample of university students. **Results:** Among our sample (*N*=776) more than 20% reported lifetime use of prescription opioids for recreational purposes, with 13.5% reporting recreational use within the past 6 months. Recreational use of alcohol, marijuana, cocaine, ecstasy, methamphetamine, and non-opioid prescription drugs within the past six months were all associated with increased odds of recreational prescription opioid use. A hierarchical logistic regression model examined the relationship between theory constructs and intention to use prescription opioids for recreational purposes. In this model, descriptive norm was associated with the greatest increase in odds of intention to misuse prescription opioids for recreational purposes (*OR*=1.37, *95% CI*: 1.23 – 1.54, *p*<.001), followed by subjective norm (*OR*=1.33, *95% CI*: 1.20 – 1.48, *p*<.001), and finally attitude (*OR*=1.13, *95% CI:* 1.09 – 1.17, *p*<.001). Additionally, Attitude was hypothesized to moderate the relationship between the additional theory constructs and intention. This hypothesis was upheld only with regard to descriptive norms (*p*=.006). Slope analysis revealed attitude to exert a protective effect against perceptions

of peer opioid use behavior. **Conclusion:** We recommend interventions among this population focus changing perceptions of peer behavior, as well as, changing attitudes toward recreational use of prescription opioids as this is shown to have a direct impact on intentions as well as moderate the effect of perceptions of peer behavior on intentions. Additionally, it is advised that future studies, move away from solely using terminology such as “nonmedical use” or “misuse” to describe this behavior as these definitions produce a degree of ambiguity when attempting to understand the determinants of this behavior, determinants which are necessary for behavior change interventions.

DEDICATION

This work is dedicated to my beautiful wife and daughter who stand by me and have stood by me throughout the most difficult of happenings. Without the love and support they have provided me I would, no doubt, have given up long ago. To them I say, thank you and I love you.

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I would like to foremost thank my committee; Dr. Martha Bass, Dr. Mary Allison Ford-Wade, Dr. Kofan Lee, and Dr. John Bentley for their valuable contribution to not only this project but my personal education while a student at the University of Mississippi. I would additionally like to acknowledge all of the additional instructors I have had the pleasure of learning under. Without their knowledge and challenge I would not possess the skills which I hold today. Thank you to my parents, brothers, grandparents, and other family members who made invaluable investment into the man I have become. Finally, thank you to my fellow graduate students who have served as my colleagues throughout this educational process. The role which they have played in my education cannot be understated. I look forward to the maintenance of these coveted relationships as we progress into the roles life would have for us.

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LIST OF ABBREVIATIONS AND SYMBOLS

CDC	Center for Disease Control and Prevention
EV	Expectancy Value
PBC	Perceived Behavioral Control
TPB	Theory of Planned Behavior

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CHAPTER I

INTRODUCTION

Opioid drug misuse, abuse, and resultant addiction has become one of the greatest threats to public health of our time and has been labeled as an epidemic (Kolodny et al., 2015). The term "misuse" is utilized to encapsulate any use without a prescription, inappropriate use by those with a prescription, and routs of administration not medically directed (Hughes et al., 2016). Opioid drugs can be grouped as either prescription opioid medications (e.g. morphine, hydrocodone, and methadone) or illegal drugs (e.g. heroin). Since 1999 drug overdose deaths have nearly tripled, with 61% of overdose deaths in 2014 alone being linked to opioids (Rudd, Seth, David, & Scholl, 2016). Moreover, approximately 100 Americans die daily from opioid related drug overdose (CDC, 2016), which has become the leading cause of accidental death (Rudd et al., 2016). Of particular concern are synthetic opioid drugs as the increase in death rates are being driven by heroin and synthetic opioids, other than methadone. Opioid related deaths increased by 15.6% from 2014-2015 while overdoses due to methadone declined by 9.1% over that same time period (Rudd et al., 2016). Also, as much as 5% of individuals 12 years and older have reported lifetime (at least once in the person's lifetime) non-medical use of prescription opioid medications (SAMHSA, 2013) and staggeringly, two million people ages 12 and older reportedly had a pain reliever use disorder in 2015 (Hughes et al., 2016).

Prescribing of opioid pain relievers has risen drastically in the United States since 1999, in 2010 sales were four times higher than in 1999 (Paulozzi, Jones, Mack, & Rudd, 2011). Overprescribing habits have been blamed for increasing consumption of opioid pain relievers, deaths due to them, and even heroin use (Kolodny et al., 2015). Approximately 80 % of heroin users report opioid pain reliever use prior to heroin usage, whereas only 1% reported the opposite linkage (Muhuri, Gfroerer, & Davies, 2013). Once addicted, users of opioid pain relievers report turning to heroin because the prescription drugs are harder to obtain and much more expensive (Cicero, Ellis, Surratt, & Kurtz, 2014).

As physician prescribing of opioid pain medication began to increase in the late 1990's, they did so in a somewhat uninformed manner pertaining to the risk for addiction associated with use. Leung and colleagues (2017) highlight a correspondence regarding increasing sales of opioid pain medications during this time and hundreds of citations appearing in the literature referencing a particular document which reported these medications posed little threat of addiction with long-term treatment (Porter & Jick, 1980). Interestingly, pharmaceutical companies who, through their aggressive marking strategies, saw drastic increases in sales during this time period (e.g. Purdue Pharma, makers of OxyContin) also payed hundreds of millions of dollars in lawsuits over misrepresentation of risk for addiction and dependence associated with their opioid drugs (Meier, 2007).

In 2015, 97.5 million people used prescription pain killers. Of these individuals, 12.5 million misused the pain relieving drugs and 2.1 million were first time misusers (Hughes et al., 2016). On average, individuals reported initiation of pain reliever use in their early to late 20s

(Hughes et al., 2016), making college students a particularly "at risk" group. Though estimates for new opioid misuse have declined since 2001 (Kolodny et al., 2015) we have seen a rise in both deaths from overdose and admissions to treatment facilities due to misuse. For substance misuse treatment, only treatment for alcohol was more prevalent in 2012 than treatment for pain relieving drugs (SAMHSA, 2013).

College students may be at higher than average risk for misuse of prescription opioid drugs, due to the previously mentioned initiation period (i.e. 20s) (Hughes et al., 2016). Prevalence estimates of college students misusing opioid pain medications approach 10% of the population (Kenne et al., 2017; Zullig & Divin, 2012). Reasons for misuse of prescription opioid drugs are similar to other substances commonly abused by college students. In their study investigating reasons for prescription opioid misuse among college students, Kenne et al (2017) reported that nearly half of their sample identified experimentation or feel good/get high as impetus for use (Kenne et al., 2017). Peralta and Steele (2010) reported nearly 40% of their sample of college students (n=465) reported lifetime prescription drug misuse, most commonly opioid drugs (Peralta & Steele, 2010). Additionally, those admitted to treatment programs for non-heroin opiates in 2015 were more likely (74%) to be between the ages of 20-39 than those admitted to treatment for all other substances combined (58%) (SAMHSA, 2017). Among college students, correlates to increased use of prescription opioids include being Caucasian, male, member of a Greek organization, and having a history of medical opioid use (McCabe, West, Teter, & Boyd, 2014). Also of concern is the linkage between prescription opioid misuse and depression as well as suicidality, which appear prominent among college students (Zullig & Divin, 2012). Interestingly, 53% of individuals report the source of their acquisition of pain relievers to be friends or relatives

(Hughes et al., 2016), indicative of theft or diversion as means of acquisition. As such, the typically large and diverse interpersonal networks of college students may place them at an increased risk for acquiring such substances.

Efforts to remedy the opioid epidemic are multifaceted and include intervention at each level of prevention. Some such strategies include implementation of the Center for Disease Control and Prevention's (CDC) recent guidelines for prescribing opioids for chronic pain (Dowell, Haegerich, & Chou, 2016), increasing the use of prescription monitoring programs, enhancing naloxone availability, increasing opioid use disorder treatment capacity, and law enforcement strategies to reduce the illicit supply of these drugs (CDC, 2017). Since individuals without a prescription drug use disorder are more likely to obtain prescription opioids through family or friends (Hughes et al., 2016), efforts utilizing the prescribers and pharmacists filling the prescriptions may be particularly efficacious. In 2012 there were 62 million prescriptions dispensed and it is evident that there exists a parallel relationship between opioids obtained through legitimate pharmacy administration and diversion as well as abuse of these drugs (Dart et al., 2015). Reduction of quantities prescribed and education on pill disposal have been suggested as additional strategies which may moderate diversion.

For the collegiate population primary prevention efforts may be of great concern and particularly effective as recreational drug use is a primary reported reason for misuse of prescription pain relieving drugs (Kenne et al., 2017; McCabe, Cranford, Boyd, & Teter, 2007). For example, it has been identified that young people misperceive the risk associated with prescription opioid use (L. D. Johnston, OMalley, Miech, Bachman, & Schulenberg, 2013) and

college students who perceive low levels of risk related to prescription opioids are 9.6 times more likely to misuse them than those who believe the drugs to be harmful (Arria, Caldeira, Vincent, O'Grady, & Wish, 2008). Kenne et al (2017) provided similar findings as opioid misusers reported lower ratings of perceived harm than did those identifying as non-misusers (Kenne et al., 2017). These findings suggest that interventions intended to change the salient beliefs regarding use of prescription opioids may be an effective way to deter usage among college students.

In addition to individual beliefs, social factors have been shown to have substantial influence on substance use behavior among college students, including prescription drug misuse (McCabe et al., 2014; Meisel & Goodie, 2015). Meisel and Goodie (2015) showed the number of friends misusing prescription drugs to be significantly related to past year prescription drug misuse in their sample of college students, with 24.4% of their sample misusing prescription medication in the last year. Perceptions of peer behavior have also been shown to relate to individual substance use. Perceiving that the majority of their peer group had misused prescription stimulants increased the odds of personal use by nearly 5 times (Helmer et al., 2016). Additionally, personal approval for the misuse of these medications was also more likely when the majority of peers approved of their misuse. Of interest is that perceptions of peer drug use are often misguided as these perceptions are often overestimated (Sanders, Stogner, Seibert, & Miller, 2014). Unfortunately, if these beliefs guide individual behavior it presents a prominent problem in need of intervention.

As described above, and consistent with many existing behavioral theories (Ajzen, 1985; Ajzen & Fishbein, 1980b; Bandura, 1997; Bandura & Walters, 1977; Deci & Ryan, 1985), human behavior is unarguably cultivated by one's own cognition and the influence of societal factors. A

dearth of published research exists evaluating the effectiveness of theory-based investigation and interventions addressing opioid misuse among college students (Peralta & Steele, 2010). However, we have evidence suggesting that interventions based upon theoretical strategies outlined by behavioral science are more effective at facilitating behavior change than those lacking such a basis for determination (K. Glanz & Bishop, 2010), and as such should be utilized.

A foundational step toward theory based intervention is the use of such theory to identify the theoretical components producing the behavior in need of change. The Theory of Planned Behavior (TPB) (Ajzen, 1991) is a well-established behavioral framework with evidence of predictability and explanatory power among a wide range of behavioral domains (Armitage & Conner, 2001). According to the TPB (**Figure 1**) one's behavior is directly influence by their intention to perform the behavior and their perception of control over the execution of the behavior. Behavior is indirectly influenced (mediated by intention) by one's attitude toward the behavior and the normative influence surrounding the behavior.

The TPB may be particularly useful in providing a basis for future interventions among college students because of its elicitation of the salient beliefs that underlie opioid misuse specific to this population, thus identifying a target for intervention. The elicitation process is a vital (Ajzen, 2006) but often overlooked component of the TPB (Armitage & Conner, 2001). Not to imply studies forgoing the process of elicitation are inconsequential, however, it is this process which allows for the development of appropriate and culturally relevant instruments and interventions (Tennille, Solomon, Fishbein, & Blank, 2009). It is through this process that the salient beliefs and referents which influence behavior are uncovered. Thus, the purpose of this study is to evaluate

the utility of the TPB in predicting intentions to misuse opioid prescription drugs among a sample of college students, while identifying the salient beliefs and specific referents of the population in order to inform future intervention efforts.

CHAPTER II

REVIEW OF LITERATURE

Opium to Opiates

Opium has a long standing presence in the history of the world. It is believed that Homer makes one of the earliest recorded references to the use of opium in his literary work, The Odyssey (8th Century B.C.). Here Helen delivers a drug into the wine given to Telemachus and his friends for the purpose of helping them deal with their grief over Odysseus, experts believe this to be opium (Lattimore, 1967; Lewin, 1931). It is agreed upon that the ancient Sumerians cultivated poppies and harvested opium from the unripe seeds of the poppy plant. Their writings refer to this plant as "Hul Gil" which translates to "joy plant". It is believed that the cultivation of opium was passed from the Sumerians to the Assyrians and then on to the Egyptians. From Egypt opium was transferred across the Arabian Sea to India and Asia (Brownstein, 1993), reaching Europe by the 13th Century A.D. through the Silk Roads. Throughout its history opium has been used as a euphoriant in religious rituals, a painless means to put people to death, medication, anesthetic, remedy for all manner of nuisance, and drug of abuse (Brownstein, 1993).

In 1806 the active ingredient of opium, morphine, was discovered and isolated by Friedrich Serturner (Serturner, 1806). Fittingly, Serturner named his morphine after Morpheus, the god of

dreams. Soon after discovery morphine became widely used as a pain treatment and anesthetic. By 1815 the drug was also being used as a substitutive treatment for individuals struggling with alcohol and opium addiction. This, of course, until the realization that morphine was more addictive to users than the drugs it was being used to treat. Along this line of substitution, scientists continued the attempt to find an alternative opiate proving safer and non-addictive. This venture lead to the creation of such substances as heroin in 1898, nalorphine in 1942, and methadone in 1946 (Brownstein, 1993). Pharmacologically speaking, drug actions are considered "opioid" in nature when the effects resemble those of morphine, the early prototype of opium derived drugs (J. A. Lord, Waterfield, Hughes, & Kosterlitz, 1977). These are all drugs, natural or synthetic, which bind to opioid receptors to cause their effects. Furthermore, "opiate" refers to a class of drugs derived specifically from the opium poppy.

Opioid medications produce their effects in the central nervous system by binding to opioid receptor sites. Work from 1973 showed there to be opiate binding sites spread throughout the central nervous system (Pert & Snyder, 1973; Terenius, 1973) in a non-uniform fashion (Hiller, Pearson, & Simon, 1973). This discovery lead to the belief that these receptor sites were likely the target of naturally occurring opiates in the form of neurotransmitters. Akil et al (1976) affirmed this hypothesis by demonstrating that an analgesia effect could be produced by administering foot shocks and the administration of naloxone (i.e. opioid antagonist drug) could reverse these effects (Akil, Madden, Patrick, & Barchas, 1976). Inferred from this experiment was the notion that pain itself caused the release of natural opiate like compounds.

These naturally occurring endogenous opioids are called endorphins, enkephalins, and

dynorphins (Brownstein, 1993; Kosterlitz & Waterfield, 1975; Watkins & Mayer, 1982). These endogenous substances are opioid peptides which produce similar effects to those of opioid drugs. Precursor proteins produce each of the pre mentioned peptides. Met-enkephalins are produced by proenkephalin (Noda et al., 1982). Prodynorphin is the precursor for the peptides which contain the Leu-enkephalin sequence (Kakidani et al., 1982) and proopiomelanocortin is the precursor for corticotropin ά-melanotorpin and *β*-endorphin (Nakanishi et al., 1979).

Opioid receptors have since been shown to be present throughout the body, typically identified by characters from the Greek alphabet, however this labeling practice has been challenged for replacement (Dhawan et al., 1996). Martin and colleges provided the first conclusive evidence for multiple opioid receptor types using animal models (Martin, Eades, Thompson, Huppler, & Gilbert, 1976). The central opioid receptors categories are the μ (mu, for morphine), δ (delta, for deferens), and κ (kappa, for ketocyclazocine) (Brownstein, 1993; Martin et al., 1976), however, research suggests more distinct receptors types (Alfred Mansour, Khachaturian, Lewis, Akil, & Watson, 1988). Mu receptors are transmembrane inhibitory protein receptors found both presynaptic and postsynaptic in the spinal cord and on the brain stem (Besse, Lombard, Zajac, Roques, & Besson, 1990; A. Mansour, Khachaturian, Lewis, Akil, & Watson, 1987). The highest density of delta receptors are located in the forebrain, although their presence exists in other brain regions and the dorsal horn of the spinal cord (A. Mansour et al., 1987). The functionality of delta receptors are not as understood as that of mu receptors. Delta receptors appear to play a role in bodily functioning outside of analgesia (Reinscheid et al., 1995).

Opioid drugs can be classified as opioid agonists, opioid antagonists, or opioid agonist-

antagonist (Brownstein, 1993; Veilleux, Colvin, Anderson, York, & Heinz, 2010). Agonist drugs exert their effects by binding to receptor sites throughout the brain, spinal cord (Pert & Snyder, 1973; Terenius, 1973), or some peripheral locations, such as the digestive tract (Camilleri, Lembo, & Katzka, 2017). Once the binding occurs these drugs produce effects similar to endogenous opiates. Some such actions are analgesia, respiratory depression, and euphoria. Of concern is the fact that tolerance has been observed with regard to the effects elicited through opioid agonist medications.

Expression of tolerance occurs in part due to the repeated opioid receptor binding (Ferguson, Zhang, Barakt, & Caron, 1998), where receptor desensitization can occur (Mohammad Ahmadi Soleimani, Azizi, Pachenari, Mirnajafi-Zadeh, & Semnanian, 2017). Some but not all of the effects of opioids may be subject to tolerance development. Analgesia and respiratory depression are subject to tolerance where effects on the digestive tract do not appear at risk. Tolerance is of prominent interest not only because it reduces the efficacy of these drugs at treating pain but also can lead to an increased risk of non-medical abusive use (misuse). Opioid agonist drugs, such as, heroin, oxycodone, hydrocodone, morphine, fentanyl, and methadone have a high affinity for abuse due to the extreme euphoric sensations they produce. Tolerance development appears to be heterogeneous in its occurrence among the various effects of opioids. The euphoric effects of opioids diminish at a quicker rate than that of the depressive effect on respiration and this is speculated to be a primary contributor to opioid overdose death.

Opioid antagonist drugs act on the opioid receptor by binding and inhibiting the agonistic effects of endogenous and exogenous opioids (Kosterlitz & Waterfield, 1975). These antagonists

bind to the receptor sites but produce no activation. Opioid antagonist drugs such as naloxone are often used in a treatment setting as an antidote. Antagonists drugs are administered to reduce the effects of agonist drugs and also reverse the effects of opioid overdose (Avetian et al., 2017). Opioid agonist-antagonist drugs produce effects similar to agonist drugs and also possess effects resembling antagonist drugs. These drugs were produced with the intent of creating a more targeted treatment approach, for instance, maintaining analgesic effects while reducing unwanted effects such as respiratory distress. For example a particular drug may act as a partial agonist on the μ receptor, a pure-agonist toward κ receptor, and an antagonist on the δ receptor. Agonist-antagonist drugs provide additional options for the management of pain, aside from pure agonist drugs, and are also used in treatment settings dealing with dependence and abuse.

The Opioid Epidemic

Opioid drugs can be grouped both as prescription opioid medications (e.g. morphine, hydrocodone, and methadone) or illegal drugs (e.g. heroin). Since 1999 deaths due to drug overdose have nearly tripled, with 61% of overdose deaths in 2014 alone being linked to opioids (Rudd et al., 2016). Moreover, approximately 100 Americans die daily from opioid related drug overdose (CDC, 2016), which has become the leading cause of accidental death (Rudd et al., 2016). Of particular concern are synthetic opioid drugs as the increase in death rates are being driven by heroin and synthetic opioids, other than methadone. Opioid related deaths increased by 15.6% from 2014-2015 while overdoses due to methadone declined by 9.1% over that same time period (Rudd et al., 2016). Also, as much as 5% of individuals 12 years and older have reported lifetime (at least once in the person's lifetime) non-medical use of prescription opioid medications

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As physician prescribing of opioid pain medication began to increase significantly in the late 1990's, they did so in a somewhat uninformed manner pertaining to the risk for addiction associated with use. Leung and colleagues (2017) highlight a correspondence with increasing sales of opioid pain medications and citations appearing in the literature referencing a particular letter (Porter & Jick, 1980) which reported these medications posed little threat of addiction with long-term usage in the treatment of chronic pain. Increases in reference to this letter occurred after the introduction of OxyContin, an extended release formulation of oxycodone, in 1995 (Leung, Macdonald, Stanbrook, Dhalla, & Juurlink, 2017), interestingly, sales of oxycodone increased by 500% from 1999-2011 (Jones, 2013). Also of interest, is the 2007 guilty plea and 600 million dollar payout by Purdue Pharma, the manufacturer of OxyContin, for misleading regulators, doctors, and patients about the potential for addiction associated with use of this particular opioid pain reliever (Meier, 2007). Cephalon, another opioid drug manufacturer, settled a similar lawsuit

in 2008 for over $400 million. Purdue Pharma, the manufacturer of OxyContin, played an aggressive role in marketing these types of pain medications to the public. This company provided financial support to the American Pain Society, American Academy of Pain Medicine, and several other practitioner and patient organizations in the late 90s and early 2000s. Of course, these donations elicited advocacy for pain management through opioid pain relievers (Fauber, 2012). Although opioid overdose appears more prominent among those receiving legitimate prescriptions for opioid medications, particularly middle to old-aged adults, they are not the only at risk group (Hughes et al., 2016).

Misuse of opioid pain relievers is a primary public health concern. The terminology of this phenomena has recently changed from "nonmedical opioid use" which was defined as, use of these medications without a prescription and in a manner inconsistent with their intent for the feelings they cause. However, the latest version of the National Survey on Drug Use and Health (NSDUH) instituted a change in terminology. The NSDUH in an annual national survey, conducted by the U.S. government through the Substance Abuse and Mental Health Services Administration (SAMHSA), that tracks the consumption of licit and illicit drug use, as well as, mental disorders. The NSDUH is a population level survey which produces population estimates for the variables collected. It was thought the definition of "nonmedical opioid use" could lead to misinterpretation by survey respondents. For instance, this definition did not capture consumption exceeding the recommended dosage for those with legitimate prescriptions. Additionally, taking the medication for the feelings it caused could be construed as an intended effect of the drugs (e.g. pain relief). As such, the term "misuse" is now utilized to encapsulate any use without a prescription, inappropriate use by those with a prescription, or routs of administration not medically directed (Hughes et al.,

2016). It should be noted that the terminology "nonmedical use" and "misuse" apply to all prescription drugs, not solely opioids.

Tolerance and Addiction

Given the tremendous relaxation and euphoria producing properties of all opioid drugs the potential for abuse and misuse are extremely high. Unfortunately, these properties combined with tolerance issues resulting from repeated use make dependence on these drugs an all too probable occurrence. The dependence problem goes beyond those who begin usage as a means to get high (the social image of dependence and addiction). Recent research suggests a failure of opioid therapy for the treatment of chronic pain (Wilson-Poe & Moron, 2017), as dependence and addiction may result. Estimates suggest that as many as one-quarter of patients prescribed long-term opioid therapy for the treatment of chronic pain develop dependence (Boscarino et al., 2010). Dependence often leads to addictive behavior where further harm is placed on the individual physically, psychologically, and socially (Beneitez & Gil-Alegre, 2017). Whether an individual's dependence stems from drug misuse or legitimate medical-based usage detoxification is generally the resolution.

Detoxification is usually accomplished in one of two ways: abrupt termination (Gowing, Ali, & White, 2006; Gowing, Farrell, Ali, & White, 2016) or tapering through the use of replacement opioids such as methadone or buprenorphine. Abrupt termination often utilizes an opioid antagonist (e.g. naltrexone) (Gowing et al., 2006) or alpha$_2$ adrenergic agonists (e.g. clonidine) (Gowing et al., 2016) to safely manage withdrawal symptoms. Common opioid

withdrawal symptoms include irritability, increasing anxiety, chills, nausea, diarrhea, sweats, insomnia, and muscular weakness (Gowing, Ali, White, & Mbewe, 2017). Tapering treatments such as methadone and buprenorphine help to manage the symptoms of withdrawal by slowly reducing dosage of the replacement opioid and may lead to longer treatments duration with fewer side effects than medication assisted abrupt termination protocols (Veilleux et al., 2010). Buprenorphine has become a prominent tapering treatment medication in recent years. Studies suggest that buprenorphine, a partial opioid agonist, may not be as effective at all dosing levels as full agonist drugs such as methadone (Mattick, Breen, Kimber, & Davoli, 2014). However, buprenorphine is often preferred because it can be administered by a local physicians office instead of a specific clinic devoted to methadone treatment and, as a partial agonist, reduces risk for abuse and respiratory depression related overdose (Veilleux et al., 2010).

Detoxification treatment for opioid addiction and dependence is often complimented by psychosocial means. Amato et al (2011) synthesized evidence suggesting psychosocial treatments (e.g. therapeutic counseling and family therapy) in conjunction with pharmacological detox therapy where associated with treatment completion, decreases in opioid use, and clinical attendance when compared to pharmacological therapies alone (Amato, Minozzi, Davoli, & Vecchi, 2011). Additionally, this form of psychotherapy may aid in resolving associated issues effecting psychological health. A well-documented relationship exists between mental health issues and opioid use and misuse (Garland, Bryan, Nakamura, Froeliger, & Howard, 2017). Moreover, adults 18 years and older with mental illness are more likely to misuse prescription opioids (Hughes et al., 2016). Studies report deleterious associates between opioid misuse and negative emotional states including suicidal behavior and depression (Divin & Zullig, 2014; Zullig

& Divin, 2012). Zullig & Divin (2014) found high school students who reported feelings of sadness, hopelessness, depressions, and attempting or considering suicide had 1.32-1.45 times the odds of opioid painkiller misuse compared to those without such feelings. Likewise, among Canadian individuals, psychological distress and suicidal ideation were associated with a greater likelihood of prescription opioid misuse (Fischer et al., 2013). Additionally, females may be at a higher risk for using these medications as a coping strategy (Lo, Monge, Howell, & Cheng, 2013), as they have a higher risk for depression diagnosis (Zullig & Divin, 2012). Studies examining opioid misuse and mental health associations often identify the co-abuse of other drugs (Fischer et al., 2013; Hughes et al., 2016; Lo et al., 2013) of which psychotherapy may benefit.

Once detoxification is complete there can remain problematic central nervous system adaptations resulting in an increased sensitivity to pain. Opioid induced hyperalgesia is a state of nociceptive sensitization caused by exposure to prescription and non-prescription opioids (Lee, Silverman, Hansen, Patel, & Manchikanti, 2011). Cumulative evidence appears to point to the μ-opioid receptor as the culprit in the development of opioid induced hyperalgesia as well as the development of acute opioid tolerance (Weber, Yeomans, & Tzabazis, 2017). Further, Weber et al (2017) suggest that this identification should help derive the solution to these problems and identify peripheral μ-opioid receptor antagonist drugs as a new treatment for opioid induced hyperalgesia. Opioid drug misuse, abuse, and resultant addiction has become one of the greatest threats to public health of our time and has been labeled as an epidemic (Kolodny et al., 2015).

Theory of Planned Behavior

The Theory of Planned Behavior (TPB) (Ajzen, 1991; Ajzen, 2005) was proposed to explain and predict behavior occurring under specific contextual circumstances. To complement the shortcomings of its foundation in attitudinal theory (Wicker, 1969), the TPB integrates social norms and intention in its prediction of behavior. In full, the TPB is an extension of the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980a; Fishbein & Ajzen, 1975). Common among both TRA and TPB is that intention is the central determinant of individual behavior. Intentions represent an individual's underlying motivation to perform a given behavioral act. More specifically, the extent an individual will strive towards a given behavior, the breadth of their effort, or how hard they will work in order to perform the act itself (Ajzen, 1991). Likewise, intention is the formation of a conscious plan to perform future behavior (Warshaw & Davis, 1985). By and large, it is expected that the stronger one's intention to perform a behavior, the more probable the performance of the behavior becomes. Constructs influencing individual intention in the TRA are attitude and subjective norm (Ajzen & Fishbein, 1980b). The TPB builds upon these constructs with the addition of perceived behavioral control (PBC) (Ajzen, 1985), which has a dual influence both on intention and behavior itself (Ajzen, 1991). As seen in **Figure 1**, the TPB deduces behavioral action to be determined by the interactive effect of intention to perform and PBC; the attitudinal and normative constructs are completely mediated by intention.

The attitudinal construct originates from expectancy value theory and represents the individual subjective judgment that the behavior act or behavioral outcome is favorable or unfavorable, positive or negative, or pleasant or unpleasant. Subjective norm is a reflection of

perceived social pressure to perform the behavior in question, usually manifested in the form of perceived opinions of important referent individuals. These constructs have shown respectable predictability of behaviors that are straight forward or, in large, lend themselves to a high degree of personal agency (Armitage & Conner, 2001). However, within the perception of the individual, the volitional nature of behavior is highly variable from one behavior to another. Likewise, perceptions of personal agency (control) vary widely between individuals when considering the same behavior. Thus, the TPB incorporates the added construct of PBC as a measure of the volitional control over behavior.

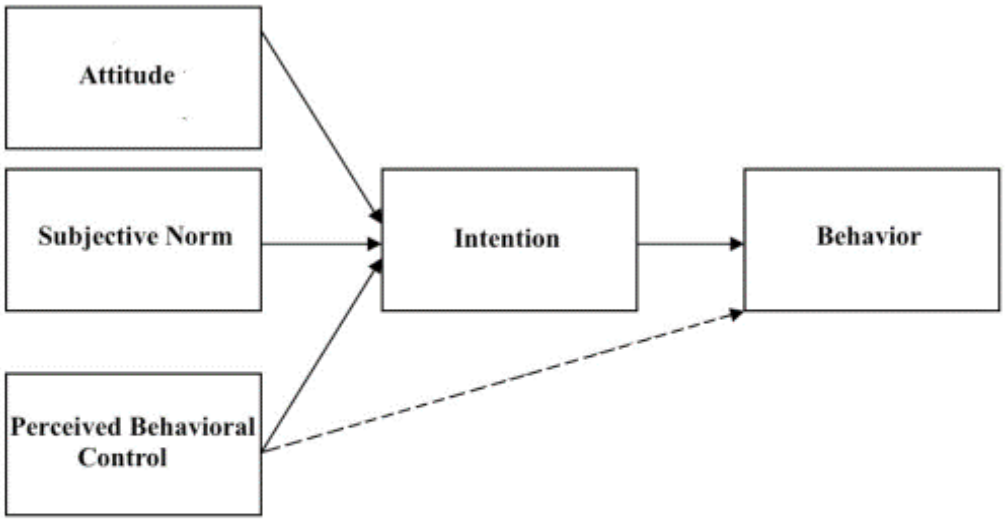


Figure 1. The Theory of Planned Behavior

More important than actual control is perceived control when considering the psychological intention to behave. When measured, this PBC construct is an evaluation of resources and the barriers that facilitate or hinder the occurrence of action. Thus, behavioral action

will be an interactive effect of intention and PBC (Figure 1) (Ajzen & Madden, 1986). The TPB is preferable to the TRA when behavior is outside the complete control of the individual and should aid in explained variance of both intention and behavioral execution (Armitage & Conner, 2001). It has been suggested that researchers applying the TRA to behavior not completely under volitional control have likely confounded the intention construct by in fact assessing another construct all together, behavioral expectation (Warshaw & Davis, 1985). This behavioral expectation is an estimation of the probability that the individual will perform the behavior in the future. The PBC construct is proposed to be conceptually similar to and interchangeable with self-efficacy (Ajzen, 1991). However, psychologists have argued that PBC and self-efficacy are conceptually different and that the measurement of self-efficacy should preferred when predicting intention or behavior (Hein De Vries, Dijkstra, & Kuhlman, 1988; Dzewaltowski, Noble, & Shaw, 1990). The TPB constructs, logic, and its efficacy will be discussed in the following pages.

The Expectancy-Value Model of Attitude Formation

The Expectancy-Value (EV) model of attitude formation provides the platform on which the TRA (Ajzen & Fishbein, 1980b) and TPB (Ajzen, 1991; Ajzen, 2005) constructs are conceptually and analytically based (Ajzen & Fishbein, 2008). The EV framework suggests an individual holds multiple subjective beliefs that an object has a particular set of attributes which the individual evaluates and applies a strength of association between the attribute and object. The attribute evaluation augments an attitude toward the object proportionate to the individual's perception regarding the likelihood that the object affords the desired attributes (Fishbein, 1963). For measurement purposes, beliefs are quantifiable as the sum of product scores for all considered

attributes when considering the likelihood an object possess the attribute multiplied by the evaluation of the attribute (i.e. desirable-undesirable). The TRA and TPB apply this reasoning to a behavioral act and its anticipated outcomes (Ajzen & Fishbein, 2008). These summed product terms (beliefs) should relate and form the basis of an individual's measured attitude, evidenced through high correlations. However, this multiplicative approach has been questioned in the literature. Armitage and Conner (1999), using a hierarchical regression approach, found there to be no additive impact on explained variance when incorporating multiplicative terms in addition to outcome beliefs and the evaluation of those beliefs alone when predicting attitudes and subjective norms for alcohol and cannabis behavior among a college sample (Armitage, Conner, Loach, & Willetts, 1999). Subsequently, Armitage et al suggest this hierarchical modeling technique be utilized in association with the TPB rather than reliance on the expectancy-value model, as it may not be applicable to all contexts. Additionally, the TPB applies this expectancy value rational for measurement of all constructs proposed to influence individual intention.

Elicitation of Salient Beliefs

The elicitation process is an important undertaking which leads to acquisition of salient beliefs that underlay the TPB constructs (Ajzen, 1991; Ajzen, 2006; Ajzen & Fishbein, 1980b; Ajzen, Nichols, & Driver, 1995). The elicitation of salient beliefs is conducted among a subsample of the target population, thereby providing the unique outcomes and referents that underpin a particular behavior for a particular group of individuals, instead of an ambiguous assumption based on another population's belief system by which their attitude was formed. Elicitation can be accomplished in various ways, for instance, pilot investigations among a few members of the target

population (L. E. Davis, Ajzen, Saunders, & Williams, 2002) or by a free-response formatted instrument (Ajzen, 2006). Regardless of methods, the participants are asked to identify advantages and disadvantages of behavioral engagement (outcome expectations), individuals or groups who approve and disapprove of their performance of the behavior (referents), and factors that facilitate and hinder the performance of the behavior in question (control factors) (Ajzen, 2006; L. E. Davis et al., 2002). Thus, the target sample group provides information relevant to their precise behavioral motives. In many studies using the TPB framework, only direct measures of the constructs attitude, subjective norm, and perceived behavior control are collected. From a practical perspective, failure to evaluate the salient beliefs on which the constructs are build is problematic, this in the sense that the salient beliefs provide the information necessary for targeted intervention (Ajzen & Fishbein, 1980b; L. E. Davis et al., 2002). For example, when attitude is shown to influence intention and subsequent behavior, what are the specific problematic beliefs regarding the behavioral engagement? This information provides the basis for behavior change.

Behavioral Beliefs

The TPB suggests that behavior is determined by independent salient beliefs systems regarding the behavior in question inclusive of behavioral, normative, and control beliefs (Ajzen, 1991; Ajzen & Madden, 1986; Fishbein & Stasson, 1990). The first set of beliefs to be discussed herein are the behavioral beliefs which give rise to the attitudinal construct of the TPB. One's attitude towards a behavior or object represents a function of his/her beliefs about that behavior coupled with an appraisal of those beliefs (Fishbein, 1963). Individuals form positive attitudes

toward behaviors which are perceived to have desirable consequences and negative attitudes toward behaviors with unfavorable consequences. Behavioral beliefs are individual views about the likelihood that their engagement in the behavior would lead to the realization of the outcomes or attributes associated with performing a given behavior.

Consider the following illustration, "Exercising regularly will cause me to lose weight", rated typically on a 7-point bi-polar scale (-3 to +3) "unlikely-likely" or "disagree-agree". The behavior is exercise and one outcome of interest is weight loss. These beliefs are further weighted by subjective outcome evaluations regarding the behavior, "For me, weight loss is…" this rated on another 7-point "bad-good" scale. Again the range (-3 to +3) is used to employ the rational of the double negative (Fishbein & Ajzen, 1975). In practice, if someone believes losing weight would be bad (-3) and they also think that exercise is unlikely to lead to weight loss (-3) then their product score would be +9, reflecting a positive contribution to the person's attitude toward exercise. Thus, the contribution of a behavioral belief to the individual's attitude toward the behavior is realized as the product of the outcome evaluation multiplied by the strength of the belief. An individual possesses multiple salient beliefs toward a behavior and as such these belief x strength products are summed to produce a behavioral belief index which is assumed to be proportional to the individual's attitude, thus an indirect measure of attitude (Ajzen, 1991).

Distinction has been made regarding beliefs that are attitudinal in nature versus those beliefs which are descriptive nature. Fishbein, however, imparts that all beliefs (i.e. descriptive, instrumental, beliefs regarding relations to other objects, etc…) about an object or behavior are relevant to the formulation of the attitude toward that object and should be considered (Fishbein,

1963).

Normative Beliefs

In the TRA and TPB the subjective norm construct is derived from the normative beliefs held by the individual. Normative beliefs are conceptualized as perceptions of the behavioral expectations of important others (e.g. mother, husband/wife, doctor, teacher, etc.); these individual's either approve or disapprove of participation in a given behavior. Accordingly, normative beliefs account for the influence a person feels from referent individuals within their social network with regard to a behavior (Ajzen & Madden, 1986). Any given behavior warrants a specific group of referents, of which the focal individual perceives as referent toward their performance of the behavior. The combination of compliance motivation with the perceived will of the referents leads to the subjective norm regarding a behavior. Similar to the way in which behavioral beliefs are measured, normative beliefs are also ascertained in a manner consistent with expectancy value framework.

Referents should be identified through the elicitation process (L. E. Davis et al., 2002) (Ajzen, 2006). The belief about whether or not the referent thinks they should perform the behavior is evaluated on a bipolar scale (-3 to +3) (Karen Glanz, Rimer, & Viswanath, 2008) or a unipolar (1 to 7) (Ajzen, 2006) scale. Motivation to comply with the referent's perceived will is measured on a unipolar scale (1 to 7). Again, product scores are produced and summed across referents to create an indirect measure of subjective norm (Fishbein & Ajzen, 1975). An example item for normative belief strength would be "my doctor thinks that I should exercise for 30 minutes per

day, 3 times per week for the next three months" scored on a 1 to 7 scale. Motivation to comply items resemble "When it comes to matters of health, I want to do what my doctor thinks I should do", once more rated on the 7 point scale (Ajzen, 2006).

Control Beliefs

Control Beliefs represent the indirect measure and basis of the construct of perceived behavioral control in the TPB. These underlying beliefs represent the perception that the behavioral act is actually under the volitional control of the individual (Ajzen & Madden, 1986). Control beliefs specifically examine the barriers and aiding factors encompassing behavioral action. The fewer obstacles or barriers to behavioral performance the greater sense of control the individual perceives. These beliefs may be the product of personal experience with said behavior or they can be the product of second-hand information from other's dealings with the behavior (Ajzen, 1991).

The salient factors are identified through elicitation from the target population and synthesized by the researchers into question form. These items reflect the likelihood the control factor will be present when attempting the performance of the behavior (belief strength) and whether the factor will impede performance (power of control factor) (Ajzen, 2006). Seven point bipolar Likert scales are used to assess each control belief and its respective perceived power (Ajzen, 1991). Often, belief strength is measured on an "unlikely-likely" scale and power of control on a "difficult-easy" scale. For example, one factor effecting control over smoking cessation could be the likelihood of encountering a restaurant that restricts smoking and assessing

whether the individual perceives this making it easier or harder to quit (Karen Glanz et al., 2008). Products of each (belief strength x power of control factor) are summed or averaged to produce an individual's measure of control beliefs regarding a behavior.

Efficacy of the Theory of Planned Behavior

Throughout its existence the TPB has developed an extensiveness body of literature applied to such diverse behaviors as physical activity, education, leisure behavior, substance use, and sexual activity, among others (Ajzen & Driver, 1992; Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Blue, 1995; L. E. Davis et al., 2002; Marcoux & Shope, 1997). Armitage and Conner (2001) produced a meta-analysis inclusive of 161 independent studies empirically testing the TPB. Collectively, the included studies showed the TPB to explain 39% of the variance in intention and 27% of the variance in actual behavior. These measures of effect demonstrate the robust ability the TPB. As expected, studies that included self-reported behavior measures accounted for more variance than those utilizing objective measures, 21% versus 31%, respectively.

In addition to providing support for the efficacy of the TPB, Armitage and Conner (2001) displayed the advantage of the TPB in comparison to the TRA by documenting the added explanatory power produced when the construct of perceived behavioral control is considered. The authors found that, on average, consideration of PBC increased the coefficient of determination for intention by 6% over and above attitude and subjective norm alone. PBC also added to the

prediction of the behavior independent of intention, by 2% on average. After weighting the correlations by study sample size, the attitudinal construct demonstrated the highest overall correlation with intention ($r = 0.49$, $R^2 = 0.24$), followed by PBC ($r = 0.43$, $R^2 = 0.18$), and finally subjective norm ($r = 0.34$, $R^2 = 0.12$) (Armitage & Conner, 2001).

Theory of Planned Behavior and Substance Use and Abuse

The TPB framework has been applied to address psychosocial factors surrounding the use or cessation of a host of substances, use of which impart not only health but legality concerns as well. Among others, cigarette smoking, alcohol, marijuana, MDMA/ecstasy, and stimulant prescription drugs have been investigated on the basis of TPB constructs (Boissonneault & Godin, 1990; Cooke, Dahdah, Norman, & French, 2016; A. K. Davis & Rosenberg, 2016; Hein De Vries, Backbier, Kok, & Dijkstra, 1995; Ito, Henry, Cordova, & Bryan, 2015; K. L. Johnston & White, 2003; Judson & Langdon, 2009; Jennifer A Kam, Masaki Matsunaga, Michael L Hecht, & Khadidiatou Ndiaye, 2009; Marcoux & Shope, 1997).

Alcohol

Research suggests that the TPB is sound in its ability to explain and predict alcohol use and abusive behavior (K. L. Johnston & White, 2003; Marcoux & Shope, 1997; Norman & Conner, 2006). Cooke et al (2016) published a recent meta-analysis documenting existing literature examining alcohol consumption under the lens of the TPB. Inclusive within this review were 40 studies meeting their a priori stated inclusion criteria. The included studies were conducted in

various developed countries. Cooke et al. calculated sample-weighted average correlations ($r+$), as a measure of effect size, using a random effects model. Significance testing was conducted across studies to examine specific moderators (i.e. pattern of alcohol consumption, age, & gender). Across studies intention held the greatest relationship with attitude ($r+ = .62$), followed by subjective norm ($r+ = .47$) and PBC ($r+ = .31$). As proposed by the model, intention had a high correlation with behavior ($r+ = .54$). Like Armitage & Conner 2001, this review showed that a number of studies incorporate measures of self-efficacy either in addition to or in place of PBC (Armitage & Conner, 2001). Self-efficacy was shown to correlate to a higher degree with intention than PBC or perceived control (Cooke et al., 2016). This provides more evidence that the constructs of PBC and self-efficacy are not quite as interchangeable as was suggested by Ajzen (1991).

Cooke et al identified moderators of the relationships between TPB constructs and alcohol use, those being patterns of consumption, age and gender. It appears, based on the meta-analytic data, that the outcome of interest, alcohol consumption pattern, changed the relationships between TPB constructs. For the attitude-intention relationship, heavy episodic drinking held the stronger relationship versus that of light episodic drinking. This difference, although statistically significant, was minor. The sample weighted average correlation for heavy versus light episodic drinking was $r_+ = .74$ and $r_+ = .72$, respectively. Additionally, studies using "getting drunk" as the outcome had a stronger attitude-intention relationship versus "quantity of drinks" or "not drinking" at $r+ = .57$, .38, and .35, respectively. Similarly, the subjective norm-intention relationship was moderated by consumption pattern. Here the strongest relationships were observed for the light episodic drinking $r+ = .57$ followed by heavy episodic drinking $r+ = .48$, not drinking $r+ = .46$,

quantity of drinks, $r+ = .28$, and getting drink $r+ = .21$. PBC had a negative relationship with intention ($r+ = -.46$) for studies utilizing getting drunk as the consumption pattern where as positive relationships were observed for those using heavy ($r+ = .44$) and light episodic drinking ($r+ = .44$). Light episodic drinking had the strongest relationship between intention and behavior (Cooke et al., 2016). Importantly, stronger relationships were observed between TPB variables when more specific definitions of consumption patterns (episodic drinking) were implored vs. a more ambiguous definition (getting drunk).

Gender was found to moderate only the attitude-intention relationship with no moderation effect on subjective norm-intention, PBC-intention, or intention-behavior. Mixed gender studies displayed a sample-weighted average correlation of ($r+ = .68$), whereas female only samples produced correlations of ($r+ = .46$) and male only samples a correlation of ($r+ = .36$). It should be noted that the vast majority of TPB studies examining alcohol behavior exhibit unequal samples based on gender. For the 40 studies incorporated in Cooke et al (2016), only seven studies had approximately equivalent male and female participants, with the majority having female dominant samples. Similarly, age of participants moderated the attitude-intention relationship as adults provided a stronger association ($r+ = .65$) than those of adolescent samples ($r+ = .40$). Also, adults showed a strong self-efficacy-intention relationship ($r+ = .57$) when compared to adolescents ($r+ = .22$) (Cooke et al., 2016).

Cooke and colleagues observed larger subjective norm-intention relationships with alcohol use than are typically found in studies utilizing the TPB (Armitage & Conner, 2001; Cooke et al., 2016; McEachan, Conner, Taylor, & Lawton, 2011). Across studies Cooke et al (2016) found a

sample-weighted average correlation of ($r+ = .47$) for the subjective norm-intention relationship. This is interesting as it may highlight not only the social nature of alcohol use (K. L. Johnston & White, 2003; Marcoux & Shope, 1997) but also the influence of referent individual's on substance use in general (A. K. Davis & Rosenberg, 2016). Similar to other meta-analyses (Armitage & Conner, 2001), Cooke et al (2016) found measures of self-efficacy to impart a similar effect on intention and behavior to that of PBC measures.

Smoking

A 2010 meta-analysis focused on the application of the TPB in predicting intention to smoke as well as smoking behavior (Topa & Moriano, 2010). Included in this meta-analysis were 27 studies focusing on smoking behavior and intention to smoke. Topa and Moriano included only studies focused on smoking behavior as opposed to cessation related behavior because the psychosocial parameters are unique to each of the two emphases. Although the current analysis excluded cessation based studies, the TPB has been applied to such investigation with promise (Babrow, Black, & Tiffany, 1990). The sample from the included studies totaled 267,977 participants. Meta-analytic fixed effects procedures estimated weighted mean correlations between TPB model components. Homogeneity of effect size was also tested using the Q-statistic. There was significant heterogeneity of effect size, therefore, moderation was assessed on the basis of several moderators including age, proportion of males, time period between measures (intention-behavior), and year of publication.

Resulting from the moderation analyses, larger effect size was observed when all measures

were taken simultaneously (i.e. cross-sectionally) than when a time interval was included between measures. Likewise, shorter time intervals produced stronger effect sizes than longer intervals. Samples from European countries exhibited the highest subjective norm-intention correlations, when compared to U.S. or other countries. More recent studies and younger samples produced stronger effect sizes for the attitude-intention relationship. More recent studies and older samples produced higher effects size for the intention-behavior relationship. The effect size for PBC-intention and PBC-behavior was stronger for older samples. It should be noted that all included studies in this meta-analysis examined relatively young samples (10-21 years), as the interest was not smoking cessation.

Collectively, the studies included in Topa and Moriano's meta-analysis provide evidence supporting the efficacy of the TPB in predicting intention to smoke and actual smoking behavior. A structural equation model of good fit produced regression coefficients reflecting the TPB's efficacy in predicting smoking behavior ($R^2 = 0.13$) and intention to smoke ($R^2 = 0.12$). Intention to smoke ($\beta = 0.30$) was a greater predictor of smoking behavior than that of PBC ($\beta = -0.14$). Subjective norm was the greatest predictor of intention to smoke followed by PBC and attitude at ($\beta = 0.20$), ($\beta = -0.17$), and ($\beta = 0.10$), respectively (Topa & Moriano, 2010). Of note, subjective norm was the greatest predictor of intention. This is contrary to many TPB studies (Armitage & Conner, 2001), however the findings are consistent with a similar meta-analysis conducted on alcohol use and abuse (Cooke et al., 2016). These findings may further identify social influences as central in the prediction and explanation of substance use behavior.

According to the United Nations Office on Drugs and Crime, drugs are not classed as either licit or illicit; it is the use of the drugs which becomes licit or illicit. Illicit drug use occurs when drugs under international control are consumed "illicitly", meaning for a non-medical, illegal, reason (UNODC, 2017). The TPB has not been widely utilized in the literature in association with illicit drug use. There are, however, few studies focused on the predictability of the TPB on the use of a variety of substances such as marijuana (Carvajal, Photiades, Evans, & Nash, 1997; Hohman, Crano, Siegel, & Alvaro, 2014; Lac, Alvaro, Crano, & Siegel, 2009), prescription stimulant drugs (Judson & Langdon, 2009) and even non-specific "drug use" (Bashirian, Hidarnia, Allahverdipour, & Hajizadeh, 2012) to name a few. Discussion of some of the available applications of the TPB to illicit drug use will be discussed in the following.

Marijuana

The TPB has been applied with success to the prediction of marijuana intention to use and use among a variety of subpopulations. As with many of the TPB studies dealing with substance use, studies considering at marijuana also utilize primarily younger populations consisting of college students and adolescents. In 1999 McMillan and Conner examined the usefulness of the TPB in predicting cannabis use among college students. Attitude, subjective norm, and PBC accounted for 65% of the variance in behavioral intention (R^2 = .653). Multiple models including measures of descriptive norm, moral norm, self-identity, habit, and a host of interaction terms provided additional explained variance beyond the TPB constructs. Notably, McMillan and Conner found there to be an interaction effect between PBC and attitude where

those who had higher perceptions of control were less likely to use marijuana if they held a negative attitude toward the substance. Of interest, descriptive norms were shown to contribute more unique variance than that of injunctive norms (the original basis for the subjective norm construct). Intentions were found to be the only significant direct predictor of actual cannabis use. (Conner & McMillan, 1999).

Likewise, in a sample of college students, McMillan and Conner (2003) found the TPB to provide strong predictability of intention to use a variety of substances including cannabis (marijuana) among nearly 500 college students. Attitude, subjective norm, and PBC accounted for 62.2% of the variance in intention to use marijuana in the next six months. PBC provided the greatest influence on intention followed by attitude and subjective norm, $\beta = .421$, $\beta = .266$, and $\beta = .216$, respectively. Additional variance was accounted for by the addition of descriptive norms and the inclusion of a multiplicative term PBCxAttitude, which was similar to the findings of Conner and McMillan (1999). For the prediction of use of the substance, approximately 70% of variance in use was accounted for by intention to use ($\beta = .847$) and PBC ($\beta = -.011$). An interaction term of the two accounted for a significant increase in explained variance ($R^2\Delta = .012$) (Mcmillan & Conner, 2003).

Consistent with these findings, Ito et al. (2015) showed efficacy for the TPB framework's use in a longitudinal study conducted among a college student sample. This study however utilized a measure of refusal self-efficacy acting as the PBC construct. The TPB predicted use intentions for male and female college students, explaining more than 70% of the variance in intention. Strong correlations were observed for males and females between use intentions and

year 1 and year 2 marijuana use ($r > .66$). Path models were constructed where year 2 marijuana use was predicted from year 1 use, use intentions, and proximity intentions accounting for 86% and 79% of the variance in year two use for males and females, respectably (Ito et al., 2015). As implemented by some (Jennifer A Kam et al., 2009; Mcmillan & Conner, 2003; Rivis & Sheeran, 2003), the current study incorporated measures of descriptive norm in addition to injunctive norm. Interestingly, no significant relationship was observed between descriptive norm and intention, though descriptive norms were high among all participants (Ito et al., 2015). The lack of influence by this type of normative perception may have been due to the study being conducted in a state where marijuana use had recently been approved for medical and recreational purposes.

A Dutch longitudinal study (N = 1023) identifying precursors to marijuana use in adolescents found the TPB constructs to be efficacious in their ability to predict behavior, with attitude showing the strongest relationship ($\beta = .16$), followed by self-efficacy ($\beta = -.15$), and ultimately normative influence ($\beta = .11$). Students utilized for analysis in the study by Malmberg et al. (2012) reported no lifetime use of marijuana at baseline assessment. Additionally, the constructs attitude, subjective norm, and self-efficacy were related to the intention to start using marijuana.

In adolescent samples, Kam et al. (2009) and Carvajal et al. (1997) demonstrated use of the TPB in predicting alcohol, tobacco, and drug use. Common between these studies was the Latino subpopulation and the compiling together of substance use into a single outcome variable; Kim et al. alcohol tobacco and drugs (ATOD) and Carvajal et al. studied “substance use”. Both

studies utilized the TPB as the guiding framework, while each incorporated additional psychosocial factors, such as, acculturation (Carvajal et al., 1997; Jennifer A Kam et al., 2009) and descriptive norms (Jennifer A Kam et al., 2009). These studies provided support for the TPB with this population and behavioral combination (ATOD). Additionally, acculturation was found to moderate the influence of subjective norm among this population of adolescents (Carvajal et al., 1997).

The literature provides additional moderators among adolescents when utilizing the TPB to predict marijuana usage, these being parenting factors and ambivalent attitudes. In a large secondary sample (N = 2,141) high parental knowledge predicted lower pro-marijuana attitudes, subjective normative influence, and PBC. Likewise, high parental warmth predicted lower pro-marijuana attitudes and subjective norms (Lac et al., 2009). Of great interest, attitudinal ambivalence moderated the effect of normative influence on marijuana use intentions and use among a national sample of adolescents (Hohman et al., 2014). This is similar to previous findings were measures of moral norms moderated the influence of attitude on intention (Conner & McMillan, 1999).

Ecstasy

Few studies have applied a theoretical framework to the explanation of ecstasy use. In a meta-analytic review Peters et al synthesized results from six studies using the TPB to explain factors related to ecstasy use and intention to use (Peters, Kok, & Abraham, 2008). Findings of this review showed aptitude for use of the TPB with ecstasy use. The sample weighted average

R^2 = .51 was observed when actual use was regressed on TPB constructs. When intention to use ecstasy was regressed on the constructs the average R^2 = .67. Included studies showed attitude to correlate strongest with intention ($r+$ = .63) and behavior ($r+$ = .53). To a lesser degree, normative influence and PBC were also associated with intention and behavioral action. Regarding normative influence, descriptive norm had a higher correlation with behavior and intention to behavior ($r+$ = .52 and $r+$ = .63, respectively) than did injunctive norm (r+=.39 and .52, respectively) (Peters et al., 2008). Included in the review by Peters et al. was Umeh and Patel (2004). Here the authors provide evidence for a significant interaction between attitude and PBC (Umeh & Patel, 2004). This finding is in line with the findings of a past study using the TPB in application with marijuana usage (Conner & McMillan, 1999), and is suggested as an explanation for the less than expected predictability of PBC in relation to intention when considering negatively evaluated behaviors (Umeh & Patel, 2004).

Prescription Drugs

The TPB has yet to be widely applied to prescription drug misuse. A handful of studies have applied this framework to explain misuse of stimulant medication among college students as these types of prescription drugs are thought to increase academic performance (Helmer et al., 2016; Judson & Langdon, 2009; Ponnet, Wouters, Walrave, Heirman, & Van Hal, 2015). Findings from these studies suggest that sources of influence on intention to use and actual use of stimulant medication (e.g. Ritalin) are consistent with the propositions of the TPB. Of the three variables theoretically suggested to influence intention, Ponnet et al. (2015) found subjective norm to provide the strongest association (β = .45) followed by attitude (β = .18) and PBC (β = .15). Further

declaring the influence of the social environment on intention and behavior, Helmer et al. (2016) documented the influence of both injunctive and descriptive norms on non-medical stimulant use. Nearly 60% of students (N = 4482) believed that the majority of their peers used non-prescribed stimulant drugs more than themselves. This descriptive norm was associated with higher odds of personal use (OR: 3.30, CI: 2.32 - 4.71). Also, normative perceptions of peer approval were associated with personal use (OR: 4.03, CI: 3.35 - 4.84) (Helmer et al., 2016). On the contrary, findings by Gallucci et al. (2015) provide little support for the TPB in predicting stimulant medication misuse. Non-significant relationships were observed for prior 30 day misuse of stimulant medication and measures of attitude and subjective norm, however, PBC was significantly associated with stimulant use (Gallucci, Martin, Beaujean, & Usdan, 2015). Importantly, Gallucci et al. (2015) identified an association between stimulant medication abuse and Greek affiliation. Students belonging to a fraternity or sorority were more than twice as likely to abuse these medicines (OR: 2.17, CI: 1.44 - 3.27).

The Consideration of Descriptive Norms

The TPB assesses social influence on intention in the form of its construct subjective norm. In its original proposition, this normative construct considered only the perceived opinions of referent persons within the social network of an individual (i.e. injunctive norm) (Ajzen, 1991; Ajzen & Fishbein, 1980b). It has been expressed that this view of social influence on behavior may be, in fact, limited in scope (Rivis & Sheeran, 2003) and suggest the utility of perceptions regarding the behavior of referents (i.e. descriptive norm). The authors of the TPB have since given support to this stance (Ajzen & Fishbein, 2005) who now encourage the measure of both injunctive

and descriptive norms when implementing the TPB, as these two normative perceptions are conceptually different and provide independent influence on intention and behavior (Manning, 2009; Rivis & Sheeran, 2003).

In their meta-analysis on the inclusion of descriptive norm with use of the TPB, Rivis and Sheeran indicate greater explanatory power in intentions to perform behaviors, with descriptive norm adding, on average, 5% to explained variance when the three principle TPB constructs had been controlled for (Rivis & Sheeran, 2003). Interestingly, and possibly expected, the influence of descriptive norm as a predictor becomes more pronounced with younger populations and studies where the behavior of interest is risky to one's health. Thus, perceptions of other's actual behavior may be of more consequence then perceptions of their approval of the behavior. Echoing the same findings, Manning (2009), in a more recent meta-analysis on the effect of subjective norm on behavior, again found greater influence in measures of descriptive norm when society held a general disapproval of the behavior in question. Remarkably, among the 196 studies included in his meta-analysis, Manning found evidence for a stronger relationship between descriptive norm than injunctive norm, the influence of which the subjective norm construct is based (Manning, 2009).

To date there has been little application of the TPB to substance use or misuse outside of alcohol (Cooke et al., 2016), tobacco (Topa & Moriano, 2010), and marijuana (Conner & McMillan, 1999). Existing studies do, however, suggests that the TPB may be well suited to explain and predict psychosocial factors associated with substance misuse as strong explanatory power has been displayed when dealing with such topics. Social influence particularly

descriptive norm (Manning, 2009), appears to be a primary contributor of substance use behavior among young people (Armitage & Conner, 2001; Conner & McMillan, 1999; Ponnet et al., 2015), particularly when neutral or ambivalent attitudes are present (Hohman et al., 2014). Likewise, the utility of interaction terms explaining additional variance in regression models has been presented among illicit drug use (Umeh & Patel, 2004). Measurement of the salient beliefs that underlay substance misuse have not been well investigated thus far as few studies have conducted the elicitation process, a necessary step in informing intervention efforts (Ajzen & Fishbein, 1980b; L. E. Davis et al., 2002). On that premise, outcome variables representing multiple substances (e.g. alcohol, tobacco, marijuana) are present in the literature (Carvajal et al., 1997; J. A. Kam, M. Matsunaga, M. L. Hecht, & K. Ndiaye, 2009), however, results from such studies may be problematic as the unmeasured beliefs which form the measured constructs of attitude, subjective norm and PBC may not be synonymous between substances.

CHAPTER III

METHODOLOGY

Participants

Participants of the current study were students at a large southern university located in a predominantly rural area of the United States. Total enrolment at the study university was just over 21,260 students, with 2,040 classed as graduate students. As of the 2016-2017 academic year, there were 11,756 female and 9,504 male students enrolled. The majority of enrolled students at the University where the sample was collected identify as white (n=16,353).

Procedures

All procedures of this study were reviewed and approved by the University's Institutional Review Board. Data for the current study was collected through a Qualtrics-based survey design. Participants were recruited with help from the University's Institutional Research, Effectiveness, and Planning Office, where access to students was accomplished by acquisition of 5,000 random student email addresses. The emails received by the students informed them of the purpose of the study and included an invitation to participate. In this email students were provided with informed consent and instructed that by clicking the survey link they were agreeing to participate

in the study. Additionally, the email stated that by submitting a completed survey they were eligible to enter into a drawing for 1 of 12 Amazon gift cards valued at $25. Once the student clicked the survey link and completed the survey their response was recorded and used for analysis. The researchers had no knowledge of who participated in the survey as the research team was blinded to the 5,000 student email addresses used for solicitation. Survey administration was conducted in late September 2017 and lasted approximately two weeks. Upon completion of the survey students choosing to enter the drawing for the one of the gift cards clicked a link to an additional survey where they simply entered their email address and closed the browser. This process provided one additional step toward preserving complete anonymity regarding responses to the study survey.

Questionnaire

The focus of this study is a specific form of prescription opioid pain reliever misuse, that being recreational use. Prior to answering specific questions the instrument introduced the concept of "recreational use" (i.e. to get high, for euphoric effects, to have fun, relax, or experiment) indicating this as the specific misuse of interest. Subsequent questioning reiterated this purpose of use (i.e. recreational). The questionnaire contained items designed to evaluate the direct measures of TPB constructs, indirect measures of the beliefs underlying the theory constructs, and demographic factors. Additional items assessed factors such as past usage of opioid medications and other substances, demographic factors and other known correlates of opioid misuse. The four constructs attitude, subjective norm, PBC, and intention were assessed through multiple items in a manner consistent with (Ajzen, 2006) and modeled after existing

instruments pertaining to substance misuse (Armitage et al., 1999; Judson & Langdon, 2009; Ponnet et al., 2015). Specific descriptions of questioning is outlined below.

Theory of Planned Behavior

Elicitation of Salient Beliefs

A small pilot study was conducted using a free-response formatted instrument (Ajzen, 2006). This instrument was designed to identify the salient behavioral, normative, and control beliefs of the target population of students. Participants comprising the sub-sample used for the pilot were University students enrolled in a general education course. Students in this course ranged from freshmen to seniors and included a wide range of educational foci (i.e. majors) and ethnic backgrounds. The researcher informed the students of their rights as participants, explained the instrument, and offered an invitation to participate. Then both the researcher and course instructor exited the classroom, thus preserving the anonymity of those choosing to participate. Students were instructed to place either a complete or incomplete instrument into an envelope left in the room, and that by returning a completed questionnaire they were agreeing to participate. Once all students were finished the researcher returned and collected the envelope. In all, 17 students from the course chose to participate by completing the short questionnaire. Free-response items questioned the perceived advantages and disadvantages of recreational prescription opioid use, individuals or groups within the social environment who influenced the use of these substances, and finally, factors believed to facilitate or hinder recreational use of prescription opioids. Content analysis revealed 10 behavioral, 6 normative, and 8 control beliefs specific to recreational opioid use and these items were included in the TPB questionnaire

delivered to the total sample.

Behavioral Beliefs. 10 behavioral outcomes were identified from the pilot study. Thus, two questionnaire items were created for each outcome believed to be associated with recreational use of prescription opioids. The first question assessed the likelihood of the specific outcome occurring (i.e. outcome expectation), the second question measured the evaluation of that outcome. Both the likelihood of outcome and the evaluation of that outcome were scored on 7-point bipolar scales ranging from -3 to +3 with the outcome scored as "Unlikely-Likely" and evaluation scored as "Bad-Good". For example, "Recreational use of prescription opioid pain medication will help me relax." and "For me, being able to relax would be….". In accordance with the expectancy-value framework, product terms were produced by multiplying outcomes by evaluations.

Normative Beliefs refer to the normative referents associated with prescription opioid misuse. The pilot revealed 6 unique normative referents relating to recreational use of prescription opioids. These referents became individual normative belief items used in the study questionnaire. Two items formed the basis for each normative belief, one assessed the perceived will of that referent and the other evaluated the participant's motivation to comply with the will of that referent. A seven-point unipolar scale 1-7 was used to score both the referents will (should not/should) and motivation to comply (Disagree/Agree) with that pressure. Normative pressure and motivation scores were used in the creation of product terms which represent the normative beliefs. One such normative belief, "My parents think that I (should not/should) use prescription opioid pain relievers for recreational purposes." and "I am motivated to do what my

parents think I should do."

Control Beliefs are the perceived factors or circumstances that will enable the misuse of prescription opioid medications or make their misuse more difficult. Similar to behavioral and normative beliefs, control beliefs are assess by two items. One item evaluates the likelihood of the control factor occurring and the second item assesses the perceived power of the factor. For example, "I will know where to find prescription opioids in the next six months." scored as (unlikely/likely) and "Knowing where to find prescription opioid pain relievers will make me (less likely/more likely) to use them for recreational purposes." Each control belief was the product score of the belief strength item (unlikely/likely) and the perceived power of that factor (less likely/more likely), both scored on a 7-point unipolar Likert type scale.

Direct Measures

Intention to misuse prescription opioids in the next six months was measured with a series of questions scored on a 7-point bi-polar (-3 to +3) semantic differential scale modeled after (Armitage et al., 1999). Intention was measured using three questions "I intend to, plan to, and want to use prescription opioid pain relieving medications (i.e., opioids like Vicodin, OxyContin, Tylenol 3, Percocet, Darvocet, buprenorphine, morphine, hydrocodone, oxycodone, methadone, fentanyl, or other such opioids) for recreational purposes in the next six months." This intention scale produced an alpha of .82 when applied to alcohol and .93 when applied to marijuana, providing adequate reliability.

Attitude was assessed by a series of four, 7-point bipolar (-3 to +3), semantic differential scales seen below and elicited by the following *"*My using prescription opioid medications (i.e., opioids like Vicodin, OxyContin, Tylenol 3, Percocet, Darvocet, buprenorphine, morphine, hydrocodone, oxycodone, methadone, fentanyl, or other such opioids) for recreational purposes in the next six months would be" bad/good, unfavorable/favorable, negative/positive, and unsatisfactory/satisfactory (Armitage et al., 1999). Internal consistency of this scale is reported at (α = .78 - .88).

Subjective Norm was assessed using a series of 3 questions and these questions referred only to injunctive norms. These items were scored on a 7-point semantic differential scale (1 - 7). For example, "People who are important to me think I (should not/should use) prescription opioid medications (i.e., opioids like Vicodin, OxyContin, Tylenol 3, Percocet, Darvocet, buprenorphine, morphine, hydrocodone, oxycodone, methadone, fentanyl, or other such opioids) for recreational purposes," "People who are important to me would (disapprove/approve) of my using prescription opioid medications (i.e., opioids like Vicodin, OxyContin, Tylenol 3, Percocet, Darvocet, buprenorphine, morphine, hydrocodone, oxycodone, methadone, fentanyl, or other such opioids) for recreational purposes, and "People who are important to me want me to use prescription opioids for recreational purposes (unlikely/likely)". These items were also adapted from Armitage et al (1999), with internal consistency (α = .83 - .89).

Perceived Behavioral Control was allocated through a series of 3 questions that identify perceptions of personal control over the recreational use of prescription opioid drugs. These items were also scored on a 7-point Likert scale (1 - 7). The three questions are noted as follows

"Whether or not I use prescription opioid medication (i.e., opioids like Vicodin, OxyContin, Tylenol 3, Percocet, Darvocet, buprenorphine, morphine, hydrocodone, oxycodone, methadone, fentanyl, or other such opioids) for recreational purposes is entirely up to me (strongly disagree/strongly agree)", "How much personal control do you feel you have over using prescription opioid pain medication (i.e., opioids like Vicodin, OxyContin, Tylenol 3, Percocet, Darvocet, buprenorphine, morphine, hydrocodone, oxycodone, methadone, fentanyl, or other such opioids) for recreational purposes? (very little/complete control)", and "How much do you feel that using prescription opioid medication (i.e., opioids like Vicodin, OxyContin, Tylenol 3, Percocet, Darvocet, buprenorphine, morphine, hydrocodone, oxycodone, methadone, fentanyl, or other such opioids) is beyond your control? (very much so/not at all)". These questions were adapted from Armitage et al (1999). Internal consistency for use with alcohol ($\alpha = .88$) and marijuana ($\alpha = .81$).

Descriptive Norm

Given the recent literature suggesting that descriptive normative influences may be of importance in directing intention and behavior of college students (Helmer et al., 2016) and behaviors that are less socially acceptable (Mcmillan & Conner, 2003; Rivis & Sheeran, 2003), measures of descriptive norm included in the study questionnaire. Questions assessed the amount of friends, other students at my university, and family members use these drugs. All questions were scored on a 6-point (1 - 6) scale ranging from none to all. For example, "Please indicate how many (if any) of your friends use prescription pain relieving medication (i.e., opioids like Vicodin, OxyContin, Tylenol 3, Percocet, Darvocet, buprenorphine, morphine, hydrocodone,

oxycodone, methadone, fentanyl, or other such opioids) for recreational purposes (Mcmillan & Conner, 2003). The 3 questions were summed to produce a single score representing perceptions of descriptive norms. Internal consistency for these measures are as follows; $\alpha = .63, .66, .73,$ and .64, for LSD, amphetamine, cannabis, and ecstasy, respectively.

History of Prescription Opioid Usage

Previous opioid medication usage was assessed by two questions identifying a temporal trend of use for each participant. The first question asked the participant "How frequently have you used prescription opioid medications (i.e., opioids like Vicodin, OxyContin, Tylenol 3, Percocet, Darvocet, buprenorphine, morphine, hydrocodone, oxycodone, methadone, fentanyl, or other such opioids) for recreational purposes in the past six months?" this answered on a 8-point Likert-type scale (0-7) with options of never, only once, more than once, every few months, every month, every week, more than weekly, or most days. The second question read "Have you ever used prescription opioid medication (i.e., opioids like Vicodin, OxyContin, Tylenol 3, Percocet, Darvocet, buprenorphine, morphine, hydrocodone, oxycodone, methadone, fentanyl, or other such opioids) for recreational purposes at least once in your lifetime?" scored on a dichotomous yes/no.

Analysis

Following the elicitation process a content analysis was used to identify common responses to the prompted questions regarding the salient beliefs and referents that influence

recreational use of prescription opioid pain relievers. These commonalities were subsequently used to construct the indirect measure scales. Descriptive statistics were calculated to reflect the characteristics of the study population. Cronbach's Alpha were reported as a measure of internal consistency for all construct scales used in the study. Any individual's showing signs of opioid dependence as assessed by the Diagnostic and Statistics Manual for Mental Disorders, Firth Edition (DSM-V) diagnostic criteria were excluded from all analyses.

Analysis of Substance Use Behavior. As polysubstance abuse is common among college students we were interested in the associations between recreational use of prescription opioids and recreational use of other drugs. To examine these associations we conducted 2 x 2 chi square tests for past six month recreational use of prescription opioids and recreational use of each of the following; alcohol, marijuana, cocaine, methamphetamine, ecstasy, and recreational use of non-opioid prescription drugs. With the chi square tests we produced odds ratios and 95% confidence intervals were presented for each association.

Analysis of Indirect Measures. As some have questioned the multiplicative underpinnings of the TPB (Armitage et al., 1999; Hardeman, Prevost, Parker, & Sutton, 2013), two methods were employed to test the multiplicative assumptions of the TPB. First, a hierarchical regression of direct measures onto the indirect measures was conducted. In this model the components of each indirect measure were broken down and incorporated in a step by step process to examine the additive effects of evaluations and product terms. For example, the regression of attitude onto behavioral beliefs. Step 1 included the outcome belief measures, step 2 the evaluation measures, and finally step 3 the multiplicative term. This process was repeated for the subjective norm and

PBC constructs. Second, a multiplicative model was compared to an additive model of belief measures in a manner consistent with past studies. Here composite measures of belief components were entered into hierarchical models. For example regarding behavioral beliefs, summed composites for outcome expectations and evaluations were entered into step one of the model and in step 2 summed product scores were entered into the model. Regarding both methods, significant additions to explained variance are evidence in support for the formation of beliefs.

Analysis of Direct Measures. Bivariate correlations were calculated and a correlation matrix produced to show the relationship between the constructs attitude, subjective norm, descriptive norm, PBC, and intention. To predict intention a hierarchical logistic regression model was applied. Of particular interest was the utility of the descriptive norm construct and the potential added explanatory power of interaction terms attitude-subjective norm and attitude-PBC. It was hypothesized that the influence of the normative and PBC constructs would change as a result of the attitude strength. Step 1 of the model contained the theoretical influences on intention, those being attitude, subjective norm, and PBC with the added construct of descriptive norm. Step 2 of the model contained interaction terms attitude-subjective norm and attitude-PBC. This analysis was the basis for powering our study. An *a priori* power analysis was conducted using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) and computed on the basis of a fixed model, R^2 increase. With an Alpha level of 0.05, power of 0.80, 3 nested predictors (i.e. step 2 of the regression), and 7 total predictors of intention the required sample size was 157 participants.

Hypotheses:

Hypothesis 1: The TPB constructs will significantly predict intention to use prescription opioid medications for recreational purposes.

Ho: $OR = e^{\beta_{1-4}} = 1$, where β_1 = attitude, β_2 = subjective norm, β_3 = descriptive norm, and β_4 = PBC.

H_1: $OR = e^{\beta_{1-4}} \neq 1$, where β_1 = attitude, β_2 = subjective norm, β_3 = descriptive norm, and β_4 = PBC.

Hypothesis 2: The descriptive norm construct will explain more unique variance in intention to use prescription opioid medication for recreational purposes than the subjective norm (representing injunctive norm) construct.

Ho: $\beta_1 = \beta_2$, where β_1 = descriptive norm and β_2 = subjective norm

H_1: $\beta_1 > \beta_2$, where β_1 = descriptive norm and β_2 = subjective norm

Hypothesis 3: The addition of interaction terms comprised of the TPB constructs attitude, subjective norm, and PBC will increase the explained variance in intention to use prescription opioid medication for recreational purposes beyond that of TPB constructs.

H_0: $R^2_{Y.A,B} - R^2_{Y.A} = 0$

H_1: $R^2_{Y.A,B} - R^2_{Y.A} > 0$

Hypothesis 4: Indirect measures will correlate with direct measures.

H_0: $r = 0$, where r = correlation between indirect and direct measures.

H_1: $r \neq 0$, where r = correlation between indirect and direct measures.

CHAPTER IV

RESULTS

Participants Characteristics

The response rate for this study was encouraging with just over 20% of students accepting the email invitation to participate. Students were provided an incentive for submitting completed surveys. Once the student arrived at the final question on the survey instrument an option was presented allowing the student to click a link to a separate survey where they could submit their email address, thereby becoming eligible for one of twelve $25 Amazon gift cards. In total, 1024 students clicked the link to the main survey provided in the solicitation email. As expected, many students (i.e. 200) provided little to no data, choosing to withdraw themselves by closing their browser windows. We made the decision to include only those who completed the instrument. Additionally, 48 individuals were excluded because they showed signs of opioid dependence as assessed by the DSM-V diagnostic criteria. Thus, we derived 776 students eligible for inclusion in analytic procedures.

Participants were University students classified as either undergraduate or graduate status, see Table 1. The mean age of participants included in the study was 21.9 years with a standard deviation of 5.5. The sample was predominately female 488 (62.9%) with 288 males

also participating and comprising 37.1% of the sample. The ethnicity of participants was essentially consistent with the demographics of the University's student population. Six hundred and twenty-one (80%) of the participants identified as White/Caucasian. Additionally, 73 (9.4%) identified as Black or African American, 42 (5.4%) as Asian, 20 (2.6%) as Hispanic, 19 (2.4%) as Other, and 1 (.10%) individual identifying Native American or Alaskan decent. Of the 776 students participating in the study, 250 (32.2%) reported that they were affiliated with a Greek institution (i.e. members of either a fraternity or sorority). The sampling procedure employed in

Table 1 Descriptive Statistics (N=776)

			Lifetime Opioid Misuse[a]
	M (SD)	**n (%)**	**n (%)**
Age	21.9 (5.5)		
Gender			
	Female	488 (62.9)	77 (15.8)
	Male	288 (37.1)	84 (29.2)
	Total		161 (20.7)
Race/ethnicity			
	White/Caucasian	621 (80.0)	136 (21.9)
	Black or African American	73 (9.4)	11 (15.0)
	Asian	42 (5.4)	6 (14.3)
	Hispanic	20 (2.6)	7 (35.0)
	Other	19 (2.4)	1 (5.2)
	Native American or Alaskan	1 (.10)	0 (0.0)
Greek Affiliation			
	Fraternity/Sorority	250 (32.2)	46 (18.4)
	Non-Greek	526 (67.8)	115 (21.9)
University Status			
	Freshman	176 (22.7)	24 (13.6)
	Sophomore	120 (15.5)	25 (20.8)
	Junior	190 (24.5)	45 (23.7)
	Senior	144 (18.6)	41 (28.5)
	Graduate Student	146 (18.8)	26 (17.8)
GPA			
	< 2.0	9 (8.1)	3 (33.3)
	2.0 – 2.4	24 (3.1)	10 (41.6)
	2.5 – 2.9	88 (11.3)	36 (40.9)
	3.0 – 3.4	246 (31.7)	53 (21.5)
	3.5 – 4.0	409 (52.7)	59 (14.4)

[a]Lifetime opioid use represents a yes response to the having used prescription opioids for recreational purposes at least once in their lifetime.

the current study resulted in a fairly even distribution of students across grade levels with 176 (22.7%) identifying as freshmen, 120 (15.5%) sophomore, 190 (24.5%) junior, 144 (18.6%) seniors, and 146 (18.8%) graduate students. Interestingly, the majority of students reported possessing above a 3.5 grade point average (52.7% ≥ 3.5 GPA). Further, only 22.5% of participants reported a GPA less than 3.0.

Lifetime Opioid Misuse

Lifetime recreational use of prescription opioid medication was higher than expected among this sample of students at 20.7%, as other studies among this population have typically produced rates of use around 10% (Kenne et al., 2017). Males reported higher levels of recreational use than females at a rate of 29.2% for males and 15.8% for females. As seen in Table 1, the highest relative percentage of recreational use by ethnic breakdown was Hispanics with 35% reporting lifetime use; however, due to the drastic difference in number of individuals comprising the various ethnic categories direct comparison should be made with caution. Interestingly, there was a slightly higher percentage of lifetime recreational use among non-Greek affiliated students when compared to those belonging to a fraternity or sorority at 21.9% versus 18.4%, respectively. Senior students exhibited the highest rates of lifetime recreational use at 28% with freshman holding the lowest percentage at 13.6%. Additionally, students reporting a GPA of 2.0 to 2.4 and 2.5 to 2.9 showed the highest relative percentage of recreational prescription opioid use at just over 40% each.

As polysubstance use is common among college aged students, we also examined the

relationship between recreational use of prescription opioids and recreational use of other commonly misused drugs (Table 2). Participants answered frequency of use questionnaire items pertaining to recreational use of these substances over the past six months. With the exception of questions pertaining to alcohol and marijuana use, there was little variation in response to the 7-poiont frequency scale items. Because of this we collapsed the responses for these items to represent a dichotomy equating to never or yes to recreational use in the past six months for each of the drugs examined. Significant relationships emerged for recreational use of prescription opioids and past six month recreational use of alcohol, cocaine, marijuana, ecstasy, methamphetamine, and "non-opioid" prescription drugs. As one would expect, the majority of students reported recreational use of alcohol in the past six months, which was associated with increased odds of prescription opioid use (*OR*=2.34, *95% CI*: 1.22 – 4.50, *p*=.009). In total, 85

Table 2 Relationship between Recreational Opioid Use and Recreational Use of Other Drugs (N=776)

Variables	*Prescription Opioid Use*		*Odds Ratio*	*95% CI*	*p*
	No	*Yes*			
Alcohol			2.34	1.22 – 4.50	.009
No	165	11			
Yes	519	81			
Cocaine			7.28	4.37 – 12.12	<.001
No	633	58			
Yes	51	34			
Marijuana			5.65	3.49 – 9.15	<.001
No	472	26			
Yes	212	66			
Ecstasy			10.21	5.08 – 20.51	<.001
No	667	73			
Yes	17	19			
Methamphetamine*			18.69	4.75 – 73.65	<.001*
No	681	85			
Yes	3	7			
Prescription Drugs			10.59	6.50 – 17.26	<.001
No	625	46			
Yes	59	46			

Significance based on X^2 tests. *Because a cell contained a value < 5 significance is based on Fisher's Exact Test. Independent Variables Reflect use of the substance within the past six months with a response of "no" coded as the reference.

students reported cocaine use in the past six months, increasing the odds of prescription opioid use over that same time period 7-fold (*OR*=7.28, *95% CI*: 4.37 – 12.12, *p*<.001). Recreational marijuana use was also a commonly reported behavior among our sample with nearly 36% (n=278) reporting use in the past six months. Using marijuana was significantly associated with prescription opioid misuse (*OR*=5.65, *95% CI*: 3.49 – 9.15, *p*<.001). College student's misuse of non-opioid prescription medication (e.g. stimulant medications) has been well established in the literature. Likewise, our study documents a high level of engagement in this behavior and additionally identified a significant relationship between prescription opioid and non-opioid prescription recreational drug use among our sample (*OR*=10.59, *95% CI*: 6.50 – 17.26, *p*<.001). Similar significant relationships emerged regarding past six month prescription opioid use and use of both ecstasy and methamphetamine, see Table 2. Heroin use was also assessed among our sample; encouragingly, not one student reported use of heroin over the past six months, as such, no data is presented herein for heroin use.

Theory of Planned Behavior

Descriptive and Reliability Data for Theory Variables

Means, standard deviations and internal consistency measures for TPB constructs can be seen in Table 3. Results for the attitude construct revealed that participants held strong negative attitudes

Table 3 Reliability and Descriptive Statistics for Direct Measures

Variable	*M*	*SD*	*(α)*
Intention			.96
I intend to use prescription opioid pain relieving medications for recreational purposes	-2.75	.89	
I plan to use prescription opioid pain relieving medications for recreational purposes	-2.76	.89	
I want to use prescription opioid pain relieving medications for recreational purposes			
Attitude	-2.76	.87	
			.96
My using prescription opioid medication for recreation purposes in the next six months would be			
Bad – Good	-2.53	1.34	
Unfavorable – Favorable	-2.55	1.31	
Negative – Positive	-2.58	1.27	
Unsatisfactory – Satisfactory	-2.46	1.44	
Subjective Norm			.64
People who are important to me think I (should not/should) use prescription opioid medications for recreational purposes.	1.21	.70	
People who are important to me would (disapprove/approve) of my using prescription opioid medications for recreational purposes.	1.39	1.21	
People who are important to me want me to use prescription opioids for recreational purposes (unlikely/likely).	1.17	.59	
Descriptive Norm			.55
Please indicate how many (if any) of your friends use prescription pain relieving medication for recreational purposes.	1.59	.91	
Please indicate how many (if any) of the students at your University use prescription pain relieving medication for recreational purposes.	2.45	1.22	
Please indicate how many (if any) of your family members use prescription pain relieving medication for recreational purposes.	1.26	.67	
Perceived Behavioral Control			.61
Whether or not I use prescription opioid medication for recreational purposes is entirely up to me.	5.25	2.31	
How much personal control do you feel you have over using prescription opioid pain medication for recreational purposes?	6.15	1.81	
How much do you feel that using prescription opioid medication is beyond your control?	6.01	1.96	

toward recreational use of prescription opioids. Likewise, individuals perceived little social endorsement for recreational use of prescription opioids. Perceptions of societal recreational use (descriptive norm) were generally low regarding prescription opioids. Interestingly, the mean value for the descriptive norm item addressing perceptions of peer use was relatively higher than that of the other descriptive norm items. Participants in the current study seemed to view recreational use of prescription opioids as a behavior under their own personal control as responses to the PBC items were generally on the high end of the scale.

The attitude and intention subscales produced excellent internal consistency (α=.96), however, the subscales pertaining to the other constructs were less stable with low internal consistency ranging from .55 – .64. The items used to assess the theory constructs in the current study were adapted from previous applications to substance use behavior among college students where they exhibited high levels of reliability. The low levels of internal consistency observed in the present study may highlight inherent differences in perceptual factors surrounding the use of prescription opioids and those regarding use of other substances like alcohol and marijuana.

Unsurprisingly, with behavior that is typically viewed as socially unacceptable, intentions for recreational use of prescription opioids were very low. Because of skewness in the intention variable (Table 3), intention was treated categorically for the primary analysis (Table 4). Those who responded “completely disagreed” with each statement were coded as no intention and those answering anything other than “completely disagree” were coded as intention.

Predicting Intentions from Direct Measures

As previously mentioned, the intention variable was dichotomized and treated categorically; as such, a logistic regression model was used to examine the relationship between theory variables and intention. The results of this analysis can be viewed in Table 4. A hierarchical model was used to identify factors influencing student intention to use prescription opioid medication for recreational purposes. Step 1 of this model included the constructs attitude, subjective norm, descriptive norm, and PBC. As it was hypothesized that individual attitude would moderate the influence of the additional constructs, step 2 of the model included product terms representing each construct's interaction with attitude. The model fit was examined using

Table 4 Hierarchical Logistic Regression of Intention onto Theory of Planned Behavior Direct Measures and Interaction Terms

Variables	*Nagelkerke R^2*	*Hosmer & Lemeshow*	*SE*	*Odds Ratio*	*95% CI*	*p*
Step 1	.383*	.420				
Attitude			.02	1.13	1.09 – 1.17	<.001
Subjective Norm			.05	1.33	1.20 – 1.48	<.001
Descriptive Norm			.06	1.37	1.23 – 1.54	<.001
PBC			.03	.96	.91 – 1.02	.160
Step 2	.409*	.266				
Attitude			.02	1.11	1.06 – 1.17	<.001
Subjective Norm			.06	1.31	1.17 – 1.47	<.001
Descriptive Norm			.06	1.33	1.18 – 1.50	<.001
PBC			.03	.96	.91 – 1.01	.135
Attitude X Subjective Norm			.01	1.01	.97 – 1.03	.118
Attitude X Descriptive Norm			.01	1.04	1.01 – 1.06	.006
Attitude X PBC			.01	1.01	.99 – 1.02	.417

PBC refers to Perceived Behavioral Control. *Nagelkerke R^2 significant at the p<.001 level for both step 1 and step 2. Chi Square Tests for Hosmer & Lemeshow test of model fit for step one (X^2=8.14$_{(8)}$, p=.420) and step two (X^2=9.98$_{(8)}$, p=.266) of the logistic model.

Hosmer and Lemeshow's goodness of fit test. For step 1 and 2 this test was nonsignificant indicating acceptable model fit with significance levels of .420 and .266 for step 1 and 2,

respectively. The lower order terms in the model explained 38.3% (R^2_N=.383) of variation in intention, this improved to 40.9% (R^2_N=.409) with inclusion of interaction effects in step 2 of the model.

Attitude, subjective norm, and descriptive norm were all significantly related to intention to use prescription opioids for recreational purposes. The descriptive norm construct accounted for the greatest increase in odds of intention (*OR*=1.37, *95% CI*: 1.23 – 1.54, *p*<.001). Similarly, a one unit increase in subjective norm composite score equated to a 1.33 increase in odds of intending to use opioids (*OR*=1.33, *95% CI*: 1.20 – 1.48, *p*<.001). Confirmatory to our hypothesis, descriptive norm had a greater influence on intention than that of the subjective norm construct, albeit only slightly. Finally, student's attitude was significantly related to intention, increasing the likelihood of intention by 13% per unit increase in attitude score (*OR*=1.13, *95% CI:* 1.09 – 1.17, *p*<.001). This model produced no evidence of a significant relationship between PBC and individual's intention to recreationally use prescription opioids.

Table 5 Correlation Matrix for Direct Measures with Means and Standard Deviations

Variable	*M*	*SD*	Att	SN	DN	PBC
Attitude	-10.11	5.10	1.00	.395*	.225*	-.009
Subjective Norm	3.77	2.02	.395*	1.00	.295*	-.008
Descriptive Norm	5.30	2.11	.225*	.295*	1.00	.156*
Perceived Behavioral Control	17.4	4.59	-.009	-.008	.156*	1.00
Intention	-8.28	2.56	.542*	.436*	.294*	-.035

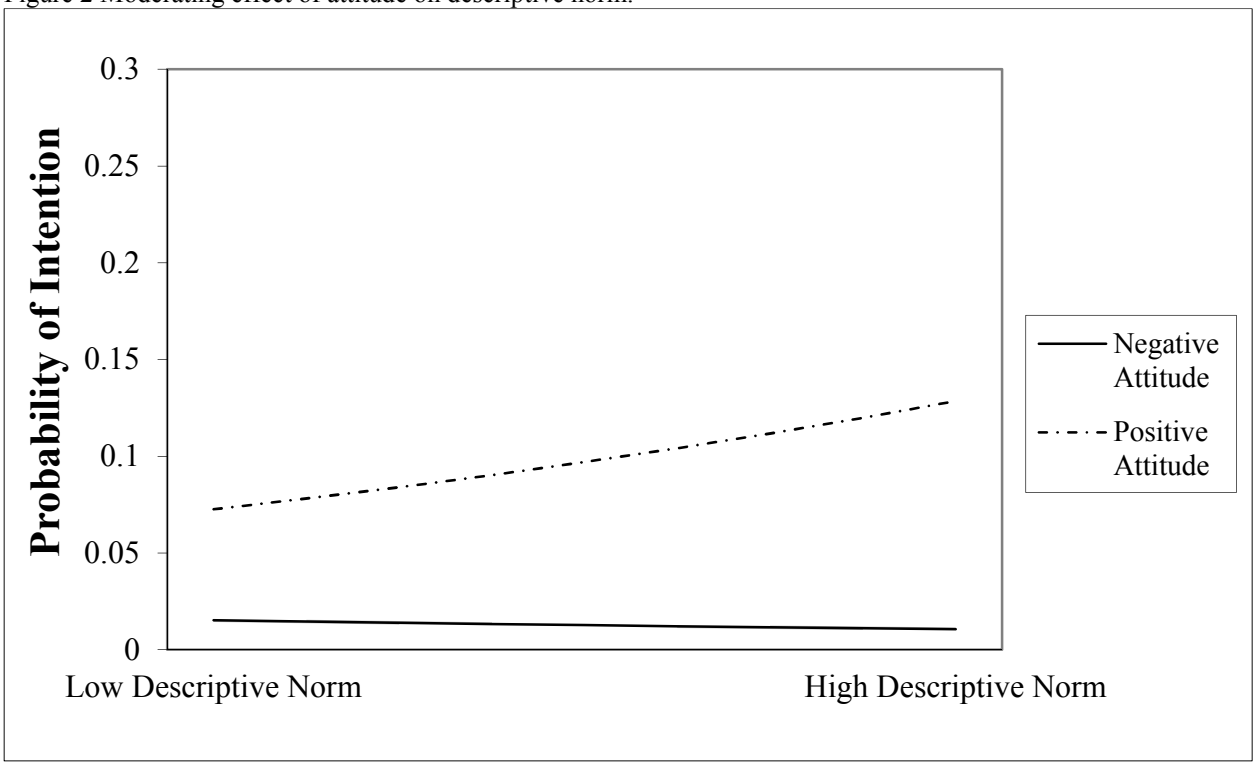
*Correlation is significant at the p<.001 level. Correlations presented are Spearman's rank-ordered non-parametric correlations.

The significant relationships identified through the logistic regression model were further supported by significant rank-order correlations seen in Table 5. Again we find, with the exception of PBC, all constructs were significantly correlated with intention to use prescription

opioids.

In step 2 of the model interaction terms were input as it was hypothesized that attitude would moderate the relationships between the other constructs and the dependent variable intention (Table 4). Little evidence was produced in support of this hypothesis as the added variables equated to modest increase in explanatory power for our model (ΔR^2=.026, p<.001). Significance was observed only for the attitude by descriptive norm interaction (*OR*=1.04, *95% CI*: 1.01 – 1.06, p=.006). Implying that perceptions of normative behavior exert stronger influence on intention among individual's with more positive attitudes toward the behavior.

Figure 2 Moderating effect of attitude on descriptive norm.



Negative attitude = 1 standard deviation below the mean. Likewise, positive attitude = 1 standard deviation above the mean.

Figure 2 presents s a visual representation of the interaction effect of the attitude x descriptive norm constructs. Here we illustrate the effect of descriptive norm on intention at one standard deviation above and below the mean of the attitude variable. Past studies have observed significant interactions between attitude and the PBC constructs, however, no such findings were detected among our data.

Evaluation of Salient Beliefs

The TPB proposes that the constructs attitude, subjective norm, and PBC are the realization of three sets of independent salient belief systems and these beliefs are conceptualized in a manner consistent with the EV framework. In accordance with the logic of the TPB it was important that we attempt to assess these beliefs through an elicitation process. The pilot elicitation study identified salient behavioral, normative, and control beliefs regarding recreational use of prescription opioid medication specific to our study population. Precisely, this process identified 10 behavioral, 6 normative, and 8 control beliefs. Table 6 displays correlations between individual beliefs and intention to use prescription opioids for recreational purposes.

Behavioral Beliefs

The majority of behavioral beliefs showed a significant relationship to student's intention to use opioids for recreational purposes. Students generally reported unfavorable outcome expectations toward the recreational use of prescription opioids (Table 6). Though the pilot study identified many possible outcomes to recreational use of opioid medication, the study

participants felt that the more positive outcomes would be quite unlikely. Specifically, relaxation occurring, feeling good, and surprisingly, getting high were generally scored to some degree unlikely as mean values were all negative on the bipolar scale. In contrast, students felt that recreational use of opioids would cause several unwanted outcomes such as making bad

Table 6 Correlation of Salient Beliefs with Intention to Use Prescription Opioid Medication for Recreational Purposes.

Belief Measure	Outcome Expectation (*b*)		Outcome Evaluation (*e*)		Correlation with Intention
	M	*SD*	*M*	*SD*	b_ie_i
Behavioral Beliefs					
”Allow me to have more fun”	-2.43	1.28	.78	2.45	.089*
”Help me relax”	-1.83	1.87	1.10	2.33	.183**
“Make me feel good”	-1.87	1.85	.93	2.40	.153**
“Allow me to get high”	-.79	2.48	-1.76	1.91	-.064
“Cause me to become addicted”	.02	2.50	-2.86	.70	.053
“Cause me to make bad decisions”	.91	2.35	-2.85	.67	.188**
“Cause me mental illness”	-.15	2.33	-2.84	.62	.127**
“Cause me physical harm”	.51	2.32	-2.88	.56	.189**
“Cause me legal trouble”	1.31	2.18	-2.91	.54	.239**
“Cause me disappointment or regret”	1.47	2.17	-2.83	.64	.276**
Normative Beliefs	Normative Referent (*b*)		Motivation to Comply (*e*)		b_ie_i
“My close friends think”	1.35	.95	3.93	2.16	.219**
“My parents think”	1.13	.66	5.10	2.07	-.005
“Other close relatives think”	1.14	.65	4.21	2.18	-.014
“My doctor think”	1.17	.77	5.39	1.90	-.024
“My professors think”	1.20	.77	4.20	2.08	.016
“My boyfriend/girlfriend or spouse”	1.25	.84	5.03	2.05	.193**
Control Beliefs	Control Factor (*b*)		Perceived Power (*e*)		b_ie_i
“I will have access to”	2.34	2.12	2.42	1.80	.359**
“I will have the opportunity to use”	2.38	2.14	2.29	1.73	.375**
“My friends will use”	2.10	1.75	1.93	1.44	.385**
“I will be stressed”	6.02	1.88	1.97	1.48	.343**
“I will have to interact with family”	6.41	1.59	1.56	1.27	.253**
“I will know where to find”	2.81	2.40	1.95	1.50	.398**
“I will attend parties”	4.98	2.40	1.92	1.43	.279**
“I will have school obligations”	6.66	1.29	1.63	1.31	.285**

Correlations displayed above are Spearman’s rank-ordered correlations. *p<.01,**p<.001. Behavioral beliefs scored on a -3 to +3 scale. Normative beliefs and control beliefs both scored on a 1 to 7 scale.

decisions, causing physical harm, legal trouble, and disappointment or regret. Evaluations of

negative outcomes, as expected, were rated "bad" with means approaching the polar negative of item scales. The significant relation of these behavioral beliefs to intention is encouraging as these may present useful targets for future educational intervention efforts.

Normative Beliefs

Significant relationships to recreational use intention were observed for two of the six normative beliefs identified by the pilot study. The influence of close friends as well as partners were significantly related to intention (ρ=.219, p<.001 and ρ=.193, p<.001 respectively). Largely, there was low agreement to all statements regarding referent approval of recreational use of prescription opioid with moderate to high motivation to comply with the perceived will of the referent (Table 6). This high level of motivation to comply with each referent provides some assurance that the elicitation process indeed produced referent individuals relevant to this particular population.

Control Beliefs

The relationship between control beliefs and intention is somewhat perplexing as significant correlations are exhibited for all control beliefs (Table 6). PBC was found to be an insignificant predictor of intention in the regression model previously discussed. There was, however, a low correlation between the direct measure of PBC and the control beliefs identified in the pilot study (ρ=.11, p<.01). This may highlight the inadequacy of the items used to assess the direct measure of PBC. Mean values for the perceived power items were all on the lower end

of item scales indicating that in general participants felt that the presence of these factors would do little to increase the likelihood of recreational opioid use. It appeared that having access to the substance (*M*=2.42, *SD*=1.80) and opportunity to use the substance (*M*=2.29, *SD*=1.73) had more of a specific impact on likelihood of use when compared to the other factors.

Testing the Multiplicative Assumption of the Expectancy Value Framework: Method I

Our study employed two testing methods in order to probe the multiplicative underpinnings of the EV and subsequent TPB frameworks. First, we regressed the direct measures attitude, subjective norm, and PBC onto the individual beliefs theorized to provide their basis. Second, we utilized a composite-based model where comparison was made between an additive model and a multiplicative model of behavioral belief formulation. Here the direct measure was regressed onto the multiplicative terms (i.e. the theory-based representation of the belief) while controlling for the aggregate scores for expectancies and evaluations. For each method, significant explained variance by the multiplicative terms is considered evidence supporting the multiplicative assumptions.

Behavioral Belief Formation

Using the first method, our study findings provide support for the multiplicative underpinnings regarding the formation of behavioral beliefs, as the TPB contests. Hierarchical modeling was used in a manner consistent with other investigators (Armitage et al., 1999; Rise, Åstrøm, & Sutton, 1998) to establish legitimacy of expectancy-value framework. The

hierarchical regression model of attitude onto the individual components provided significant predictive power at each stage of the model (**Table 7)**. Outcome expectations were entered into stage 1 of

Table 7 Hierarchical Regression of Attitude onto Behavioral Belief Elements

	Recreational Opioid Use					
	M	*SD*	*B*	*SE B*	*ß by stage*	*Final ß*
Stage 1 (outcome expectations)						
”Allow me to have more fun”	-2.43	1.28	1.61	.19	.41****	.30****
”Help me relax”	-1.83	1.87	-.14	.15	-.05	-.03
“Make me feel good”	-1.87	1.85	.36	.16	.13**	.03
“Allow me to get high”	-.79	2.48	-.05	.08	-.03	-.02
“Cause me to become addicted”	.02	2.50	-.08	.10	-.04	-.33*
“Cause me to make bad decisions”	.91	2.35	.02	.11	.01	-.30*
“Cause me mental illness”	-.15	2.33	.14	.11	.06	.09
“Cause me physical harm”	.51	2.32	-.05	.12	-.02	-.30
“Cause me legal trouble”	1.31	2.18	-.04	.13	-.02	-.38
“Cause me disappointment or regret”	1.47	2.17	-.15	.13	-.06	-.32
Stage 2 (outcome evaluations)						
”Allow me to have more fun”	.78	2.45	.24	.12	.11**	.43****
”Help me relax”	1.10	2.33	-.06	.14	-.03	-.11
“Make me feel good”	.93	2.40	-.04	.15	-.02	.02
“Allow me to get high”	-1.76	1.91	.34	.11	.13***	.12***
“Cause me to become addicted”	-2.86	.70	-.13	.27	-.02	-.05
“Cause me to make bad decisions”	-2.85	.67	.19	.30	.02	.08*
“Cause me mental illness”	-2.84	.62	.12	.35	.01	.01
“Cause me physical harm”	-2.88	.56	-.29	.41	-.03	-.05
“Cause me legal trouble”	-2.91	.54	-.27	.38	-.03	.03
“Cause me disappointment or regret”	-2.83	.64	.81	.33	.10**	.10**
Stage 3 (product term)						
”Allow me to have more fun”	-1.50	7.08	.25	.07	.35****	.35****
”Help me relax”	-1.11	6.84	-.08	.07	-.11	-.11
“Make me feel good”	-.80	6.98	.02	.07	.03	.03
“Allow me to get high”	2.49	6.58	.07	.04	.09*	.09*
“Cause me to become addicted”	-.22	7.43	-.22	.12	-.32*	-.32*
“Cause me to make bad decisions”	-2.81	6.93	.24	.13	.32*	.32*
“Cause me mental illness”	.39	6.85	-.13	.15	-.18	-.18
“Cause me physical harm”	-1.53	6.91	.24	.20	.32	.32
“Cause me legal trouble”	-3.91	6.51	.32	.23	.41	.41
“Cause me disappointment or regret”	-4.39	6.41	-.23	.16	-.28	-.28

Stage 1 R^2 = .224 (p<.001); Stage 2 $R^2\Delta$ = .032 (p<.001); Stage 3 $R^2\Delta$ = .030 (p=.001). Outcome expectations and evaluations scored on -3 to +3 bipolar scale. (*p<.10, **p<.05, ***p<.01, ****p<.001)

the model where they accounted for 22.4% of the variation in attitudes (R^2=.224, p<.001). Next

we entered outcome evaluations into stage 2 of the regression model where they accounted for an additional 3.2% of explained variance (ΔR^2=.032, p<.001). Lastly the addition of product terms into the final stage of the model produced an increase in explained variance of 3.0% (ΔR^2=.030, p=.001). This modeling included 10 different behavioral beliefs which were identified through a pilot elicitation process.

Table 8 Hierarchical Regression of Subjective Norm onto Normative Belief Elements

	Recreational Opioid Use					
	M	*SD*	*B*	*SE B*	*ß by stage*	*Final ß*
Stage 1 (normative referent)						
"My close friends think"	1.35	.95	.73	.09	.34****	.28****
"My parents think"	1.13	.66	.54	.19	.18***	.19**
"Other close relatives think"	1.14	.65	-.12	.19	-.04	-.03
"My doctor think"	1.17	.77	-.18	.12	-.07	-.23*
"My professors think"	1.20	.77	-.05	.12	-.02	-.10
"My boyfriend/girlfriend or spouse"	1.25	.84	.34	.10	.14***	.29***
Stage 2 (motivation to comply)						
"My close friends think"	3.93	2.16	.07	.04	.08*	.01**
"My parents think"	5.10	2.07	-.06	.05	-.06	-.04
"Other close relatives think"	4.21	2.18	-.01	.05	-.10	.04
"My doctor think"	5.39	1.90	.04	.05	.04	-.05
"My professors think"	4.20	2.08	-.03	.05	-.03	-.06
"My boyfriend/girlfriend or spouse"	5.03	2.05	-.07	.04	-.07*	.02
Stage 3 (product term)						
"My close friends think"	4.95	3.70	.05	.04	.09	.09
"My parents think"	5.63	3.84	-.02	.06	-.03	-.03
"Other close relatives think"	4.63	3.06	-.05	.07	-.07	-.07
"My doctor think"	6.16	4.65	.08	.05	.18	.18
"My professors think"	4.98	4.20	.04	.05	.09	.09
"My boyfriend/girlfriend or spouse"	6.06	4.23	-.07	.05	-.15	-.15

Stage 1 R^2 = .254 (p<.001); Stage 2 $R^2\Delta$ = .009 (p=.144); Stage 3 $R^2\Delta$ = .006 (p=.386). Referent beliefs and motivation to comply are each scored on a 1 to 7 scale. (*p<.10, **p<.05, ***p<.01, ****p<.001)

Normative Belief Formation

The multiplicative assumptions that underlie the normative beliefs in the TPB were not supported by our data. The normative perceptions of the will of referents relating to recreational use of prescription opioids explained 25.4% of the variance in subjective norm when entered into

stage 1 of our hierarchical model. Motivation to comply with these referents was not significant (ΔR^2=.009, p=.144) in stage 2. Further, there was no significant contribution of multiplicative terms into the model (ΔR^2=.006, p=.386). For this model, only stage 1 showed significance, which restrains the relevance of compliance motivation and the multiplicative terms in predicting subjective norm.

Table 9 Hierarchical Regression of Perceived Behavioral Control onto Control Belief Elements

	Recreational Opioid Use					
	M	*SD*	*B*	*SE B*	*ß by stage*	*Final ß*
Stage 1 (control factor)						
"I will have access to"	2.34	2.12	-.01	.15	-.01	-.10
"I will have the opportunity to use"	2.38	2.14	.02	.17	.01	.11
"My friends will use"	2.10	1.75	.03	.12	.01	.01
"I will be stressed"	6.02	1.88	.37	.11	.15***	.09
"I will have to interact with family"	6.41	1.59	.62	.14	.22****	.30****
"I will know where to find"	2.81	2.40	.14	.10	.07	.14**
"I will attend parties"	4.98	2.40	-.05	.07	-.03	-.01
"I will have school obligations"	6.66	1.29	.28	.17	.08	.07
Stage 2 (perceived power)						
"I will have access to"	2.42	1.80	.30	.15	.12**	.11*
"I will have the opportunity to use"	2.29	1.73	-.28	.17	-.11*	-.10
"My friends will use"	1.93	1.44	.30	.17	.09*	.09
"I will be stressed"	1.97	1.48	-.05	.17	-.02	-.04
"I will have to interact with family"	1.56	1.27	-.26	.15	-.07*	-.08*
"I will know where to find"	1.95	1.50	-.52	.18	-.17***	-.17***
"I will attend parties"	1.92	1.43	.10	.16	.03	.05
"I will have school obligations"	1.63	1.31	.27	.15	.08*	.09*
Stage 3 (product term)						
"I will have access to"	6.51	9.10	-.10	.06	-.20	-.20
"I will have the opportunity to use"	6.47	9.16	.14	.07	.28**	.28**
"My friends will use"	4.89	7.70	.02	.06	.03	.03
"I will be stressed"	12.33	10.61	.08	.09	.18	.18
"I will have to interact with family"	9.98	8.47	-.13	.08	-.24	-.24
"I will know where to find"	6.33	8.71	-.08	.05	-.15	-.15
"I will attend parties"	10.13	9.83	-.04	.06	-.09	-.09
"I will have school obligations"	10.83	8.90	.01	.10	.02	.02

Stage 1 R^2 =.163 (p<.001); Stage 2 $R^2\Delta$ = .022 (p=.008); Stage 3 $R^2\Delta$ = .011 (p=.242). Control factors and perceived power are each scaled 1 to 7. (*p<.10, **p<.05, ***p<.01, ****p<.001)

Control Belief Formation

The construct PBC was found in the current study to be insignificant in its ability to influence intention to use prescription opioids recreationally. However, the effects of both control factors (stage 1) and the perceived power variables (stage 2) were significant predictors of PBC (R^2=.163, p<.001) and (ΔR^2=.022, p=.008), respectively (Table 9). In this case the product terms representing the behavioral beliefs (stage 3) made no significant contribution to the model. Thus, applying this testing methodology we have to conclude that support was not found for the multiplicative foundations of control beliefs.

Testing the Multiplicative Assumption of the Expectancy-Value Framework: Method II

To further probe the multiplicative assumption we additionally incorporated another method used to evaluate the expectancy-value model. This test of the multiplicative assumption inserts aggregated expectancy and evaluation scores into a hierarchical regression model then includes the multiplicative term after expectancies and evaluations have been controlled for, thus comparing an additive model to a multiplicative model. Results of this evaluation are presented for behavioral, normative, and control beliefs and can be seen in Table 10. Support for the multiplicative model was observed for the behavioral beliefs and control beliefs models only.

Using this method, strong support was provided for the multiplicative model with regards to behavioral beliefs. Concerning the regression of attitude onto behavioral beliefs, the addition of a product term increased the explained variance by 14% (ΔR^2=.14, p<.001). Though minimal, the product term increased explained variance in the PBC construct beyond that of the independent effects of control factors and perceived power (ΔR^2=.01, p=.003). For normative

beliefs, we observed no added benefit with the inclusion of a multiplicative term as there was no

Table 10 Hierarchical Regression of Attitude, Subjective Norm, and Perceived Behavioral Control onto Indirect Measures (Testing Additive and Multiplicative Models)

Behavioral Beliefs	*B*	*SE*	*ß*	*p*
Additive Model (R^2=.057, p<.001)				
Outcome Expectation	.01	.01	.03	p=.433
Outcome Evaluation	.15	.02	.23	p<.001
Multiplicative Model (R^2=.197, p<.001)				
Outcome Expectation	.17	.02	.45	p<.001
Outcome Evaluation	.23	.02	.37	p<.001
Multiplicative Composite	.07	.01	.60	p<.001

Normative Beliefs	*B*	*SE*	*ß*	*p*
Additive model (R^2=.189, p<.001)				
Normative Referent	.23	.02	.42	p<.001
Motivation to Comply	-.01	.01	-.07	p=.042
Multiplicative model (ΔR^2=0.00, p=.619)				
Normative Referent	.25	.04	.45	p<.001
Motivation to Comply	-.01	.01	-.04	p=.576
Multiplicative Composite	-.01	.01	-.05	p=.619

Control Beliefs	*B*	*SE*	*ß*	*p*
Additive Model (R^2=.097, p<.001)				
Control Factor	.146	.02	.33	p<.001
Perceived Power	-.04	.02	-.09	p=.017
Multiplicative Model (R^2=.107, p=.003)				
Control Factor	.20	.03	.46	p<.001
Perceived Power	.07	.04	.14	p=.098
Multiplicative Composite	-.03	.01	-.32	p=.003

increase in explained variance beyond the additive model. Interestingly, and with the exception of the multiplicative model's significance regarding control beliefs, the findings of this test of the multiplicative assumptions of the EV and TPB frameworks produced similar results to those observed using the prior testing method where the direct measure was regressed onto individual beliefs.

Optimal Scaling

For comparative purposes the optimal scaling approach advocated by (Ajzen, 2006) was utilized to present the relationship between indirect and direct measures. It is theorized that the relationship between belief based measures and direct measures should be maximized, because these are the salient beliefs obtained from the study population themselves (i.e. elicitation), we accept that these beliefs possess some degree of validity. In optimal rescaling the coefficients obtained in the multiplicative regression model (Table 10), are used to create the least-squares estimate of the rescaling constant to be added to or subtracted in order to rescale the belief items. Thus, these rescaling constants maximized the relationship between indirect and direct measures. For example, with regard to behavioral beliefs the unstandardized coefficient for the outcome expectation is divided by the unstandardized coefficient of the product term and this ratio is used to rescale the evaluation items. Likewise, the unstandardized coefficient of the evaluation term is then used in the same fashion to produce the ratio used for rescaling the

Table 11 Pearson's Correlations between Direct Measures and Indirect Measures Using both A Priori Scaling and Optimal Scaling Methods

Attitude	I	II	III
I. Direct Measure	1.0		
II. a priori Scaling (-3 to +3)	.12***	1.0	
III. Optimally Scaled	.44****	.26****	1.0
Subjective Norm	I	II	III
I. Direct Measure	1.0		
II. a priori Scaling (1 to 7)	.24****	1.0	
III. Optimally Scaled	-.43****	-.48****	1.0
Perceived Behavioral Control	I	II	III
I. Direct Measure	1.0		
II. a priori Scaling (1 to 7)	.11***	1.0	
III. Optimally Scaled	-.33****	-.35****	1.0

(*p<.10, **p<.05, ***p<.01, ****p<.001)

expectation items. As seen in **Table 11**, the optimal scaling approach substantially increased the magnitude of the correlations between indirect and direct measures. However, for subjective

norm and PBC, the rescaling process resulted in unreasonable negative correlations. The spurious relationships observed for subjective norm and PBC were produced as a result of small negative coefficients assigned to the multiplicative term by the regression model.

CHAPTER V

DISCUSSION

Extensive literature exists linking college aged individuals to risky behavior, inclusive of substance misuse. Our study contributes to this broad body of literature by examining psychosocial factors and their association to an area of increasing concern, prescription opioid misuse. As national and international efforts to curb the current opioid crisis progress the results of this current research may stand to make a valuable contribution in understanding this behavior among this particular population.

To our knowledge this is the first study to examine recreational use of prescription opioid pain relievers among college students while applying the TPB as framework. Additionally, the current study explicitly considered "recreational use" of prescription opioids, as the literature suggests this is a primary motive for misuse of prescription opioids among this population (S. Lord, Brevard, & Budman, 2011). This distinction is important because previous studies have focused on "nonmedical use" or "misuse" of these drugs which is, to some extent, ambiguous. These definitions of use imply only that substance use is not in accordance with physician direction, regardless of psychological antecedents. Thus, nonmedical use and misuse do not differentiate between uses for pain relief (i.e. as the substance was intended) and those of a recreational motive (e.g. get high). Lord et al (2011) found that 19% of their population of

college students reported “management of chronic pain” as motivation for nonmedical use. Likewise, Kenne et al (2017) reported 33.9% of their sample of college students reported “relieve physical pain” as primary reason for first misuse of prescription opioids. Similarly, McCabe et al (2007) stated the most common motive for nonmedical use of prescription opioids among participants was “because it relieves pain” at 63%. As motives for use indeed differ, it therefore becomes pertinent that specificity be maximized when attempting to understand this behavior with the purpose of behavior change in mind. As we consider opioid use for pain relief and that for recreation it is clear that we are contemplating two distinct behaviors.

Lifetime Recreational Opioid Use

Among our sample 20.7 percent of participants self-reported using prescription opioid pain relievers for recreational purposes at least once in their lifetime. This exceeds many estimates of misuse among college students. For context, a recent study among a similar sample size of college students found that 9.5% of their sample reported lifetime misuse of prescription opioid drugs (Kenne et al., 2017). Similarly, in a large sample of 4580 undergraduates, McCabe et al (2007) reported rates of lifetime use at 14.3%. Moreover, McCabe et al (2014) examined trends in nonmedical opioid use among college students from 2003-2013. Here they report significant decreases across the period of study arriving at 8.8% in 2013. There have, however, been reports of lifetime use of opioids among college populations in excess of our findings. One such study examining a relationship between nonmedical prescription drugs and risky sexual behavior found that of 435 participants, 32.6% reported nonmedical use of pain reliving medication at least once (Benotsch, Koester, Luckman, Martin, & Cejka, 2011). Additionally,

Peralta & Steele (2010) observed 27.3% of their participants report nonmedical prescription opioid use. These studies serve as reference, however, for direct comparison purposes they are not ideal as they utilize terminology (i.e. nonmedical use) rendering identification of recreational behavior impossible.

Our study included a large percentage of Greek affiliated students at 32% of our total sample. Past research has demonstrated these students may be at increased risk for engagement in non-medical use of prescription drugs (Gallucci et al., 2015) and has presented evidence of increased odds of opioid use when compared to non-Greek students (McCabe et al., 2014). Though our study did not subject Greek affiliation to significance testing, it would appear that our findings do not support the increased risk identified by McCabe et al (2014), as there was a higher relative percentage of lifetime misuse among non-Greek students in our sample. Similar to our study, Peralta & Steele (2010) reported no significant relationship between Greek affiliation and nonmedical prescription drug use.

Among our sample males were more likely to report past recreational use of prescription opioids. From the standpoint of engagement in risky health-related behavior this finding is not surprising. At the time of preparation of this manuscript the most recently available national data suggests that males have a higher propensity for misuse of prescription opioids (Hughes et al., 2016). Herein they site that females, as a whole, take more of the medication, however, males are more likely to misuse prescription opioids. Nevertheless, studies incorporating significance testing on gender have shown non-significant differences between male and female college students concerning lifetime nonmedical opioid use (McCabe et al., 2007; Peralta & Steele,

2010).

Polysubstance misuse is common and of concern for all age groups (Hughes et al., 2016). Existing research suggests that this type of behavior is not unusual among college students and has been shown inclusive of prescription opioid misuse (McCabe et al., 2007; Meisel & Goodie, 2015). Our findings highlight relationships between recreational use of prescription opioids and recreational use of other substances. We assessed past six months recreational use of alcohol, cocaine, marijuana, ecstasy, methamphetamine, and other prescription drugs, with each increasing the odds of recreational prescription opioid use. Our findings were somewhat similar to national estimates provided by the 2015 National Survey on Drug Use and Health. For example, 42.5% of prescription opioid misusers reported overlapping methamphetamine use (Hughes et al., 2016). Similarly, in our study recreational use of methamphetamine provided the largest increase in odds of recreational use of prescription opioids. Additionally, ecstasy, cocaine, and misuse of non-opioid prescription drugs are nationally identified correlates of prescription opioid misuse and in our sample each provided substantial increases in odds of recreational use of prescription opioids.

As is common among college populations we found the majority of our sample consumed alcohol for recreational purposes in the past six months. This behavior equated to a more than 2-fold increased odds of recreational prescription opioid use. Presenting similar findings was McCabe et al (2007). Interestingly, and in support of differentiation of motive, they found that for participants who reported misusing prescription opioids for pain reliving purposes there was no significant relationship between risky alcohol use and opioid misuse. However, for

participants reporting motives other that pain relief (e.g. recreational) the odds of binge drinking or having alcohol related problems increased by more than two times. As we contend, these findings provide additional support for examination of specific types of misuse (e.g. recreational use).

Among our sample 278 individuals self-reported recreational use of marijuana in the past six months. Participation in this behavior resulted in more than a 400% increase in odds of personal recreational use of prescription opioids. The relationship between marijuana use and prescription drug misuse is not unique to our population. Meisel and Goodie (2015) produced similar findings as 44% of their sample of college students reported marijuana use at least once in the past year. Additionally, they reported that this behavior also increased the odds of prescription drug misuse. It should be noted that Meisel & Goodie (2015) did not look exclusively at prescription opioid medication as they were interested in nonmedical use of any prescription drugs. However, they did note opioid analgesics as the second most commonly misused prescription medication among their sample. Similarly, Benotsch et al. (2010) found that among college students reporting nonmedical prescription drug use, 50% reported marijuana use as well.

The high levels of marijuana use among college aged students are concerning. A recent report by the Substance Abuse and Mental Health Services Administration sites that in 2016, among commonly abused substance, marijuana had the highest rates of initiation (i.e. first time use) among individuals 12 and older. Additionally, they report that only about one-third of individuals 12 and older see marijuana use as a high risk behavior (Lipari, Ahrnsbrak,

Pemberton, & Porter, 2017). Likewise, one study incorporating a national samples of American youths (n=1,134,734) documented significant reductions in perceived harm in the past 25 years (Keyes et al., 2016). Couple this low perceived risk with the fact that nearly half of respondents believe that acquisition of marijuana is easy and this may provide some explanation for the high rates of use seen among college age samples (Lipari et al., 2017).

Although we see different relationships when observing prescription drug misuse and use of illicit drugs across all age groups (Hughes et al., 2016), we find that studies focused on college students typically report seeing the highest overlap, in sheer numbers, between prescription drug misuse and marijuana (Benotsch et al., 2011; Meisel & Goodie, 2015). Our findings reflect this notion as well as we found a high number of our sample participating in both behaviors. Though we cannot infer a directional link between marijuana use and prescription drug misuse, the high levels of overlap observed between these particular substances among college aged individuals necessitates further inquiry. Marijuana is often referred to as a gateway drug (Taylor et al., 2017) and as such, participation in this particular behavior may facilitate experimentation with prescription opioid medications. Future intervention efforts focused on nonmedical prescription drug use among college student will do well to take into account marijuana use as well.

An extensive body of literature exists regarding nonmedical use of prescription drugs among college students (Arria et al., 2008; Garnier et al., 2010; Sanders et al., 2014). Much of the previous studies among this population have focused on prescription stimulant drugs (Gallucci et al., 2015; Helmer et al., 2016; Ponnet et al., 2015). This class of drugs have been given attention among college populations because of their high prevalence of misuse, as it is

believed that use of such drugs aid in academic performance (Helmer et al., 2016). Regardless of the class of drug, it appears that the college atmosphere provides students with ample access and opportunity to attain and subsequently misuse prescription drugs (Garnier et al., 2010). Our study included specific items assessing lifetime use of prescription opioids as well as past six month use of both opioids and non-opioid prescription drugs. Among our sample of college students we observed concerning, albeit not unique, levels of nonmedical prescription drug use. Specifically, 20.7% reported lifetime recreational use of opioids, 11.9% reported past 6 month recreational opioid use, and finally 13.5% reported recreational use of non-opioid prescription drugs within the past 6 months.

Theory of Planned Behavior

Few studies have applied the TPB framework to nonmedical use of prescription drugs in attempts to understand psychosocial factors associated with this behavior. What does exist applies specifically to nonmedical stimulant use (Gallucci et al., 2015; Judson & Langdon, 2009; Ponnet et al., 2015). As stated, we believe this to be the first application of the TPB framework to the specific nonmedical use of opioid prescription medications, for recreational motives or otherwise. The main findings of the current study support the utility of the TPB within this behavioral domain. With the exception of the PBC-intention relationship, our findings are consisted with the TPB's propositions (Ajzen, 1991), and confirmatory to our hypotheses. The results of our regression model revealed significant relationships between intention and theory constructs attitude, subjective norm, and descriptive norm. However, in our model PBC had no significant effect on intention to use prescription opioids for recreational purposes. This is

somewhat expected with negatively evaluated behaviors as there is typically a negative or no significant relationship between PBC and intention when the behavior is evaluated negatively (Eagly & Chaiken, 1993). We additionally hypothesized that, with regard to normative influence on student intention, perceptions of descriptive norms would be more determinant than that of injunctive norms (i.e. subjective norms). Though only slight, the descriptive norm construct increased the odds of intention to a greater degree than that of subjective norm. This is indicative that perceptions of peer behavior may carry more influence than perceptions of peer will. We also found some support for our final hypothesis in which we proposed attitude to moderate the relationship of the other study variables with intention. Our data showed this to be accurate only for the descriptive norm construct. However, because we found descriptive norm to exert the most influence on intention, this is quite an important finding.

We found that the strongest predictors of intention among our sample were the variables representing social influence, which is contrary to many empirical investigations (Armitage & Conner, 2001). Our study included measures of two independent forms of social norms, which were both significantly associated with intention. In addition to the subjective norm construct, which is in effect a measure of injunctive norm, we incorporated a measure of descriptive norm. Resent literature advocates the addition of this descriptive norm construct (Ajzen, 2006; Ajzen & Fishbein, 2005; Helmer et al., 2016; Manning, 2009; Rivis & Sheeran, 2003). Among our sample, descriptive norm had the strongest influence on intention to use prescription opioids for recreational purposes. This finding may not be surprising among a study population of college students when the behavior in question is recreational drug use. In addition to peer influence typically being a strong determinant of behavior among this population, a meta-analysis by Rivis

and Sheeran (2003) provided evidence that the descriptive norm construct has shown strong relationships to intention among younger populations and when the behavior in question is a health-risk behavior. Additionally, the subjective norm construct has historically shown a weak relationship with intention (Armitage & Conner, 2001), thus, supporting our findings that descriptive norm may be a more relevant representation of normative influence and predictor of intention.

The descriptive norm construct has not been extensively applied to TPB based studies focused on substance use behavior. Conner and McMillan (1999) found descriptive norms to be a significant predictor of intention to use marijuana. Likewise, McMillan and Conner (2003) applied the TPB framework to study marijuana, ecstasy, LSD, and amphetamines. Here they entered descriptive norm into a staged model and found that in relation to all substances the descriptive norm construct significantly explained variance in intention beyond that of attitude, subjective norm, and PBC. Interestingly, with the exception of marijuana, injunctive norm was nonsignificant once descriptive norm entered their models. Research findings also demonstrate that in relation to alcohol use among college students descriptive norms of the behaviorally relevant reference group significantly predict intention to binge drink (K. L. Johnston & White, 2003).

In relation to nonmedical prescription drug use, Helmer et al., (2016) conducted an international (i.e. seven European Countries) study examining peer influence on stimulant use among university students. The findings here display the influence of descriptive norm as odds of personal use increased more than 3-fold for students who perceived the majority of their peers

had non-medically used prescription stimulants. Similar to the meta-analytic findings of Rivis and Sheeran (2003), our study findings show modest correlations between descriptive norm and subjective norm indicating that these are indeed assessing different concepts. Because of the finding discussed above and additional work suggesting significant overestimation of peer pharmaceutical misuse behavior (Sanders et al., 2014) we would recommend that future interventions focus on cultivating desirable perceptions of normative behavior. Possible intervention tactics may include social approaches such as peer abstinence groups or educational interventions focused debunking misperceptions of peer drug use.

We observed a significant positive relationship between attitude and intention. This finding comes as no surprise; more positive attitude regularly relates to more intention to perform the behavior (Ajzen, 1991). As others have identified interactions between attitude and additional variables (Conner & McMillan, 1999; Mcmillan & Conner, 2003; Umeh & Patel, 2004) we further investigated attitude on the basis of its potential moderating effect upon other variables in the model. The previously referenced studies observed attitude's moderation of PBC. Conner and McMillan (1999) found that, in relation to marijuana use intentions, when attitude was low PBC had a negative association with intention, however, when attitude was high PBC had no effect of intention. This finding supports the notion of Eagly and Chaiken (1993) in that intention to perform negatively evaluated behaviors often exhibits no significant relationship to PBC. Conversely, McMillan and Conner (2003) found that the relationship as well as the significance of the relationship between PBC and intention varied as a function of attitude. Here they found that as attitude became more positive PBC's prediction of intention became greater for LSD, amphetamines, marijuana, and ecstasy. Moreover, Umeh and Patel (2004) found PBC

to take ecstasy significantly predicted intention only for those with positive attitudes. Though both McMillan and Conner (2003) and Conner and McMillan (1999) incorporated measures of descriptive norm, only Conner and McMillan tested the interaction effects of attitude and descriptive norm and this interaction was nonsignificant.

Our study contributes to the TPB literature by, to our knowledge, being the first to identify a significant interaction between attitude and descriptive norm. Among our data the only significant moderation occurred between attitude and descriptive norm, where we observed a protective effect of attitude. Descriptive norm had a reduced effect on intention for those with more negative attitudes toward recreational use of opioid medication. Similar findings in relation to injunctive norms were observed by Hohman et al (2014) where they found attitude ambivalence to moderate the influence of friend norms on intention to use marijuana. As we know peer influence may exert a powerful effect on young people's decision making, this information may highlight the utility of educational interventions aimed at changing attitudes toward this behavior. As we saw descriptive norm to have the greatest degree of influence on intention, thus, efforts to attenuate this factor are advised.

In accordance with the TPB salient beliefs were elicited from a subsample of the study population through a pilot investigation. Results of this pilot were used to develope survey items which were then evaluated among the entire study sample. The TPB suggests that the salient beliefs of the sample are of great importance as they identify the deliberations that govern behavior. Optimal scaling exhibited reasonable correlations between the belief measures and their respective direct measures, ranging in magnitude from r = .33-.44. However, the optimal

scaling procedure produced counter intuitive correlations for the variables subjective norm and PBC where the sign was changed as a result of the small negative weights applied to the product terms utilized in the transformation. Because of this we used correlations between untransformed beliefs and intention for interpretive purposes (Table 6).

Behavioral belief items exhibiting stronger relationships with intention were items pertaining to negative consequences of recreational use of prescription opioids, for example, causing legal trouble and causing disappointment or regret. Participants perceived these particular outcomes to be fairly likely and assigned extremely negative evaluations to these outcomes. Highlighting these consequences may prove fruitful for future intervention efforts, as perceptions of threat surrounding behavior are useful deterrents of action (Rosenstock, 1974).

Among normative beliefs we identified two important persons or groups. Close friends and partner relationships were both significantly associated with intention. Participants perceived little approval for opioid use by these referents and were also generally motivated to comply with the perceived will of these specific referents. Our findings, in relation to referent influence, echo the importance of the behaviorally relevant reference group, as close friends and partners provided the only significant associations with intention. Thus, perceptual influences on behavior such as perceived opinions of those with whom the individual shares a close bond, emotionally or otherwise may be efficacious targets for social interventions.

In our logistic regression model we observed no significant relationship between PBC and intention. Conversely, we found each individual control belief to be significantly related to

intention. This could be in part due to the low level of reliability observed for the scale used to assess PBC among our sample. This scale was adapted from a previous study where it showed moderate to high internal consistency when applied to marijuana and alcohol use. Additionally, in their a priori scaling, control beliefs correlated minimally with PBC. The items used to asses PBC (Table 3) focus on general perceptions of personal control over recreationally using prescription opioids. Perhaps the presentation of individual belief items provided more situational and contextual details and this may have elicited a more accurate estimation of personal control, which was not accounted for in the PBC items. It is quite interesting that many of the individual control beliefs showing stronger relationships to intention pertained to elements specific to the social context. This again provides evidence of the tremendous influence the social environment may have over recreational use of prescription opioids among college students. Furthermore, it has been suggested that unlike behavioral and normative beliefs, control belief measures may be better predictors of intention than the direct measure of PBC (Rise et al., 1998) our data supports this conclusion. As few studies have choose to include belief-based measures (Armitage & Conner, 2001) and even fewer have assessed control beliefs regarding socially unacceptable behavior among this population, there is little opportunity for comparison. We adapted the PBC scale used by Armitage et al (1999). Here they found a significant relationship between PBC and alcohol and marijuana use among a college sample. Direct comparison is not possible here as their study utilized different control beliefs and the relationship between these belief measures and intention was not established.

Another explanation for these findings is in line with contingencies described by Bagozzi (1992) where he proposes that the relationship between attitude and intention may fail to emerge

when there is little probability for consummation of the act. This could presumably hold true for the PBC intention relationship as well. In our study students may have viewed the likelihood of actually using prescription opioids as minimal, and thus, the relationship between intention and its predictors may have been reduced. Mean values for control beliefs associated with acquisition of prescription opioid in our study were all below the midpoints of their associated scales (Table 6), evidencing low levels of belief they would actually have the ability to use them. Additionally, Bagozzi also discusses the interplay between attitude and subjective norm, where someone may hold a positive attitude toward an act, however, the social pressure they feel renders the measure of their attitude insignificant in predicting intention. Our findings somewhat confirm this interplay between constructs with regard to descriptive norm as attitude served as a moderator. McMillan and Conner (2003) found support of this notion as they observed PBC to lose its relationship to intention as attitude become increasingly negative. These findings support past literature which speculates that it should be expected that PBC be unrelated to negatively evaluated behaviors (Eagly & Chaiken, 1993).

Testing Multiplicative Assumptions of the Theory of Planned Behavior

Our study utilized two means of evaluating the multiplicative assumptions of belief-based items outlined by the EV and TPB frameworks. Taken collectively, we found convincing evidence for the multiplicative assumptions regarding the attitude construct as all testing methods provided support. These findings are similar to previous tests also validating this EV model of attitude formation utilized by the TPB (Hardeman et al., 2013; Rise et al., 1998). On the contrary, lack of support was identified for these assumptions applied to subjective norms

and PBC as neither method provided supporting evidence.

Armitage et al (1999) hierarchically regressed attitude, subjective norm, and PBC onto individual belief items (i.e. method 1 of our procedure) pertaining to alcohol and marijuana, finding support only for subjective norm specific to alcohol use. These findings conflict with our own when applying the same test as we observed support for attitude only. Rise et al (1998) also utilized this method of testing the attitude construct only and their findings are in accord with that of the current study, with the addition of multiplicative terms providing similar contribution to explained variance in attitude. The regression of subjective norm and PBC onto individual belief items provide no support for the multiplicative contribution for either construct, conflicting with the results of Armitage (1999). Ajzen and Fishbein (2008) refute this method of testing the multiplicative assumption. They posit that only when there is sufficient variance in both belief strength and evaluation for most beliefs can this method produce significant contributions by inclusion of product terms. Additionally, they site the tremendous multicollinearity problem this approach creates. Our use of this method confirms this notion, as our study involved the use of 10 behavioral, 6 normative, and 8 control beliefs and, thus, the inclusion of product terms created an enormous degree of instability in the model. Centering variables may correct this, however, Ajzen and Fishbein (2008) discourage this practice with regard to semantic differentially scaled belief items. These may be reasons for the conflicting findings between studies subjecting TPB components to such tests. Similarly, these points may explain different results we observed when subjecting different costructs to this testing procedure. For example, the normative beliefs in the current study produced substantially less variation in response for both measures of referents and motivation to comply, rendering stage 2

and 3 of this model insignificant.

The second approach to testing the multiplicative assumptions of belief measures compared an additive composite model against a multiplicative composite model in accordance with recommendations of past studies (Bagozzi, 1984; Hardeman et al., 2013). This method using composite items for each component of the belief measures is more in accordance with the logic of the EV framework (Ajzen & Fishbein, 2008). As previously eluded to, our utilization of this method provided support for the attitude modeling where the multiplicative model provided a substantial contribution to explained variance. This model, however, produced minimal improvement in explained variance for PBC and no improvement for subjective norm when compared to the additive model. Additionally, there was some evidence of multicollinearity regarding the PBC model, as the variance inflation factor for the product term was 10.06 and tolerance equaled .10. Again, centering may have resolved this collinearity issue (Lindley & Walker, 1993), however, centering belief measures prior to creation of product terms may violate their psychological significance.

As recommended optimal scaling was used for each independent set of salient beliefs. Though this practice seemed to maximize the relationship between behavioral beliefs and attitude, as it is intended to do, this process resulted in counter-intuitive coefficients for subjective norm and PBC as the magnitude of the relationship increased, however, the nature of the relationship changed (i.e. positive correlations became negative). Similar to the results of Hardeman et al (2013) this change in sign was due to small negative regression coefficients for product terms used in the rescaling process. These confusing results would likely not have

occurred had there been a more substantial contribution by product terms, thus unstandardized coefficients of the product term would have deviated further away from zero. This explanation is consistent with past recommendation that there must be substantial support for a multiplicative model (Bagozzi, 1984). Additionally, optimal scaling is recommended when using beliefs measures to maximize the relationship between indirect and direct measures without having to test a multitude of different scaling systems. Our findings and those of Hardeman et al (2013) show, this process may not always be appropriate. When applied to our data optimal scaling increased the magnitude of the relationships between indirect and direct measure for all constructs, however, unless it is advised to ignore the change in sign this method appears invalid in some circumstances.

Our findings in addition to those previously presented (Armitage et al., 1999; Hardeman et al., 2013; Rise et al., 1998) complicate the acceptability of the EV framework's application to TPB constructs. The argument for or against the utility of the multiplicative nature of belief formation and appropriateness of its application appears to be a statistical versus psychological one. As Ajzen and Fishbein (2008) contest, there is no psychological basis in attempting to infer why an individual holds a negative or positive attitude towards an object or behavior from outcome expectation alone, without also understanding the evaluation of that expectation or vice versa. Belief measures are typically excluded from prediction modeling with regards to intention or behavior when applied to the TPB. Also, it is specifically instructed that these beliefs be attained through elicitation from a random subsample of the study population. When these contingencies are upheld and when these measures correlate to some degree with the outcome of interest, they may provide useful information for behavioral explanation and intervention. This

should hold true regardless of whether or not multiplicative composites can explain unique variance in regression modeling after controlling for their respective components. It should also be noted that many studies, inclusive of this one, testing the multiplicative assumptions have focused on either health promoting (Hardeman et al., 2013; Rise et al., 1998) or health debilitating behaviors (Armitage et al., 1999). This fact leads to restricted variance across scales assessing expectations and evaluations and, thus, as Ajzen and Fishbein (2008) suggest multiplicative terms inserted into later stages of hierarchical models can explain little or no variance beyond that of their respective lower order terms.

This study is not without its limitations. First the cross-sectional nature of this study does not allow for direct linkage of intentions to use prescription opioid pain reliving drugs for recreational purposes to future behavior. Further study is warranted applying the TPB to this particular form of substance misuse. Second, the scales used to assess TPB constructs in the current study were adopted from past study where they were validated in association with the misuse of other substances. This may be one explanation for the low levels of internal consistency we observed for some of the construct scales. Thirdly, this study utilized psychosocial measures of recreational prescription opioid use among a sample of college students from one southern university. Though we observed a hearty response rate of over 20% from randomly solicited students, the findings may not translate to students of other universities or non-college populations. Fourth, since the current study data were collected by means of self-report we cannot rule out the presence of certain biases consistent with survey methodology. Specifically, since this study focused on socially unacceptable behavior social desirability bias and misinterpretation bias are possible. Our data, however, is equivocal and even exceeds

existing prevalence rates for previously assessed substance misuse among this population. Therefore, we can infer that any existing underestimation is not unique to our study. Also, we took actions attempting to reduce the likelihood of participant misunderstanding of questioning throughout our study. Specifically, examples were provided to ensure that participants completely understood what types of medication constituted opioid medications. Also, we reiterated the concern of only recreational use and what we meant that definition to be periodically throughout the questioning to ensure we were not assessing other forms of drug misuse. Finally, a large number of student chose to withdraw themselves from the study by closing the web browser, it is possible that there could have been differences between those providing complete versus incomplete data.

In conclusion this study is the first to specifically examine "recreational use" of prescription opioid medication and one of few to apply a behavioral theory to the understanding of prescription opioid use among any population. We found support for the application of the TPB regarding recreational prescription opioid use among this population. Amid our sample, elements of the social environment held the greatest influence on intentions for recreational opioid use and, as such, intervention efforts at this interpersonal level are advised among this population. Given our findings, it is advisable that future studies examine this behavior among non-college populations to investigate whether these important social constructs hold the same influence on intention. Additionally, we recommend that future studies, whether theory-based or otherwise, move away from solely using terminology such as "nonmedical use" or "misuse" to describe this type of behavior. These definitions produce a degree of ambiguity when attempting to understand the psychosocial determinants of this behavior, determinants which are necessary

for development of fruitful behavior change interventions. With escalation of national and international efforts to decrease abuse of prescription opioid medications specificity will be necessary if we are to reach an efficacious solution. Lastly, we advise that before attempting use of optimal scaling techniques researchers should establish support for the multiplicative model of belief formation to avoid unclear or possibly misleading results.

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VITA

Curriculum Vitae

Robert Eugene Davis, PhD(c)

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Education

Doctor of Philosophy: Health and Kinesiology, University of Mississippi, School of Applied Science, (anticipated: December, 2017)

Masters of Health Promotion, University of Mississippi, School of Applied Science, (2015).

Bachelor of Exercise Science, University of Mississippi, School of Applied Science, 2012.

Professional Certifications and Affiliations

American College of Sports Medicine (ACSM).

CPR and First Aid Certified.

Certified Nutrition Environment Measures Surveyor (NEMS).

Employment History

Health Exercise Science and Recreation Management
Graduate Instructor/Researcher
University of Mississippi
(8/12/2012) – (present)

Department of Outreach
Distance Learning Facilitator
University of Mississippi
(8/12/2010) – (7/15/2015)

Research & Other Scholarly Contributions

Peer Reviewed Publications:

1. **Davis R.E.**, & Loprinzi P.D. (2017). Pocket Carried and Waist-Mounted Accelerometry. *Journal of Behavioral Health*. *6*(2), 93-98

2. **Davis, R.E.** & Loprinzi, P.D. (2017). Accelerometer methodology: Issues with attachment style at the waist. *Journal of Behavioral Health*, 6, 157-162.

3. **Davis, R.E.,** & Loprinzi, P.D. (2016). Examination of Accelerometer Reactivity Among a Population Sample of Children, Adolescents, and Adults. *Journal of Physical Activity and Health*, *13*(12), 1325-1332.

4. Loprinzi P.D., & **Davis R.E.** (2016). Socio-Ecological Risk Predictors of Physical Activity and Associated Mortality. *American Journal of Health Promotion,* 0890117116662943.

5. Loprinzi, P.D., & **Davis, R.E.** (2016). Recent Temporal Trends in Parent-Reported Physical Activity in Children in the United States, 2009 to 2014. In *Mayo Clinic Proceedings* (Vol. 91, No. 4, pp. 477-481). Elsevier.

6. Loprinzi, P.D., & **Davis, R.E.** (2016). Psycho-Socioeconomic bio-behavioral associations on all-cause mortality: cohort study. *Health Promot Perspect*, *6*(2), 66-70.

7. Loprinzi, P.D., & **Davis, R.E.** (2016). Promotion of Weight Loss by Health-Care Professionals: Implications for Influencing Weight Loss/Control Behaviors. *American Journal of Health Promotion*, 0890117116667369.

8. Loprinzi, P.D., & **Davis, R.E.** (2016). Bouted and non-bouted moderate-to-vigorous physical activity with health-related quality of life. *Preventive Medicine Reports, 3,* 46-48.

9. Loprinzi, P.D., & **Davis, R.E.** (2015). Secular trends in parent-reported television viewing among children in the United States, 2001–2012. *Child: care, health and development, 42(*2), 288-291.

10. Loprinzi, P.D., **Davis, R.E.**, & Fu, Y.C. (2015). Early motor skill competence as a mediator of child and adult physical activity. *Preventive Medicine Reports*, *2*, 833-838.

11. Loprinzi, P.D., & **Davis, R.E.** (2015). Daily movement patterns and predicted 10-yr risk for a first atherosclerotic cardiovascular disease (ASCVD) event using the pooled cohort risk equations among US adults. *Preventive medicine*,*81*, 78-81.
12. Loprinzi, P.D., & **Davis, R.E.** (2015). Effects of individual, combined, and isolated physical activity behaviors on all-cause mortality and CVD-specific mortality: Prospective cohort study among US adults. *Physiology & behavior*,*151*, 355-359.

13. Nahar, V.K., Ford, M.A., Boyas, J.F., Brodell, R.T., Hutcheson, A., **Davis, R.E**., ... & Biviji-Sharma, R. (2014). Skin cancer preventative behaviors in state park workers: a pilot study. *Environmental health and preventive medicine*, *19*(6), 467-474. Articles

Books and Book Chapters:

1. **Davis, R.E**., & Loprinzi, P.D. (2017). Disordered Sleep among Older Adults. *Recent Advances in Geriatric Medicine: An Interdisciplinary Approach to Geriatric Medicine*, *2*, 84-95.

Current Research Projects:

1. **Davis, R.E.**, Bass, M.A., Bentley, J.P., Ford, M.A., & Lee, K. Salient Beliefs and Social Influence on Intentions to Misuse Prescription Opioid Pain Relievers: An Application of the Theory of Planned Behavior.

2. **Davis, R.E.**, Bass, M.A., & Nahar, V.K. The Association between Depressive Symptomatology and Prescription Opioid Drug Use among College Students.

Abstracts and Presentations:

1. Vinayak K. Nahar, M. Allison Ford, Martha A. Bass, **Robert E. Davis**, Amanda Hutcheson. 2013. Osteoporosis Health Beliefs, Knowledge, Preventive Behaviors, and Bone Mineral Density in Asian Indian Populations. ACSM Annual Meeting.

2. Gdovin JR, Wilson SJ, Williams CC**,** Eason JD, Hoke EL, Luginsland LA, Hill CM, Donahue PT, **Davis RE**, Chander H, Wade C, Garner JC. The acute effects of golf

specific footwear on reaction time latencies. Southeast Chapter of the American College of Sports Medicine (SEACSM) Annual Meeting, Greenville, SC. February 16-18 2017.

3. Williams CC, Wilson SJ, Gdovin JR, Eason JD, Hoke EL, Luginsland LA, Hill CM, Donahue PT, **Davis RE**, Chander H, Wade C, Garner JC. The influence of golf specific footwear on whole body reaction times. Southeast Chapter of the American College of Sports Medicine (SEACSM) Annual Meeting, Greenville, SC. February 16-18 2017.

4. Wilson SJ, Gdovin JR, Williams CC**,** Eason JD, Hoke EL, Luginsland LA, Hill CM, Donahue PT, **Davis RE**, Chander H, Wade C, Garner JC. The Effects of Golf Specific Footwear on Human Balance. Southeast Chapter of the American College of Sports Medicine (SEACSM) Annual Meeting, Greenville, SC. February 16-18 2017.

Teaching Experience

ES 440 - Behavioral Aspects of Exercise (Exercise Psychology)
Cognitive and behavioral considerations related to establishing and maintaining personal, commercial, corporate, or clinical-based exercise programs. Emphasis on strategies for increasing adherence to physical activity guidelines and reducing attrition.

HP 191- Personal and Community Health
A comprehensive health course, including principles and practices of healthful living for the individual and community; major health problems; responsibilities of home, school, health agencies.

ES 473/493- Undergraduate Practicum/Internship
The major goal of both the practicum and internship program is to bridge the gap between classroom theory and job realities. Students are provided an extensive practical learning experiences under the direction of an Agency Supervisor and an Exercise Science Practicum Advisor.

HP 203- First Aid & CPR
Safety instruction and practices in the methods as prescribed in the American Red Cross standard and advanced courses.

EL 124 - Racquetball
EL 147 - Tennis
EL 151 - Weight Lifting
EL 156 - Jogging
EL 169 - Aqua Exercise
EL 269 - Advanced Aqua Exercise

Academic Advising

Academic advisor: Department of Health Exercise Science and Recreation Administration, University of Mississippi - 2012-present.

Academic advisor: Exercise Science & Health Care Professions, Freshmen Orientation Summer 2016

Peer Reviewer:

American Journal of Health Promotion

Journal of Health Psychology

Health and Quality of Life Outcomes

Journal of Circadian Rhythms

Laboratory Affiliations

1. Center for Health Behavior Research, University of Mississippi – 2012-present
2. Applied Physical Activity Epidemiology Laboratory, University of Mississippi - 2016

Grants and External Funding

RebelWell Grant Drafting Committee Member – Employee Wellness Initiative 2014 Blue Cross Blue Shield Grant $250,000

Speaking Engagements and Presentations

February 2014 – Topic: Graduate Opportunities in Exercise Science, guest lecturer for an introduction to exercise science class at the University of Mississippi.

March 2016 – Topic: Maintaining Motivation While Moving Through the Stages of Change (Transtheoretical Model). Workshop for faculty and staff of the University of Mississippi.

September 2017 – Topic: Keeping Science Scientific. Introductory lecture on science and research delivered to students of the University of Mississippi's Department of Writing and Rhetoric.

Professional Qualifications & Continuing Education

Interdisciplinary Certificate Program in Applied Statistics (2017)
The University of Mississippi Graduate School

Concentration Study Program for Specialization in Applied Statistics

Nutrition Environment Measures Survey (NEMS) (July 2012)
The University of Pennsylvania School of Medicine
In association with the Robert Wood Johnson Foundation
Certified NEMS Rater

Environmental Systems Research Institute (ESRI) (July 2012)
ArcGIS Desktop Training Course
Geographic Information 24 hour Course

Geographic Support System Initiative (US Census Bureau) (October 2012)
Workshop focused on the use of Census data with GIS software
Geographic Information Systems 4 hour Course

Assessing the Built Environment for Physical Activity (December 2012)
The University of Pennsylvania School of Medicine
In association with the BEAT Institute (Built Environment Assessment Training Institute)
CPR & First Aid (May 2011-present)
American Red Cross
Certified in CPR & First Aid

Payed Service

2016 – Statistical analyst for RebelWell program evaluation

Volunteer Service

2014 – RebelWell Wellness on Wheels Health Fair

2012 - Safe Trick or Treating on the Oxford Square: Health Exercise Science and Recreation Management Booth Sponsor

2011 - 2014 Employee health fair, University of Mississippi

2011 - 2017 Special Olympics

2010 - Habitat for Humanity

Awards/Honors

2016 – Kevser Ermin Professional Development Award. The University of Mississippi

Research Interests

Biopsychosocial determinants of behavior
Substance use, misuse, and abuse
Physical activity as a tool for behavior change
Health behavior theory
Measurement methods

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