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DEADLY COMBINATIONS: FACTORS THAT ARE ASSOCIATED WITH
SIMULTANEOUS AND CONCURRENT POLYSUBSTANCE USE

by

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B.A. Washburn University 2019

A thesis submitted in partial fulfillment of the requirements
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ABSTRACT

Mortality reports show that most overdose deaths include more than one substance. In addition, there is a gap in the literature that discusses risk factors for polysubstance use. The objective of this study was to explore what factors relate to the likelihood of engaging in polysubstance use, defined as using more than one substance. Specifically, the goal was to evaluate predictors of simultaneous (i.e., the use of alcohol and another substance at the same time in the past six months) polysubstance use and concurrent (i.e., the use of any two substances in the past six months) polysubstance use, vs. no substance use and single substance use combined.

Data were obtained from the 2021 CARA Orange County Residents Survey conducted by the Orange County Drug Free Office. Seven hundred thirty-five participants aged 18 years and older were asked about their drug use, risk perceptions of polysubstance use, sensation seeking, ACE scoring, and protective measures used while using drugs and alcohol. SPSS was used to conduct bivariate and logistic regression analysis to predict simultaneous and concurrent polysubstance use from demographic factors, sensation seeking, ACE scores, number of sexual partners, and incapacitated sexual assault.

Bivariate and logistic regression analysis demonstrate that neither simultaneous nor concurrent polysubstance use were associated with most demographic factors. Number of sexual partners was positively associated with both simultaneous and concurrent polysubstance use; however, incapacitated sexual assault was not related to either type of polysubstance use. High sensation-seeking and high ACE scores were significantly associated with simultaneous and concurrent use.

This research supported the hypothesis that higher sensation seeking and ACE scores were associated with a greater likelihood of engaging in both concurrent and simultaneous

polysubstance use. Future research is needed to further explore the frequency and problems associated with polysubstance use. This study sets the groundwork to analyze psychosocial risk factors for polysubstance use.

I want to dedicate this work to Andy J. Inskip, who always encouraged me to stay curious. Andy always emphasized the importance of education and especially cared for marginalized communities.

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CHAPTER ONE: INTRODUCTION

Recent literature frequently neglects the importance of polysubstance research compared to research on single substance use. The lack of research on polysubstance is partially due to variation in terminology used. Polysubstance use is an umbrella term that needs to be qualified by narrower terms such as simultaneous and concurrent use (Sokolovsky et al., 2020). Because some researchers do not provide well-defined terms or explain how they use specific terminology (Valente et al., 2020; Olthuis et al., 2012; Weng et al., 2020), it can be difficult for researchers to compile previous data to better understand polysubstance use. To ensure comprehension among readers, this researcher will use the term polysubstance use to describe the use of more than one substance, including both simultaneous and concurrent use.

Simultaneous use is defined herein to explain the use of one or more substances where the effects overlap. This means that users are combining the effects of two or more drugs (Crummy et al., 2020; Ives & Ghelani, 2006; Bunting et al., 2020; Connor et al., 2014, as cited in Fernandez-Calderon et al., 2020; Barret et al., 2006). Concurrent use is defined in this paper as the use of one or more substances within a given timeframe (simultaneously or not). This term is primarily used within research to describe polysubstance use within 30 days, three months, or six months, and can be used to describe both the overlapping of effects and non-overlapping of effects (Crummy et al. 2020; Ives & Ghelani 2006; Reyes et al. 2013; Font-Mayolas et al. 2013). This paper will use concurrent use to describe general use of two or more substances within the last six months. By clarifying definitions for critical terms, patterns across polysubstance research can be better understood.

The present research highlights the importance of analyzing both simultaneous and concurrent polysubstance use, considering how existing findings vary based on polysubstance terminology (Crummy et al., 2020; Bunting et al., 2021; Zuckermann et al., 2020; Cicero, 2020).

Specifically, the goals of this study were to 1) explore if sensation-seeking traits and childhood trauma, as measured by the ACE questionnaire, predict polysubstance among a sample of individuals aged 18-55 and 2). explore if the number of sexual partners and incapacitated sexual assault were associated with simultaneous or concurrent polysubstance use. Demographic factors, such as age, race, education, and income, are included as control variables.

Understanding who is most likely to engage in simultaneous and concurrent polysubstance use can lead to more effective prevention and intervention measures. Specifically, the results of this study may have implications for informing effective polysubstance prevention and the use of risk reduction measures (Samoff et al., 2020). First, I discuss the language used within research and the importance of polysubstance use research.

This study uses Problem Behavior Theory (Jessor & Jessor, 1977), a biopsychosocial model, to explore what factors predict polysubstance use and if these factors are different for concurrent and simultaneous use. This study highlighted the emerging literature surrounding theories on single and polysubstance predictors relating to sensation seeking, ACE scores, sexual risk, and sexual assault. This study begins to fill the gap in the literature regarding simultaneous and concurrent polysubstance use. Next, my intentions, methods, and results are presented. I conclude with the need for further research and how this research can impact the community.

CHAPTER TWO: LITERATURE REVIEW

Defining Polysubstance Use

The discussion of polysubstance use began to gain more attention in the 1990s. However, the discussion of taking two or more drugs together so that the effects overlap emerged more frequently in recent literature. Critical recent discussion has focused on the importance of terminology (Crummy et al., 2020; Bunting et al., 2021; Zuckermann et al., 2020; Cicero, 2020). Polysubstance use has been used in the literature as an umbrella term to cover many different behaviors. A general definition that is frequently used in research was coined by Connor et al. (2014). It states that polysubstance use is "the consumption of more than one drug over a defined period, simultaneously or at different times for therapeutic and/or recreational purposes" (p. 4). When Connor et al. (2014) state that polysubstance use can refer to either simultaneous or concurrent use as an umbrella term, it causes a lack of clarity when comparing findings across studies when they don't specify the type of polysubstance use. For example, polysubstance use can refer to using more than one substance within a matter of months (Crummy et al., 2020; Ives & Ghelani, 2006; Reyes et al., 2013; Font-Mayolas et al., 2013).

Ives & Gherlani (2006) explain that polysubstance use is often separated into two categories: time and effect. The term is also often used to explain using more than one drug within a short time so that the effects overlap (Crummy et al., 2020; Ives & Ghelani, 2006; Bunting et al., 2021; Connor et al., 2014, as cited in Fernandez-Calderon et al., 2020; Barret et al., 2006). Most current research relies on time categories by asking about drug use within a retrospective period instead of evaluating the overlap of effects. However, it is essential to differentiate the two due to the very different effects these forms of polysubstance use present to the user. Ives & Gherlani (2006) explain that researchers are commonly looking at concurrent

use when evaluating time categories and may use a retrospective period to indicate polysubstance use. For example, using two or more substances within 30 days would demonstrate a time category.

Polysubstance use is applied in literature as an umbrella term. Most research has further divided polysubstance into a few different subcategories: Simultaneous use, Concurrent use, and Sequential use (Crummy et al. 2020; Ives & Ghelani 2006; Reyes et al. 2013; Font-Mayolas et al. 2013). There have been common themes within the literature, which are important to understand.

Simultaneous use, although its operationalization varies across different studies, is frequently defined as taking two or more substances in the same setting in which the effects of more than one drug overlapped (Ives & Ghelani, 2006; Bunting et al., 2020; Connor et al., 2014, as cited in Fernandez-Calderon et al., 2020). This can mean that they are taken within the same time and location but can also mean that they were taken at different times, but the effects of the drugs were still overlapped (Crummy et al. 2020; Ives & Ghelani 2006; Bunting et al. 2020; Connor et al., 2014, as cited in Fernandez-Calderon et al., 2020; Barret et al. 2006). Sokolovsky et al. (2020) defined simultaneous use as “at the same time so that their effects are overlapped” (p. 6). Other researchers that Sokolovsky et al. (2020) evaluated used terminology such as “at the same time” (Brière et al., 2011; Earleywine and Newcomb, 1997; Midanik et al., 2007), “on the same occasion/event” (Collins et al., 1998; Pape et al., 2009), “within three hours” (Martin et al., 1996a, 1996b), “in combination” (Pakula et al., 2009) and “so the effects overlap” (Terry-McElrath et al., 2013). These examples are representative of the diverse range of definitions present in current literature and are demonstrated in Table 1.

Defining simultaneous use becomes complex as it can be measured by time or overlap of effects (Ives & Ghelani 2006). Many researchers use the Addiction Severity Index (ASI), which measures use within the last 30 days (Padyab et al., 2018) and employ it to measure concurrent use. Concurrent use has generally been used to explain that a particular drug was taken within a given time (Crummy et al., 2020; Ives & Ghelani, 2006; Reyes et al., 2013; Font-Mayolas et al., 2013). Similar to the ASI, usually, when referring to concurrent use, a researcher will ask participants what drugs they have used within a period (i.e., 30 days, three months, six months).

Sequential use is often defined as taking more than one substance on different occasions (Crummy et al., 2020). Sequential use is often similar or the same as simultaneous use. Although some individuals who engage in sequential polysubstance use may also engage in simultaneous use, some researchers do not differentiate between the two patterns. An example of sequential use would be taking one drug and then a few hours later taking an additional drug. This term still implies that the effects may be overlapped but frequently indicates that the use of the two (or more drugs) were spaced out and may have been taken within several hours of each other. This definition is similar to some simultaneous use definitions (Ives & Ghelani, 2006; Bunting et al., 2020; Connor et al., 2014, as cited in Fernandez-Calderon et al., 2020).

Acronyms developed within recent literature include Simultaneous Polysubstance Use (SPU), Concurrent Polysubstance Use (CPU), and Polysubstance Use (PSU). Co-use and multi-drug use have also been used interchangeably, with polysubstance use as the umbrella term to describe the use of more than one substance (Ives & Ghelani, 2006; Olthuis et al., 2012; Bailey et al., 2019). These linguistic issues can present serious problems within literature and confuse the reader and other researchers when trying to compare findings across different studies. Although substance use research offers an abundance of content analyses and systematic

reviews, there do not appear to be reviews that specifically analyze polysubstance terminology. Researchers are now tasked with interpreting how each study defines these terms and how they differ across studies. I compiled the most frequently used definitions in literature to avoid adding more confusion to the terminology.

The lack of consistent terminology within simultaneous and concurrent polysubstance use presents a great need to create standard definitions and units of measurement. Lacking consistent terminology presents a barrier to this research and future research on this topic. Currently, research resorts to ill-defined terms, which frequently confuses the reader when comparing data across different studies. Many present-day surveys (such as Monitoring the Future data) are missing the importance of measuring simultaneous use. National substance use surveys only measure concurrent use, so they may miss essential research disparities between polysubstance use types and be unable to show the pattern of use that causes most overdose deaths. Although polysubstance use research offers essential contributions to substance use research, there has been a lack of data reflecting simultaneous use. I explore the meaning of simultaneous use and why the study of simultaneous use is critical.

Terminology and how it is frequently used within literature is listed in Table 1. This table showcases the vast array of terms used and the differing definitions for each.

Table 1. Different Terms Used Within Polysubstance Research

Term	Acronyms	Defined As	Defined By
Polysubstance use	PSU	"A person is considered a polysubstance user if they use more than one substance including use of multiple drugs on separate occasions or at the same time" (p. 2); "refers to these unique patterns of use of more than one drug. PSU can be simultaneous, sequential or regular interval" (p. 1); "the use of multiple substances" (p. 2); "sample as the co-occurring, nonmedical use of any of the following drug classes: nicotine, marijuana, excessive alcohol use defined as having more than 4 drinks in a single day, antidepressants, anxiolytics, muscle relaxants, prescription sleep medications, prescription stimulants, crystal meth, crack or cocaine, hallucinogens, and MDMA... within the last month"(p. 245)	(Crummy et al. 2020; Bunting et al; Zuckermann et al. 2020; Cicero 2020
Polydrug use		"The use of more than one drug" (p. 226) is often used interchangeably for polysubstance use.	Ives & Ghelani 2006
Co-use		The use of more than one substance is often used as a synonym for simultaneous use: "simultaneous use of two substances" (p. 1)	Olthuis et al. 2012; Bailey et al 2019
Simultaneous use	SPA	Using multiple drugs at the same time, "the use of two or more substances on the same occasion" (p. 2); "Two or	(Crummy et al. 2020; Ives & Ghelani 2006; Bunting et al.

Term	Acronyms	Defined As	Defined By
		more substances at the same time” (p.226); “the use of different substances during a single consumption session, with overlapping effects” (p. 1); “the tendency to administer multiple substances concomitantly” (p. 325)	2020; Connor et al., 2014, as cited in Fernandez-Calderon et al., 2020; Barret et al. 2006;
Concurrent use	CPU	Using multiple drugs at the same time; "the use of different drugs over a drug-using career" (p. 226); use of two or more substances within the last month; two or more substances used within the last six months; use of two or more substances within the last year	(Crummy et al., 2020; Ives & Ghelani, 2006; Reyes et al., 2013; Font-Mayolas et al., 2013; Kelly et al.).
Sequential use		Using multiple drugs on different occasions; "one substance followed by another" (p. 1); the order in patterns of administration when using more than one substance regarding when they are used and their doses	(Crummy et al., 2020; Bunting et al., 2020; Barrett et al. 2006)
Regular interval use		“two or more substances used in the same day/week/month” (p.1)	Bunting et al. 2020;
Concomitant use		To administer simultaneously	Barrett et al., 2006
Multidrug intoxication		“Using multiple substances at once, as well as heavy binge drinking, moderate marijuana, crack/cocaine, prescription drug misuse, and low levels of heroin use.” (p. 1)	Sadeh et al., 2020

Term	Acronyms	Defined As	Defined By
Multi-substance use dependency		Being addicted to more than one substance.	Sadeh et al., 2020
Co-administer		Administering two or more substances concomitantly or otherwise referred to as simultaneous use	(Barrett et al., 2006; Olthuis et al., 2012).

Individuals at the greatest risk of accidental overdose are those who take a drug(s) while still under the effect of another drug (Valente et al., 2020). The mortality review report from the county in which this survey was administered (Orange County) stated that 64.3% of deaths were related to more than one drug in the body at the time of death (Medical Examiner's Office of Orange County Florida, 2019). Instances such as these appear to be on the rise. Fentanyl was present in almost 90 percent of overdose fatalities (Donley & Hall, 2021). Fentanyl has been the driving force of a large portion of these polysubstance use overdoses (Medical Examiner's Office of Orange County, Florida, 2019). As the community continues to experience the rise of fentanyl, it is likely that polysubstance overdose will also continue to rise.

The Importance of Polysubstance Research

When accounting for alcohol, cigarettes, vaping, and marijuana, many people may engage in polysubstance use without acknowledging the risk. Most research currently focuses on general use within a time period (e.g., 30 days, three months, six months, and 12 months) (Crummy et al., 2020; Ives & Ghelani, 2006; Reyes et al., 2013; Font-Mayolas et al., 2013). Onyeka et al. (2012) found that there was an average of 3 substances used among individuals who were dependent on drugs. This number has likely increased now with the presence of fentanyl and other dangerous analogs in the drug supply. Zuckermann (2020) evaluated substance use by high school students and found that of the 39% who reported using substances, 53% reported that they use three or more substances. The most common combination among youth in this study was drinking alcohol and vaping. Among those who reported using three or more substances, youth were most likely to participate in alcohol, vaping, and marijuana. This study reviewed use within the last month and did not differentiate between those who used simultaneously versus those who used concurrently.

In addition to recreational use, the National Epidemiological Survey on Alcohol and Related Conditions (NESARC) found that there was a significant correlation between adults diagnosed with a Substance Use Disorder (SUD) and dependence on more than one substance (McCabe et al., 2017) included 56.8% of prescription opioid users who had another SUD and 97.5% of those diagnosed with a hallucinogen disorder. Compared to this, only 15% of those diagnosed with an alcohol use disorder also had a co-occurring SUD. These researchers also found that those with multiple substance use disorders also had a higher likelihood of mood, personality, and other psychiatric disorders. In this study, those who were most likely to have multiple SUDs included males and young adults. Those who use more than one substance are also at a higher risk of overdose and poorer physical health (Connor et al., 2014).

It is important to acknowledge opioid use presence within polysubstance use when evaluating overdose deaths. In the first half of 2018, 62.6% of opioid overdose deaths presented with another drug in their body (Gladden et al., 2019). As stated previously, polysubstance use increases the individual's odds of overdose. By providing education on the risks associated with polysubstance use, the community can raise awareness on how to prevent overdose.

Deadly Combination

Although some individuals who engage in substance use are aware that they are simultaneously taking more than one substance, not all users are aware that their preferred drug may be laced with another drug at the time of consumption.

Recently, fentanyl has spiked within the drug market. The Centers for Disease Control and Prevention (CDC) has declared synthetic opioids, such as fentanyl, as the driving force within the third wave of the opioid crisis (2021). It is not easy to examine how many individuals know what drugs are in their supply without accurate testing. Fentanyl in the current drug market

is mostly illicitly made and is highly potent. This drug offers a cheap price tag, so it is often mixed with other drugs by drug dealers to increase their profit margin. Many users may be unaware of its presence, making it especially deadly. A study conducted by Valente et al. (2020), for example, reported that most heroin users acknowledged that there is a high possibility that their drugs may be laced with fentanyl. However, some participants reported that the drugs they accessed were "pure." While some individuals who use heroin know they are at increased risk for fentanyl exposure, those who do not use opioids may not be aware of their exposure risk. Death reports offer important insight into the current crisis and other drug trends.

The Need for Polysubstance Overdose Knowledge in Orange County

Following Florida reports, approximately 14 Floridians die from an overdose each day (Orange County Opioid Advisory Committee, 2021). With fentanyl in the drug supply, polysubstance use deaths are becoming more frequent (Medical Examiner's Office of Orange County, Florida, 2019). The medical examiner stated that 2,499 of the 2,882 cocaine deaths involved another drug (Delcher et al., 2020). In Orange County alone, fentanyl was present in 83% of accidental overdose deaths from January to June 2021 (Orange County Opioid Advisory Committee, 2021). From 2018 to 2020, there was a 62% increase in overdose calls. From July 2020 to July 2021, there were 2,720 suspected overdoses, including six fatalities. (Orange County Opioid Advisory Committee, 2021). The Orange County Medical Examiner's report indicated an average of two drugs present in the body at death, and 64.3% of overdose deaths included two or more drugs. Over 25% of the deaths included three or more drugs in the body (Medical Examiner's Office of Orange County, Florida, 2019). These deaths reflect the dire need for polydrug research in our county and many other U.S. counties that show the same trend in fatalities.

Predictors of Polysubstance Use

Although many researchers have sought to identify predictors of polysubstance use, it is difficult to draw meaningful conclusions from research that defines and measures polysubstance use in different ways. Most current research that investigates predictors of polysubstance use focuses on concurrent use and does not separate simultaneous use from concurrent use. It is important to note that simultaneous and concurrent polysubstance use are not mutually exclusive terms and those who engage in simultaneous polysubstance use are also considered concurrent users. Simultaneous use may have different predictors than concurrent use and therefore is an important aspect when interpreting polysubstance use. Despite this, some research has found significant correlations between polysubstance use and specific mental health symptoms and personality traits (Bailey et al., 2019). Along with this, the age of first use (Lopez-Quintero et al., 2011), how the drug is administered, e.g., by injection or smoking (Valente, 2020; Barret, 2006), and poor treatment outcomes (Sadeh et al., 2021; Manhapra & Rosenheck, 2021) are also significantly related to concurrent polysubstance use. By better understanding why and who engages in simultaneous and concurrent polysubstance use, we can better target and provide adequate prevention, services, and harm reduction measures to groups at most risk.

Polysubstance use is most prevalent among individuals in their twenties than in other age groups. In one study, 42% of simultaneous polysubstance users fell into the 22-29-year-old age group (Fernandez-Calderon et al., 2020). Olthuis (2020) found that except for alcohol, tobacco, and cannabis, individuals aged 18-22 years were the most susceptible to trying less common and more risky substances for the first time.

Other demographic characteristics are also associated with the likelihood of polysubstance use. Fernandez-Calderon et al. (2020) found that those who were more likely to be polysubstance users included those who were male, had a low academic level and were non-

heterosexual. Joseph & Chacko, 2020 argue that sexual minority populations are more likely to experience discrimination and other forms of trauma linked to substance use as coping mechanisms. Orange County data indicates a trend in overdoses among white males (Donley & Hall, 2021).

Along with demographic factors, other predictors of polysubstance use include the type of drug and the increased likelihood to be used together compared to other combinations of substances. Individuals who use needles to inject their drugs are more likely to be polysubstance users than non-injection users (Schneider et al., 2019). Winkelman et al. (2018) found that more than 50% of individuals who use heroin also use sedatives and other tranquilizers. Between 83 and 92.3% of heroin users also use prescription pills. Valente et al. (2020) found that over 90% of heroin users also use cocaine. This study looked at injection users and found that over half of the sample (53%) reported using five or more different substances.

Polysubstance Use and Sensation Seeking

Zuckerman described sensation-seeking as "a trait defined by the seeking of varied, novel, complex, and intense sensations and experiences, and the willingness to take physical, social, legal, and financial risks for the sake of such experience." Sensation-seeking was coined as a personality trait in the early 1960s and was used to describe individuals who seek out new and exciting experiences (Zuckerman, 1994, p. 27). In 1964, the Sensation Seeking Scale, or SSS, was created. This scale was critiqued for its low reliability (Mehrabian & Russell, 1973) and has not been utilized very often in its original form (although adaptations were subsequently developed). It was also often critiqued for forced responses and outdated terms (Arnett 1994). Thus, responses were not all-inclusive, and respondents were sometimes expected to choose an answer that did not effectively represent their personality.

The base of this scale was used to create other scales. For example, the Sensation Seeking Scale for Children (Russo et al., 1993), the Arnett Inventory of Sensation Seeking (Arnett, 1994), and the Brief Sensation Seeking Scale (BSSS) (Hoyle et al., 2002) were created using the fundamental basis of the SSS-V but adjusted to fit appropriate and fit populations. The BSSS was also created in two versions, one containing four questions and the other containing eight. These revised scales continue to measure the original four subcategories: thrill and adventure, experience-seeking, disinhibition, and boredom susceptibility (Zuckerman, 1994).

Although these scales have been used in research since their creation, the BSSS-8 has gained popularity due to its reliability and short response time. The BSSS-8 retraced questions from the original SSS-V but utilized a Likert scale instead of a two-option response. It contains eight questions and retains the four subcategories scaling established by Zuckerman (1994) as mentioned prior (2 questions per category). Hoyle et al. (2002) found validity in this scale when comparing it to the SSS-V and found that it could measure sensation-seeking traits and the 40-question scale. This study validated that the BSSS-8 represented the same validity across age, sex, and ethnicity demographics.

Researchers have generally found that sensation seeking is positively associated with engagement in substance use. Examples include a study (Eze et al., 2020) that found that a high level of sensation seeking, assessed with the BSSS-8, was associated with engagement in substance use. They also found no differences between genders when evaluating if sensation-seeking led to the use of multiple substances. Pechorro et al. found no significant differences between genders when utilizing the BSSS to examine drug use behaviors (2018). Hildebrandt et al. (2020) found similar results but differentiated between substance use and addiction. Although sensation seeking predicted substance use, it did not predict addiction. Gonzalez Ponce et al.

(2019) found similar results when studying a sample of those who attend music festivals. Although this study did not use the BSSS-8, it measured sensation seeking and found that those who scored higher in sensation seeking were most likely to use cannabis, mushrooms, LSD, ketamine, and poppers. Although there was a relationship between sensation seeking and polysubstance use, individuals who engaged in more substance use were also more likely to use harm reduction measures than individuals who used single substances. Although sensation-seeking traits predicted the increased likelihood of participating in polysubstance use, this study found that individuals high in sensation seeking often set limits on the quantity of drugs they used, took smaller doses, avoided mixing stimulants, and would wait for the effects of a drug to set in before taking more.

Individuals high in sensation-seeking tend to seek stimulating and arousal experiences (Roberti, 2004). Bardo et al. (1996) explained that these neural reward pathways present with sensation-seeking are similar to those of substance use. This study supports previous literature and provides an important aspect for understanding polysubstance use. Although there has been research on how sensation-seeking predicts substance use (Hildebrandt et al., 2020; Pechorro et al., 2018; Eze et al., 2020), there is no research to my knowledge that examines how it directly relates to simultaneous polysubstance use. There currently is no known research on if sensation-seeking using the BSSS-8 predicts simultaneous polysubstance use. This is important considering there may be different risk factors for those who engage in simultaneous use versus those who engage in concurrent use.

Polysubstance Use and ACE Scores

According to existing literature, there is a strong positive association between childhood trauma and substance use (Fletcher, 2020; Forster et al., 2017; Shin et al., 2017). One way to

quickly assess trauma present in one's childhood is the Adverse Childhood Experience (ACE) questionnaire. This questionnaire is widely used by mental health agencies and researchers (Center for Disease Control and Prevention, 2021). This scale contains ten questions regarding overall household dysfunction experienced before the age of 18. This includes questions regarding if someone in the household had experienced mental health or substance use. The ACE is easy to administer and captures the different forms of abuse or trauma that may be present in childhood (Center for Disease Control and Prevention, 2021). The CDC (2021) reports that 61% of adults reported at least one ACE. Forster et al. (2017) found that between half and three-fourths of participants had been exposed to at least one ACE. They also found that 1 in 6 adults scored higher than 4.

Although ACEs are common, those who are at higher risk for later health issues (Felitti et al., 2019) and psychological problems (Center for Disease Control and Prevention, 2021), including drug use, are those who report more than 4 ACEs (Forster et al., 2019). For individuals who experience traumatic experiences, drugs may serve as a coping strategy (Peles et al., 2014). Individuals who experience sexual abuse are at an increased risk for substance and multi-drug dependency (Shand et al., 2011). In a sample of women who checked into a substance abuse center, 68% had a history of sexual abuse (Mendoza-Melendez et al., 2018). Heavy users were more likely than recreational users to report childhood maltreatment and abuse (Sadeh et al., 2021). This demonstrates that substance use approaches and treatment should consider the presence of early childhood traumatic experiences.

Although there is extensive research linking childhood trauma to substance use, less is known about the associations between childhood trauma and polysubstance use. Of the research that has analyzed these relationships, there appears to be a relationship between childhood

trauma and polysubstance use. Forster et al. (2017) found a positive correlation between concurrent polysubstance use and ACE scores. There does not appear to be any research that evaluates the association between simultaneous use and ACE scores. ‘

There is no known research on polysubstance and ACE scores within Orange County. There is, however, research on general drug use and ACE scores. Among Orange County, FL youth, the average ACE score of youth participating in the 2020 Florida Youth Substance Abuse Survey: Orange County (2021) was 1.8, and over 18% of youth reported an ACE score of 4 or more. Substance use was significantly correlated with ACE scores when looking at youth trends. Of youth who reported four or more ACEs, 28% reported alcohol use, compared to only 18% of youth who had an ACE score below four. This trend is also represented in youth who vape and use marijuana. Youth who reported ACE scores above four were over 1.5 times more likely to vape or use marijuana. Although research has heavily focused on the link between ACE scores and substance use, the research on simultaneous polysubstance use is lacking (Center for Disease Control and Prevention, 2021). It is important to assess if there is a difference between simultaneous use and concurrent polysubstance use due to the difference in risk factors for each. Education and prevention can be directed at each group by examining who is at most risk for simultaneous polysubstance use.

Polysubstance Use, Incapacitated Sexual Assault, and Sexual Risk

Having a higher number of sexual relationships can present different risks, including adverse health outcomes such as contracting or transmitting an STI or experiencing unwanted pregnancy (Hoyle, Fejfar, & Miller, 2000). Previous research has found a positive association between drug use and the number of sexual partners. However, little is known about how number

of sexual partners relate to simultaneous and concurrent polysubstance use. (Bobashev, Zule, Osilla, & Wechsberg, 2009; Dir, Coskunpinar, & Cyders, 2014; Hoyle et al., 2000).

Little is also known about how simultaneous polysubstance use relates to an individual's likelihood of victimization, but there is an abundance of research that assesses these associations with single drug and alcohol use (Bobashev, Zule, Osilla, & Wechsberg, 2009; Dir, Coskunpinar, & Cyders, 2014; Hoyle et al., 2000). It is important to note that although there is a relationship between these variables, it does not appear to be a causal relationship but instead appears that they co-occur. In other words, people who use drugs tend to be in spaces where people have sex frequently (i.e., alcohol and sex in bars and clubs) and substance use is often used following victimization as a coping mechanism, such that there is likely a bidirectional relationship between substance use and victimization (Bersamin et al., 2012; Feltmann et al., 2021).

One common form of victimization is sexual violence (Ataiants et al., 2022). A study on the college population found that 61.5% of sexual violence victims reported being under the influence of alcohol when the assault took place. Along with this, 20.8% of victims reported using drugs and alcohol prior to the assault (O'Callaghan & Ullman 2021). This is in line with previous research that states that over 45% of undergrad college women are under the influence of alcohol during a sexual assault (Gilbert et al., 2019). Other research has also reported a correlation between sexual assault and marijuana use among young and college-age adults (Stefansen et al., 2020; Bonar et al., 2020). These relationships cannot be assumed to be causal, but instead, it is important to recognize the relationship as co-occurring. Those who have been victimized may be using substances as a coping strategy (Peles et al., 2014). Understanding incapacitated sexual assault, and substance use is important due to higher rates of victim-blaming, self-blame, and avoiding coping strategies employed (Lorenz & Ullman, 2016; Peter-

Hagene & Ullman, 2018). Along with this, incapacitated sexual assault lowers the chance of the victim going to the police and raises the chances of mental illness and substance use (Kilpatrick et al., 2007).

Current literature often studies the association between drug use and sexual violence but focuses on single substance use (Stefansen et al., 2020; Bonar et al., 2020). Since there may be different risks associated with participating in simultaneous polysubstance use, it is important to analyze the relationship between sexual risk, sexual violence, and polysubstance use.

Theory Implications

This paper focuses on the concepts of Problem Behavior Theory (Jessor & Jessor, 1977), a social psychological theory that explains how drug use is based on personality, environment, and behavior. The basic concepts of this theory are derived from Social Learning Theory (Rotter 1954) and Merton's (1957) concept of anomie (Jessor, 2001). The original theory was developed to explain problem drinking in adolescence. This theory was used to guide the questions asked and explain the survey findings.

The survey reflects how personality traits such as sensation-seeking relate to simultaneous polydrug use. Personality, environment, and behavior are viewed as some of the most effective systems (Jessor, 2001). According to this theory, personality is represented by three components: motivational-injection structure, a personal belief structure, and a personal control structure.

Along with personality, Jessor & Jessor (1977) argue that drug use is correlated with the perceived environment. The environment in this survey focuses on the environment that was present during childhood. Although some research (Finan et al., 2017) has focused on parental problem drinking in childhood and adult problem behavior, this theory is not frequently used to

support adult problem behaviors. This is also the first time this theory will be used to utilize the ACE questionnaire. One focus will be on how childhood abuse and neglect relate to simultaneous polydrug use.

The final component of Problem Behavior Theory includes behavior. Problem behavior is explained by Jessor & Jessor (1977) as any behavior that is not seen as socially acceptable. Problem behaviors include participating in drug use since this is seen as sociologically deviant. This paper will examine how simultaneous polysubstance use relates to both personality and environment.

CHAPTER THREE: METHODOLOGY

Present Research

In this article, I do not distinguish between those who use drugs recreationally from those who are addicted to substances. The survey assesses substance use and does not measure if addiction is present. Polysubstance use is assessed, and problem behaviors are not assessed. Researchers should not assume that those who use substances experience addiction. Congruent with Carl Hart's book *Drug Use for Grown-Ups: Chasing Liberty in the Land of Fear* (2021), most of those who use substances never experience problem behavior. He argues that most individuals who use drugs are recreational users and when drugs are used responsibly. Despite this, most research focuses on addiction and does not differentiate between addiction and use.

In addition, this research evaluates both simultaneous and concurrent use. Simultaneous use in this paper refers to an individual's past six months of using another substance with alcohol so that the effects overlap. Concurrent use in this paper refers to an individual's past six months of using any two substances (regardless of whether or not their effects overlap). Although it is easier to measure concurrent use, simultaneous use poses much more danger to the user according to overdose trends and therefore offers importance in understanding overdose prevention.

This present research is designed better to understand predictors of simultaneous and concurrent polysubstance use as defined above and compare differences in the two models. This research will examine demographic factors, sensation seeking, adverse childhood experiences, sexual risk behavior, and sexual assault victimization. Based on the previous literature, the following research questions and hypotheses were generated:

Research Questions

- What demographic factors are associated with simultaneous and concurrent polysubstance use?
- Is sensation-seeking associated with simultaneous or concurrent polysubstance use?
- As measured by the ACE questionnaire, does childhood trauma predict engagement in simultaneous or concurrent polysubstance use?
- Are sexual risk behavior and sexual assault victimization associated with simultaneous or concurrent polysubstance use?

Hypotheses

- Hypothesis 1: Demographic factors will be associated with simultaneous and concurrent polysubstance engagement. Individuals who engage in simultaneous and concurrent polysubstance use will likely be younger, white, and male.
- Hypothesis 2: Individuals who engage in simultaneous or concurrent polysubstance use will report higher sensation seeking.
- Hypothesis 3: Individuals who engage in simultaneous or concurrent polysubstance use will report higher ACE scores.
- Hypothesis 4: Those who engage in simultaneous or concurrent polysubstance use will report higher numbers of sexual partners and will be more likely to report sexual assault.

Participants and Procedures

The data collected are from the *CARA Orange County Residents Survey (2021)*, which the Orange County Drug Free Office conducted. Funding came from a federal grant awarded to the Orange County Drug Free Coalition. This survey, conducted using Qualtrics, includes 735

participants aged 18 years and older. A Qualtrics panel was used for this survey to accommodate the large pool of participants with demographic and diversity characteristics within the pool of Orange County, Florida residents. Eligibility criteria included age and Orange County residency.

Qualtrics managed the recruitment process and compensated participants for completing the survey (\$10). The survey was available in both English and Spanish, and participants were oversampled for those aged 18-40 years, as these are the individuals most affected by overdose deaths. The survey was distributed to a previously established panel of respondents. No personal identifying information was collected. Participation was voluntary, and a participant could exit the survey at any time.

Along with this, Qualtrics managed the panel to ensure participants were similar to the demographics of Orange County, FL. Compensation was dependent on completing the questionnaire. Qualtrics managed the cleaning of the data to remove speeders, cheaters, straight liners, and poor-quality responses. Qualtrics managed this process, and the Orange County Drug Free office did not receive information on missing responses or why respondents were removed.

Because the survey was distributed through the Orange County Drug Free Coalition, it did not require an initial IRB. Subsequently, the University of Central Florida's Institutional Review Board process required for secondary data and was approved on October 26, 2021.

The survey included questions about perceptions of polysubstance use, participants' substance use, harm reduction measures used, and knowledge of Narcan and Good Samaritan laws. This survey also included a Brief Sensation Seeking Scale (BSSS-8) and an Adverse Childhood Experiences (ACE) questionnaire. I was a primary contributor to crafting the survey.

Measures

Substance Use

Concurrent polysubstance use

The concurrent polysubstance use variable was created with the Drug History Questionnaire (DHQ). According to previous research, an option for nicotine was added because it is one of the most common substances used with other substances (Zuckerman et al., 2020; Barrett et al., 2006). Participants could choose multiple substances used within the last six months. The time frame was chosen to be consistent with the previous CARA survey (2020) administered the year previous. Examples for each class of drugs were provided to make it clearer for the participant. The options included:

- Alcohol
- Cannabis: Marijuana, hash oil, pot, weed
- Stimulants: Cocaine, crack, blow
- Stimulants: Methamphetamine - meth, ice, crank
- Amphetamines/other stimulants: Ritalin, Adderal, Vyvance
- Benzodiazepines/tranquilizers: Valium, Librium, Xanax, Diazepam, roofies, downers
- Sedatives/hypnotics/barbiturates: Amytal, Seconal, Dalmane, Quaalude, Phenobarbital
- Heroin: smack, scat, brown sugar, dope
- Street or illicit methadone
- Other opioids: Percocet, Opium, Morphine, Hydrocodone, Oxycodone
- Hallucinogens: LSD, PCP, mescaline, peyote, mushrooms, ketamine, ecstasy
- Inhalants: glue, gasoline, aerosols, paint thinner, poppers, rush, whippets

- Steroids: Deca-Durabolin, Durabolin, Equipoise, Winstrol, Anadrol, Oxandrin, roids, juice
- Illegal use of prescription drugs (describe)

Due to an error in survey programming in which participants were forced to respond before moving to the next question and no "does not apply" option was provided, all participants had to select at least one substance to move forward. Accordingly, participants who selected more than one option were coded as engaging in polysubstance use. It was impossible to differentiate between individuals who used just one substance in the past six months and individuals who did not use any substances in the past six months; therefore, both were included in a single group based on their selection of just one option from the list. The final variable was thus coded dichotomously such that 1 = the presence of the past six months concurrent polysubstance use and 0 = the absence of the past six-month concurrent polysubstance use).

Simultaneous polysubstance use

To assess simultaneous polysubstance use, participants were also asked two questions about whether they used any of the drugs listed in the DHQ (as listed above) in combination with 1) alcohol or 2) opioids. These were two separate questions, and participants were only directed to this question if they responded that they used alcohol or opioids. According to mortality reports, these two drugs were chosen based on the high likelihood of use (Zuckerman et al., 2020; Barrett et al., 2006) and because they are the most dangerous when combined with another drug (O'Donnell et al., 2020). According to research, alcohol often is used with other drugs, especially nicotine and marijuana (Zuckerman et al., 2020). Opioids were chosen due to their dangers when combined with other drugs. Last year in Orange County, 87.6% of the overdoses

showed the presence of fentanyl (Donley & Hall, 2021). Specifically, participants were asked the following two questions:

- Have you taken any of the following in the last six months while also consuming alcohol?
- Have you taken any of the following in the last six months while also consuming opioids (prescription opioids, heroin, non-prescribed fentanyl, etc.)?

Simultaneous use was defined as using one or more substances and alcohol or opioids.

The questions were asked as bulleted above. These are dichotomous variables and were coded as 1 (the participant engages in simultaneous polysubstance use) or 0 (the participant does not engage in simultaneous use). Due to low endorsement ($n=36$) of opioid use with another substance in this sample, this question was not included in the analyses below and instead focused just on simultaneous substance use, including another substance at the same time as alcohol in the past six months.

The concurrent and simultaneous use variables are included in two separate models representing the different kinds of polysubstance use.

Sensation Seeking

Participants completed the 8-item Brief Sensation Seeking Scale (BSSS-8), published by Stephenson et al. in 2003, a condensed version of the Original Sensation Seeking Scale published in 1978. The original Sensation Seeking Scale contained 40 questions and measured the same four categories: thrill and adventure seeking, experience-seeking, disinhibition, and boredom susceptibility.

The questions asked of participants were presented as a Likert scale with response options ranging from strongly disagree (0) to strongly agree (5) as follows:

- I would like to explore strange places
- I get restless when I spend too much time at home
- I like to do frightening things
- I like wild parties
- I would like to take off on a trip with no pre-planned routes or timetables
- I prefer friends who are excitingly unpredictable
- I would like to try bungee jumping
- I would love to have new and exciting experiences, even if they are illegal.

To produce a total sensation-seeking score, items were summed. Due to the forced response survey feature, there were no missing values. Sum scores produced a numerical range from 8 to 40, in which higher scores indicated higher sensation seeking.

Adverse Childhood Experience (ACE) Questionnaire

Participants were questioned about potential childhood trauma exposure using the Adverse Childhood Experience (ACE) questionnaire (Felitti et al. 1998), which includes inquiries about events that happened to them before the age of 18. This assessment is composed of 10 questions, and it refers to abuse, neglect, and overall household dysfunction. All questions can be answered by a yes or no response. The higher an individual scores on an ACE questionnaire, the more adverse experiences present within a participant's childhood, potentially leading to more negative lifelong experiences. ACE scores that have negative health effects are those over four. The sum of participants' scores is used in the analysis.

Sexual Risk Behavior and Incapacitated Sexual Assault

Because previous literature demonstrates that substance use co-occurs within the likelihood of victimization (Blayney et al., 2019; Bedard-Gilligan et al., 2011; Larimer et al., 1999), survey responses are evaluated to see if the same is true for polysubstance use. The survey contains two questions regarding sexual risk behavior and incapacitated sexual assault, one to assess each, respectively. These questions were selected based on other national surveys regarding sexual activity (University of Minnesota Medical School, 2003) and incapacitated sexual assault (Krebs et al., 2007), as listed below.

- **Sexual Partners:** Question 1 measures sexual activity by measuring how many sexual partners the participant has had in the past year. Respondents are asked: **“How many people have you been sexual with in the past year?”** Five options are presented to the participant: 0, 1, 2-3, 4-10, and more than 10. This question was used by the Program in Human Sexuality, Department of Family Practice and Community Health, University of Minnesota Medical School, 11/25/03. This variable is coded as 0-4, where 0 indicates a report of zero sexual partners and 4 accounts for those who reported over 10.
- **Incapacitated Sexual Assault Victimization:** **“Have you been a victim of unwanted sexual contact occurring when you were unable to provide consent or stop what was happening because you were passed out, drugged, drunk, incapacitated, or asleep?”** This question was based on the study conducted by Krebs et al. and assesses the participant’s ability to consent to sexual activity and measures incapacitated sexual assault (2007). This variable is coded as 0 for no incapacitated sexual assault and 1 for those who have been a victim of incapacitated sexual assault.

Demographics

Demographic questions were asked based on the previous *CARA Orange County Residents Survey (2020)*. Participants were asked about their age, race, ethnicity, gender, education level, and income. These were included as control variables in both bivariate analysis and logistic regression models.

Age

Participants were asked, "What is your age?" Participants were able to type their age. Again, those that participated in this survey had to be between the ages of 18 and 55.

Gender

To measure gender, participants were asked, "What is your current gender?" Participants were able to select from the options of 'man,' 'woman,' 'transgender,' 'a gender not listed here, and 'prefer not to answer. Due to the small sample of 'transgender,' 'a gender not listed here, and 'prefer not to answer' categories, these participants were not included in the analysis (n=10). Those who identified as men were then coded as 1 and those identified as women were coded as 0.

Race

To measure race, participants were asked, "How would you describe yourself?" Respondents were able to select from the options: 'White,' 'Black,' 'American Indian,' or 'Alaska Native,' 'Asian,' 'Native Hawaiian or other Pacific Islander,' and 'other.' This was a select all that apply question, since some individuals may identify with more than one race. These options were then each analyzed separately by race. Each was coded as 1 or 0. 1 indicated that they were included in a given race, or 0 indicated they did not identify with the given race.

Ethnicity

To measure ethnicity, participants were asked, "Are you of Hispanic, Latino, or Spanish origin?" Respondents were able to select yes or no. Those who identified as Hispanic, Latino, or of Spanish origin were then coded as 1, and those who responded no were then coded as 0.

Education

To measure education, participants were asked, "What is the highest degree or level of school you have completed?" Respondents were given the options of 'Less than a high school diploma,' 'High school degree or equivalent,' 'Trade school or other certification,' 'Some college, no degree,' 'Associates degree,' 'Bachelor's degree,' 'Graduate degree.' The responses were coded from the lowest level to the highest. For example, 'less than a high school diploma was coded as 1, and 'graduate degree' was coded as 7.

Income

To measure income, participants were asked "What is your gross household income (before taxes)?" Participants were then prompted to select one of the following: '\$15,000 or less', '\$15,001-\$25,000', '\$25,001-\$35,000', '\$35,001-\$45,000', '\$45,001-\$55,000', '\$55,001-\$65,000', '\$65,001-\$75,000', 'Over \$75,000'. These were then coded from the least amount value to the highest value amount. For example, '\$15,000 or less' was coded as 1 and 'over \$75,000' was coded as 8.

Data Cleaning

The survey was distributed between October 11, 2021, and November 11, 2021. After data collection reached completion, the project manager from Qualtrics sent a complete report, including raw data in an excel file. No partial responses were kept according to Qualtrics protocol. Qualtrics project manager scrubbed the data to remove speeders, cheaters, straight liners, and poor-quality responses. The Orange County Drug Free Office was not notified of any

removed participants. Once the excel file with all responses arrived, the data were exported to SPSS version 24 (IBM).

Once exported to SPSS and coded data as discussed previously, descriptive statistics and bivariate correlations were assessed. Frequencies, means and standard deviations provide basic information about the sample, including the percentage of participants who engage in simultaneous and concurrent polysubstance use, means and standard deviations for sensation seeking, and the number on the ACE.

CHAPTER FOUR: RESULTS

Preliminary Analysis

Seven hundred thirty-five participants completed the survey. A set of chi-square tests were used to evaluate the relationship between simultaneous and concurrent use and categorical variables such as gender, race, ethnicity, and sexual violence. An independent t-test analysis was used to describe the relationship between simultaneous and concurrent polysubstance use and continuous variables such as income, education, sensation seeking, ACE scores, and sexual risk behavior. Along with the bivariate analysis listed, two logistic regression analyses were conducted to examine the relationship between the independent variables (i.e., BSSS-8, ACE, sexual partners, and incapacitated sexual assault, along with demographic factors) and polysubstance use. The first model predicted simultaneous polysubstance use (i.e., using another drug with alcohol so that the effects overlap), and the second model predicts concurrent polysubstance use (i.e., the use of more than one substance in the last six months).

Model 1

- Dependent variable:
 - Simultaneous Polysubstance Use (Simultaneous polysubstance use/no simultaneous polysubstance use)
- Independent variables
 - Brief Sensation Seeking Scale -8 (BSSS-8) (scaling 8-40)
 - Adverse Childhood Experiences score (ACE) (scaling 0-10)
 - Sexual partners (0,1,2-3,4-10,10+)
 - Incapacitated sexual assault (yes/no)
- Covariates

- Race (White, Black, American Indian, or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, and other).
- Ethnicity (Hispanic, Latino, or Spanish origin/non-Hispanic, Latino, or Spanish origin)
- Gender (man/woman)
- Education (Less than a high school diploma, High school degree or equivalent, Trade school or other certification, Some college, no degree, Associates degree, Bachelor's degree, Graduate degree)
- Age (18-55)
- Income (\$15,000 or less, \$15,001-\$25,000, \$25,001-\$35,000, \$35,001-\$45,000, \$45,001-\$55,000, \$55,001-\$65,000, \$65,001-\$75,000, Over \$75,000)

Model 2

- Dependent variable:
 - Concurrent polysubstance use (concurrent polysubstance use/no concurrent polysubstance use)
- Independent variables
 - Brief Sensation Seeking Scale -8 (BSSS-8) (scaling 8-40)
 - Adverse Childhood Experiences score (ACE) (scaling 0-10)
 - Sexual partners (0,1,2-3,4-10,10+)
 - Incapacitated sexual assault (yes/no)
- Covariates
 - Race (White, Black, American Indian, or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, and other).

- Ethnicity (Hispanic, Latino, or Spanish origin/non-Hispanic, Latino, or Spanish origin)
- Gender (man/woman)
- Education (Less than a high school diploma, High school degree or equivalent, Trade school or other certification, Some college, no degree, Associates degree, Bachelor's degree, Graduate degree)
- Age (18-55)
- Income (\$15,000 or less, \$15,001-\$25,000, \$25,001-\$35,000, \$35,001-\$45,000, \$45,001-\$55,000, \$55,001-\$65,000, \$65,001-\$75,000, Over \$75,000)

Hypothesis 1 (H1) tests the relationship between the dependent variables, simultaneous and concurrent polysubstance use, and demographic factors including age, gender, race, ethnicity, income, and education. Continuous variables such as age, education, and income were analyzed in an independent t-test. In contrast, categorical variables such as gender, race, and ethnicity were analyzed in a chi-square test. Following these bivariate analyses, these independent and covariate variables were also included in logistic regression. Each variable was tested in 2 models with each of the dependent variables: simultaneous polysubstance use and concurrent polysubstance use. These analyses assess if demographic factors are associated with simultaneous and concurrent polysubstance use. Bivariate testing explains individual associations with demographic factors, and the logistic regression analyzes if these predictors remain related to polysubstance use after all factors are included.

Hypothesis 2 (H2) tests the relationship between the dependent variable, polysubstance use, and sensation seeking (BSSS-8). Two models were conducted to predict simultaneous and concurrent polysubstance use, respectively. An independent t-test was conducted first to assess

the relationship between sensation-seeking and both types of polysubstance. These variables were then included in two logistic regression models (for concurrent and simultaneous use) with other predictors and covariates. Bivariate testing explains individual association between sensation seeking and simultaneous and concurrent polysubstance use. The logistic regression will then assess if these predictors remain related to polysubstance use after all predicting factors are included in the model.

Hypothesis 3 (H3) tests the relationship between simultaneous and concurrent polysubstance use and Childhood Adverse Experiences (ACE) scores. An independent t-test examined the relationship between ACE scores and simultaneous and concurrent polysubstance use. This variable was then included in 2 logistic regression models that examined the relationship between ACE and simultaneous and concurrent polysubstance use and other predicting variables.

Lastly, Hypothesis 4 (H4) tests the relationship between polysubstance use and number of sexual partners and incapacitated sexual assault. A bivariate analysis included both chi-square and independent t-tests. Incapacitated sexual assault, as indicated as yes or no, was run in a chi-square analysis with both simultaneous and concurrent polysubstance use variables. Sexual risk, as indicated by the number of sexual partners, was analyzed in an independent t-test. Sexual risk and sexual violence were analyzed in two logistic regression models to predict simultaneous and concurrent polysubstance use respectively, to test associations when other predicting variables are present.

Demographics

Of the 735 participants, 50% participants identified as men (n=365), 49% were identified as women (n=357), and about 1% reported that their gender was not listed (n=3) or preferred not

to answer ($n=7$). To account for these differences within gender, gender was coded according to men and woman categories. Those who did not identify as men or women were excluded from gender analyses due to the small sample size. Other control variables such as race were coded according to the participant's identification. Participants were able to identify with more than one race. Those who identified as white (57.76%) were coded as "White," those who identified as "Black or African American" (25.32%) were coded as "Black," those who identified as "American Indian or Alaska Native" (3.82%) were coded as "Native," "Asian" (3.94%) was coded as "Asian," "Native Hawaiian or other Pacific Islander" (1.53%) was coded as "Islander," and "other" (7.63%) were categorized as "other." Ethnicity was coded as Hispanic, Latino, or Spanish origin (29.25%) or non-Hispanic, Latino, or Spanish origin (70.5%). A majority of the sample had at least a high school degree (96.6%; $n = 725$), and over a third of the sample had a bachelor's level degree or higher (35.92%; $n = 264$). Participants ages ranged from 18-55 years ($M = 32.72$, $SD = 10.29$). Ages 18-40 were over-sampled due to the higher risk of overdose.

Two variables were created to describe polysubstance use. Simultaneous substance use assessed whether participants used another substance simultaneously with alcohol in the last six months. 28.3% ($n = 208$) of the sample engaged in past 6-month simultaneous substance use with alcohol and another substance. Concurrent polysubstance use assessed whether participants used any two substances in the past six months. 42.3% ($n = 311$) of the sample engaged in the past six-month concurrent polysubstance use. Regarding incapacitated sexual assault, 21% ($n = 154$) reported that they had ever experienced incapacitated sexual assault, and 79.1% ($n = 581$) reported no history of incapacitated sexual assault. See Table 2 for demographic information.

Table 2: Demographics (n=735)

	Frequency	Percent
Gender (n=735)		
Man	368	50.07%
Woman	357	48.57%
Transgender	0	0
A gender not listed here	3	0.41%
Prefer not to answer	7	0.95%
Race (n=735)		
American Indian or Alaska Native	30	3.82%
Asian	31	3.94%
Black or African American	199	25.32%
Native Hawaiian or other Pacific Islander	12	1.53%
White	454	57.76%
Other (please specify)	60	7.63%
Ethnicity (n=735)		
Hispanic, Latino, or Spanish origin	217	29.52%
Not Hispanic, Latino, or Spanish origin	518	70.48%
Education (n=735)		
Less than a high school diploma	25	3.40%
High school degree or equivalent	173	23.54%
Some college, no degree	143	19.46%
Associates degree	107	14.56%
Bachelor's degree	178	24.22%
Graduate degree	86	11.70%
Trade school or other certification	23	3.13%
Household Income (n=733)		
\$15,000 or less	108	14.73%
\$15,001- \$25,000	72	9.82%
\$25,001-\$35,000	97	13.23%

	Frequency	Percent
\$35,001-\$45,000	92	12.55%
\$45,001-\$55,000	83	11.32%
\$55,001-\$65,000	60	8.19%
\$65,001-\$75,000	64	8.73%
Over \$75,000	157	21.42%
Concurrent Polysubstance Use (n=735)		
Uses two or more substances	311	42.3%
Uses one or no substances	424	57.7%
Alcohol Simultaneous Use (n=735)		
Uses other substances with alcohol	208	28.3%
Does not use other substances with alcohol	527	71.7%
Incapacitated Sexual Assault (n=735)		
Incapacitated sexual assault victimization	154	21.0%
No incapacitated sexual assault victimization	581	79.1%

Descriptive Statistics

Descriptive analysis for all scale variables included standard deviations and means. Table 3 includes the descriptive statistics of the sample. The mean score of the Adverse Childhood Questionnaire (ACE) was 2.78 (SD = 3.17), 0 indicated the lowest score, and 10 represented the highest score. These scores indicate that this sample overall had a low level of Childhood Adverse Experiences. About one third of the sample reported an ACE score of 4 or higher (32.5% n=239) An ACE score of four or higher has been used as a cut-off to establish a higher risk for negative health outcomes. The Brief Sensation Seeking Scale 8 (BSSS-8) had a mean score of 23.51 (SD = 8.01). The lowest score was an 8, with the highest being a 48. The number of sexual

partners had a mean of 1.10 (S.D. = .89). The lowest score was 0 compared to its highest score of 4, indicating 10 or more partners.

Table 3: Descriptive Statistics (N=735)

Variable	N	M	SD	min	max
ACE	735	2.78	3.17	0	10
Sensation seeking	735	23.51	8.02	8	40
Age	735	32.72	10.29	18	55
Gross Income	733	4.62	2.62	1	8
Education	735	3.21	1.89	0	6
Sexual partners	735	1.10	.89	0	4

Of those who engaged in concurrent polysubstance use (n = 311), 59.48% of participants engaged in concurrent polysubstance use were men (n = 182). White individuals were most likely to report concurrent polysubstance use (66.56%, n = 211). Those who reported Hispanic/Spanish nationality accounted for 29.26% (n = 91). Of those who reported incapacitated sexual assault(n = 154), 61.03% (n = 94) of them had reported polysubstance use. Of those who reported concurrent polysubstance use, 30.23% reported incapacitated sexual assault.

Of those who engaged in simultaneous polysubstance use (n= 208), 60.59% were male (n = 123). White individuals were most likely to report concurrent polysubstance use (67.79%, n = 141). Those who reported Hispanic, Latino, or Spanish ethnicity accounted for 23.08% (n = 48). Of those who reported incapacitated sexual assault (n=154), 38.31% (n = 59) reported

simultaneous polysubstance use. Of those who reported simultaneous polysubstance use, 28.37% reported incapacitated sexual assault.

Primary Analysis

Bivariate Analysis

To test all hypotheses, independent t-tests were conducted between the dependent variables (i.e., simultaneous polysubstance use and concurrent polysubstance use) and independent continuous variables, including sensation seeking, Adverse Childhood Experiences, and sexual risk, and age. Chi-Square analyses were conducted to assess the relationship between polysubstance use variables and dichotomous/categorical variables, including incapacitated sexual assault, gender, race, and ethnicity. Each test was run with a significant threshold of 0.05.

Independent t-tests were conducted to examine the relationship between concurrent polysubstance use and age, education, sexual partners, gross income, number of sexual partners, sensation seeking, and ACE scores. Individuals who engage in concurrent polysubstance use report significantly higher sensation seeking ($M = 27.29$, $SD = 6.98$) compared to individuals who do not engage in concurrent polysubstance use ($M = 20.74$, $SD = 7.60$), $-11.951(733)$, $p < .001$. Individuals who engage in concurrent polysubstance use report significantly higher number of sexual partners ($M = 1.38$, $SD = .91$) compared to individuals who do not engage in concurrent polysubstance use ($M = .89$, $SD = .82$), $-7.68(733)$, $p < .001$. Additionally, individuals who engage in concurrent polysubstance use report significantly higher ACE scores ($M = 3.77$, $SD = 3.47$) compared to individuals who do not engage in concurrent polysubstance use ($M = 2.03$, $SD = 2.73$), $-7.64(733)$, $p < .001$. Finally, individuals who engage in concurrent polysubstance use are significantly younger ($M = 31.58$, $SD = 9.31$) compared to individuals who do not engage in concurrent polysubstance use ($M = 33.56$, $SD = 10.90$), $2.58(733)$, $p < .001$.

This analysis indicated that there were no significant relationships between concurrent polysubstance use and education ($p=.376$), and income ($p=.136$).

Independent t-tests were conducted to examine the relationship between simultaneous polysubstance use and age, education, sexual partners, gross income, number of sexual partners, sensation seeking, and ACE scores. Individuals who engage in simultaneous polysubstance use report significantly higher sensation seeking ($M = 27.55$, $SD = 6.95$) compared to individuals who do not engage in simultaneous polysubstance use ($M = 21.91$, $SD = 7.86$), $-9.05(733)$, ($p<.001$). Individuals who engage in simultaneous polysubstance use report significantly higher number of sexual partners ($M = 1.35$, $SD = .88$) compared to individuals who do not engage in simultaneous polysubstance use ($M = 1.00$, $SD = .87$), $-4.89(733)$, $p<.001$. Additionally, individuals who engage in simultaneous polysubstance use report significantly higher ACE scores ($M = 3.88$, $SD = .24$) compared to individuals who do not engage in simultaneous polysubstance use ($M = 2.99$, $SD = .13$), $-6.11(733)$, $p<.001$. When evaluating simultaneous polysubstance use, there was no significant relationship with education ($p = .401$), age ($p = .121$), and income ($p = .872$).

Chi-square tests of independence were conducted to assess the relationship between concurrent polysubstance use and categorical variables, including gender, race, and ethnicity. The relation between gender and simultaneous polysubstance use was significant, $\chi^2(1, N = 725) = 22.19$, $p = (p<.001)$. Men (59%) were more likely than women (41%) to engage in concurrent polysubstance use. The relationship between individuals identifying as white and concurrent polysubstance use was significant, $\chi^2(1, N = 735) = 5.24$, $p = (p=.02)$. White individuals (67%) were more likely than non-white individuals (33%) to engage in concurrent polysubstance use. ($p=.022$). There was no relationship between concurrent polysubstance use and Hispanic/Latino

ethnicity (vs. not Hispanic/Latino) ($p=.893$) or those identified as Black (vs. not Black) ($p=.122$). This analysis did not include comparisons for other races due to the small sample size.

Additional chi-square tests of independence were conducted to assess the relationship between simultaneous polysubstance use and categorical variables, including gender, race, and ethnicity. The relation between gender and simultaneous polysubstance use was significant, $\chi^2(1, N = 725) = 14.35, p = (p<.001)$. Men (61%) were more likely than women (39%) to engage in simultaneous polysubstance use. The relation between individuals identifying as white and simultaneous polysubstance use was significant, $\chi^2(1, N = 735) = 4.45, p = (p=.04)$. White individuals (68%) were more likely than non-white (32%) individuals to engage in simultaneous polysubstance use. The relation between individuals identifying as Hispanic/Latino and simultaneous polysubstance use was significant, $\chi^2(1, N = 735) = 5.80, p = (p=.02)$. Hispanic/Latinos were less likely than non-Hispanic/Latino individuals to engage in simultaneous polysubstance use. Those identified as black had no relationship with engaging in simultaneous polysubstance use ($p=.244$). This analysis did not include other races due to the small sample size.

Logistic Regression

Logistic regression analyses were conducted to analyze relationships between the independent variables and the two polysubstance use variables (i.e., simultaneous and concurrent). This analysis was most appropriate for these data due to the presence of dichotomous dependent variables. Two models were analyzed for simultaneous and concurrent polysubstance use, respectively. The simultaneous polysubstance use model was conducted to predict whether participants used other substances while using alcohol in the past two months.

The concurrent model was conducted to predict whether participants used two or more substances within the last six months. Table 4 includes the full model results for simultaneous use (model 1) and concurrent use (model 2).

Simultaneous Use (Model 1)

Of the 735 participants, 203 reported simultaneous polysubstance use. The logistic regression analysis results indicated that all demographic factors, such as age, race, ethnicity, gender, education, and income, were not significantly associated with simultaneous polysubstance use. However, as hypothesized, sensation seeking, ACE scores, and the number of sexual partners (risk) were significantly associated with simultaneous polysubstance use. When participants scored higher in sensation seeking, the odds ratio of engaging in simultaneous polysubstance use increased by a factor of 1.08 ($p < .001$). Those with higher rates of ACE scoring increased the odds ratio of engaging in polysubstance use by a factor of 1.09 ($p = .010$). Finally, those who reported more sexual partners increased the odds ratio of participating in simultaneous polysubstance use by a factor of 1.30 ($p = .016$). Incapacitated sexual assault was not a significant predictor in this model ($p = .810$). Model fit statistics include Nagelkerke R square and Hosmer and Lemeshow. Nagelkerke R square for model 1 was .204. The Hosmer and Lemeshow value was 12.85 ($p = .582$).

Concurrent Use (Model 2)

Of the 735 participants included in the model, 305 participated in concurrent polysubstance use. Similar to model 1, model 2 did not show significance within most demographic variables, including age, race, ethnicity, gender, and education. However, there was a significant relationship with gross income, with the odds of participating in concurrent

polysubstance use increasing by a factor of 1.09 ($p = .041$). Similar to model 1, sensation-seeking traits, ACE scores, and number of sexual partners (risk) were significant predictors. Higher sensation-seeking traits increased the odds ratio by 1.11 ($p < .001$). When evaluating ACE scores, the odds ratio increased by a factor of 1.08 ($p = .032$). Finally, when evaluating the increase in number of sexual partners, the odds increased by a factor of 1.59 ($p < .001$). Similar to model 1, incapacitated sexual assault was not significant in relation to concurrent polysubstance use ($p = .105$). Model fit statistics include Nagelkerke R square and Hosmer and Lemeshow. Nagelkerke R square for model 2 was .306. The Hosmer and Lemeshow value was 11.609 and was not significant ($p = .226$).

Table 4: Simultaneous Use (Model 1) and Concurrent Use (Model 2)

Variables	Model 1: Simultaneous Use (n=735)			Model 2: Concurrent Use (n=735)		
	b	a	SE	b	a	SE
Age	.00	1.00	.01	-.00	1.00	.01
Gender	.25	1.29	.19	.26	1.29	.18
Race						
Black	-.33	.72	.31	-.27	.76	.29
White	.22	1.25	.28	.26	1.30	.26
Hispanic/Latino	-.59	.56*	.22	-.06	.94	.20
Income	.01	1.01	.04	.09	1.09*	.04
Education	-.08	.92	.01	-.10	.91	.05
Sensation Seeking	.08	1.08***	.01	.10	1.11***	.01
ACE	.09	1.09**	.03	.07	1.08*	.03

Incapacitated sexual assault	-.07	.94	.26	.38	1.47	.24
Number of sexual partners	.26	1.30*	.11	.46	1.59***	.57

Note. b= coefficients; a= odds ratio; SE=standard error. *p<.05. **p<.01. ***p<.001

CHAPTER FIVE: DISCUSSION

The purpose of this study was to understand risk factors for polysubstance use by examining the effects of sensation seeking, ACE scores, incapacitated sexual assault, and number of sexual partners on both simultaneous polysubstance use (i.e., use of another drug with alcohol so that the effects overlap) and concurrent polysubstance use (i.e., use of two or more drugs within the last six months). In addition, demographic differences in polysubstance use were assessed. There has been an increased need for polysubstance research due to increased polysubstance-related mortality (Medical Examiner's Office of Orange County, Florida, 2019).

Hypothesis 1 (H1) in this paper was guided by mortality examinations in Orange County and other drug trends research. This hypothesis tested the demographic trends present in concurrent and simultaneous polysubstance use. Hypothesis 2 (H2) and 3(H3) were guided by Problem Behavior Theory (Jessor & Jessor 1977). These hypotheses tested if high levels of sensation seeking (H3) and ACE scores (H4) were related to the engagement of polysubstance use (simultaneous and concurrent). The final and fourth hypothesis (H4) was exploratory and related to research on drug use, co-occurring incapacitated sexual assault, and the number of sexual partners (O'Callaghan & Ullman, 2021).

High sensation-seeking scores (H2) and high ACE scores (H3) were significantly related to engaging in both simultaneous and concurrent polysubstance use. This was reflected in both the bivariate analysis and the logistic regression. Incapacitated sexual assault was not significantly related to concurrent or simultaneous polysubstance use. However, the number of sexual partners was associated with both simultaneous and concurrent polysubstance use (H4), indicating that the higher number of sexual partners in the past year increases the likelihood of an individual engaging in simultaneous and concurrent polysubstance use.

Demographics and Polysubstance Use

Results indicated that no demographic factors (H1) were associated with polysubstance use in the logistic regression models; however, those who were white (vs. not white) and men (vs. women) were significantly more likely to engage in simultaneous and concurrent polysubstance use in the bivariate analysis. This indicates that these factors are associated with polysubstance use, however, these associations are not significant when accounting for the other variables in the logistic regression model. This is represented in previous literature that states white males are the most likely to engage in substance use (Fernandez-Calderon et al., 2020) and are most frequently presented in overdose deaths (Hall & Donley, 2021).

Sensation Seeking and Polysubstance Use

Consistent with what was hypothesized (H2), there were significant relationships between sensation-seeking and simultaneous and concurrent polysubstance use. This is consistent with previous literature that indicates that higher sensation-seeking is significantly related to drug use (Pechorro et al., 2018; Gonzalez Ponce et al., 2019). However, this study was one of the first known studies to assess whether sensation-seeking relates to simultaneous and concurrent polysubstance use. The current study finds that polysubstance use is related to higher sensation-seeking scoring, like other drug use behaviors.

The BSSS-8 measures 4 categories: boredom susceptibility, disinhibition, experience-seeking, and thrill & adventure-seeking. Individuals high in sensation-seeking tend to seek stimulating and arousal experiences (Roberti, 2004). Bardo et al. (1996) explained that these neural reward pathways are similar to substance use. This study supports previous literature and provides an important contribution to understanding simultaneous and concurrent polysubstance use.

Adverse Childhood Trauma and Polysubstance Use

When evaluating Hypothesis 3 (H3), findings indicate that ACE scores were significantly related to both simultaneous and concurrent polysubstance use. This means that those who have more adverse childhood experiences, otherwise known as childhood trauma, are more likely to engage in polysubstance use.

ACE scores were a significant predictor of both simultaneous and concurrent polysubstance use. This is supported by previous research that shows that childhood trauma is significantly related to drug use (Fletcher, 2020; Forster et al., 2017; Shin et al., 2017). This was the first study, to my knowledge, that examined childhood trauma as it relates to simultaneous and concurrent polysubstance use.

Number of Sexual Partners and Incapacitated Sexual Assault as it Relates to Polysubstance Use

Finally, the last hypothesis examined whether number of sexual partners and incapacitated sexual assault were associated with concurrent and simultaneous polysubstance use (H4). Incapacitated sexual assault was not related to simultaneous or concurrent polysubstance use, but the number of sexual partners was. This does not correspond with past research on substance use and incapacitated sexual assault.

Previous research indicates that substance use and sexual assault often co-occur (O'Callaghan & Ullman 2021). Gilbert et al. stated that almost half of those who were victims of sexual assault had been under the influence of drugs or alcohol at the time of assault (2019). Along with this, substance use often follows victimization. Substances may be used as a coping strategy for those who have experienced incapacitated sexual assault (Bilgin, Bondü, & Elsner, 2021; Peles et al., 2014). Understanding incapacitated sexual assault, and substance use is

important due to higher rates of victim-blaming, self-blame, and avoiding coping strategies employed (Lorenz & Ullman, 2016; Peter-Hagene & Ullman, 2018).

This study does not show the same trend demonstrated in previous literature on substance use and incapacitated rape, and instead does not show a relationship between incapacitated rape and simultaneous and concurrent polysubstance use. Future research should expand on sexual assault questions and ask more questions to better understand how incapacitated sexual assault relates to polysubstance use. Other forms of sexual assault may be related to simultaneous and concurrent polysubstance use. Future research could also examine gender differences to better understand if gender within polysubstance use categories relates to incapacitated sexual assault. Sexual assault might be related to polysubstance use for women but not men.

The number of sexual partners was related to the engagement in concurrent and simultaneous polysubstance use. This indicates that the more sexual partners someone has, the more likely they will engage in simultaneous and concurrent polysubstance use. This is consistent with other research that evaluated sexual partners and drug use. However, to my knowledge, this was the first study that evaluated sexual partners in relation to polysubstance use. This is supported by previous research that states that drug use is related to risky sexual behaviors (Bobashev, Zule, Osilla, & Wechsberg, 2009; Dir, Coskunpinar, & Cyders, 2014; Hoyle et al., 2000).

Strengths, Limitations, and Suggestions for Future Research

This study contributes to polysubstance literature by analyzing both concurrent and simultaneous polysubstance use. This study had many strengths. There has not been research on how sensation seeking, ACE scores, incapacitated sexual assault and number of sexual partners, and how these factors relate to both simultaneous and concurrent polysubstance use. This

research is novel in that it assesses simultaneous and concurrent use separately and examines the predictors of each. This study aimed to better understand individuals who are at potential risk of overdose based on polysubstance use engagement.

Previous research focuses on concurrent use, which may not always account for simultaneous use. Researchers do not know much about the difference between simultaneous and concurrent polysubstance use predictors. By applying Problem Behavior Theory (Jessor & Jessor 1977), this research examined how social and psychological variables predict polysubstance use. Although most demographic factors assessed in the current study were not related to polysubstance use in the logistic regression, there were significant relationships between polysubstance use with sensation seeking, adverse childhood experiences, and the number of sexual partners.

Due to the use of a predetermined panel, those who participated in the survey were representative of the race and gender demographics in Orange County. This study also targeted those most affected by overdose deaths and sampled those aged 18 and 55. The diversity and generalizability offered strength in this study and made results applicable to the community.

Although this research provides a better understanding of polysubstance use, there were limitations. Due to the survey having a forced response for the substance use checklist assessment, it was impossible to differentiate between participants who did not engage in any past six-month substance use and participants who engaged in substance use involving one substance. Although some participants indicated in the write-in box that they do not use any substances, other participants did not write anything, so researchers cannot accurately determine whether or not participants engage in any substance use. This is important because predicting factors may just be generally related to substance use and not exclusively polysubstance use.

This study focused on the presence vs. absence of polysubstance use, and the frequency of substance use was not assessed. Therefore, there was no way to indicate the differences in how frequently individuals engaged in polysubstance use (simultaneous and concurrent use). A frequency assessment would allow for a more nuanced assessment due to increased variability in the dependent variable. This study also did not assess if problem use was present. By evaluating problem use, research can better differentiate if there are significant differences in those who engage in simultaneous and concurrent polysubstance use recreationally vs. those who may demonstrate potential problem behaviors. Those who participate in a higher frequency of use also have a higher risk of overdose, so it is crucial to not only understand the predicting factors of those who use recreationally but also those who may present with dependency.

Another limitation was that concurrent and simultaneous variables differed on more than just whether substances were used at the same time or not. One variable was examining the overlapped polydrug use with alcohol alone, while the other was looking at all drugs. Consequently, it does not allow for conclusions to be drawn about whether differences in concurrent use are due to using substances when the effects overlap. This is important to note because this research may demonstrate significant relationships to substance use in general related to the dependent variables and these may not account for polysubstance use exclusively. Participants who engage in simultaneous and concurrent polysubstance use should also be compared to participants who engage in single substance use or no substance use rather than combining them. Future research can do this by separating and comparing no use, single-use, and polysubstance use to better understand if there are different predictors for each.

Further research should also oversample for polysubstance use to examine the heterogeneity within individuals who engage in polysubstance use, such as differences based on

each drug used. Examining simultaneous drug use by drugs other than the combination with alcohol, research may yield different findings than those present in this study. This is especially relevant with the simultaneous use of other drugs with opioids. This study sought to look at the relationship between simultaneous use of another drug with opioids but did not yield enough participants to make meaningful conclusions. Future research should further understand simultaneous opioid users as they appear to be the most at risk in Orange County (Donley & Hall, 2021).

Future research should further investigate the relationship between sensation seeking, ACE scores, sexual risk, and polysubstance use by considering risk perceptions and motivations for polysubstance use. By better understanding risk perceptions and motivations to engage in polysubstance use, prevention measures can be established, and educational tools can be created.

CHAPTER SIX: CONCLUSION

As the overdose crisis progresses, polysubstance use is becoming more prevalent (O'Donnell et al., 2020). With this study, I aimed to explore factors that could predict simultaneous and concurrent polysubstance use. Due to the inconsistency of terminology and measurement methods in past research, it is difficult to make meaningful conclusions about the difference in predicting factors in prior research. This paper sought to better understand the predicting factors for those who engage in polysubstance use. By better understanding who is at higher risk for engaging in polysubstance use, communities can target specific populations for prevention and harm reduction measurements. This means that community organizations can better understand who needs harm reduction services and can better market themselves to those at risk.

Unlike other research (Donley & Hall, 2021), this study demonstrates that simultaneous and concurrent polysubstance are not associated with most demographic factors. Although race (white) and gender (male) had a significant relationship with polysubstance use in the bivariate analysis, this was no longer true when it was analyzed with other variables in a logistic regression. This indicates that although there is a relationship with race and gender and polysubstance use, the other variables in the models accounted for more of the variability. Demographic predictors help the community better understand what populations are most at risk and can better establish programs to address cultural needs. Income remained significantly related to simultaneous polysubstance use in the full models, indicating that those who had higher income were more likely to engage in simultaneous polysubstance use.

High sensation-seeking and ACE scores were significantly related to both simultaneous and concurrent polysubstance use. This supports previous research that has found that sensation seeking, and high ACE scores can predict drug use (Forster et al., 2017; Sadeh et al., 2021;

Mendoza-Melendez et al., 2018; Peles et al., 2014; Shand et al., 2011; Hildebrandt et al., 2020; Pechorro et al., 2018; Eze et al., 2020). Polysubstance use and sexual partners are related, whereas polysubstance use and incapacitated sexual assault are not. This was found for both simultaneous and concurrent polysubstance use. Both models showed significant relationships between sensation seeking, ACE scores, number of sexual partners, and polysubstance use, supporting the idea that simultaneous and concurrent polysubstance use have similar predictors, as measured in the current study. Although future research is needed to better explore polysubstance frequency and problem use, this study sets the groundwork to analyze biopsychosocial factors within concurrent and simultaneous polysubstance.

This study provides meaningful contributions to polysubstance research by assessing predictive factors of concurrent polysubstance use and providing information on simultaneous polysubstance use. This is important due to the extensive research conducted on concurrent polysubstance use and the lack of simultaneous use research. Also, unlike much of recent literature, this study focuses on the presence vs. absence of polysubstance use rather than problem substance use. This is important because most individuals use drugs without ever developing a dependency (Hart, 2021).

APPENDIX A: DRUG QUESTIONNAIRE INDEX BASED QUESTIONS

Within the last six months, have you used or consumed any of the following substances for recreational purposes?

- ALCOHOL
- CANNABIS: Marijuana, hash oil, pot, weed
- NICOTINE: Cigarettes, e-Cigarettes, or vapes
- STIMULANTS: Cocaine, crack, blow
- STIMULANTS: Methamphetamine — meth, ice, crank
- AMPHETAMINES/OTHER STIMULANTS: Ritalin, Adderall, Vyvanse
- BENZODIAZEPINES/ TRANQUILIZERS: Valium, Librium, Xanax, Diazepam, roofies, downers
- SEDATIVES/HYPNOTICS/BARBITURATES: Amytal, Seconal, Dalmane, Quaalude, Phenobarbital
- HEROIN: smack, scat, brown sugar, dope
- STREET OR ILLICIT METHADONE
- OTHER OPIOIDS: Percocet, Opium, Morphine, Hydrocodone, Oxycodone
- HALLUCINOGENS: LSD, PCP, mescaline, peyote, mushrooms, ketamine, ecstasy (MDMA)
- INHALANTS: glue, gasoline, aerosols, paint thinner, poppers, rush, whippets
- STEROIDS: Deca-Durabolin, Durabolin, Equipoise, Winstrol, Anadrol, Oxandrin, roids, juice
- ILLEGAL USE OF PRESCRIPTION DRUGS (describe)

In the last six months have you taken any of the following while also consuming alcohol?

- ALCOHOL
- CANNABIS: Marijuana, hash oil, pot, weed
- NICOTINE: Cigarettes, e-Cigarettes, or vapes
- STIMULANTS: Cocaine, crack, blow
- STIMULANTS: Methamphetamine — meth, ice, crank
- AMPHETAMINES/OTHER STIMULANTS: Ritalin, Adderall, Vyvanse
- BENZODIAZEPINES/ TRANQUILIZERS: Valium, Librium, Xanax, Diazepam, roofies, downers
- SEDATIVES/HYPNOTICS/BARBITURATES: Amytal, Seconal, Dalmane, Quaalude, Phenobarbital
- HEROIN: smack, scat, brown sugar, dope
- STREET OR ILLICIT METHADONE
- OTHER OPIOIDS: Percocet, Opium, Morphine, Hydrocodone, Oxycodone
- HALLUCINOGENS: LSD, PCP, mescaline, peyote, mushrooms, ketamine, ecstasy (MDMA)
- INHALANTS: glue, gasoline, aerosols, paint thinner, poppers, rush, whippets
- STEROIDS: Deca-Durabolin, Durabolin, Equipoise, Winstrol, Anadrol, Oxandrin, roids, juice
- ILLEGAL USE OF PRESCRIPTION DRUGS (describe)

APPENDIX B: BRIEF SENSATION-SEEKING SCALE (BSSS-8)

Response Categories

1. Strongly disagree
2. Disagree
3. Neither disagree nor agree
4. Agree
5. Strongly agree

Questions

1. I would like to explore strange places
2. I get restless when I spend too much time at home
3. I like to do frightening things
4. I like wild parties
5. I would like to take off on a trip with no pre-planned routes or timetables
6. I prefer friends who are excitingly unpredictable
7. I would like to try bungee jumping
8. I would love to have new and exciting experiences, even if they are illegal

APPENDIX C: ACE QUESTIONNAIRE

While you were growing up, during your first 18 years of life:

1. Did a parent or other adult in the household often or very often... Swear at you, insult you, put you down, or humiliate you? or
Act in a way that made you afraid that you might be physically hurt?

Yes No If yes enter 1 _____

2. Did a parent or other adult in the household often or very often... Push, grab, slap, or throw something at you? or
Ever hit you so hard that you had marks or were injured?

Yes No If yes enter 1 _____

3. Did an adult or person at least 5 years older than you ever...
Touch or fondle you or have you touch their body in a sexual way? or
Attempt or actually have oral, anal, or vaginal intercourse with you?

Yes No If yes enter 1 _____

4. Did you often or very often feel that ...
No one in your family loved you or thought you were important or special? or
Your family didn't look out for each other, feel close to each other, or support each other?

Yes No If yes enter 1 _____

5. Did you often or very often feel that ...
You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? or

Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?

Yes No If yes enter 1 _____

6. Were your parents ever separated or divorced?

Yes No If yes enter 1 _____

7. Was your mother or stepmother:

Often or very often pushed, grabbed, slapped, or had something thrown at her? or

Sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard? or

Ever repeatedly hit at least a few minutes or threatened with a gun or knife?

Yes No If yes enter 1 _____

8. Did you live with anyone who was a problem drinker or alcoholic or who used street drugs?

Yes No If yes enter 1 _____

9. Was a household member depressed or mentally ill, or did a household member attempt suicide?

Yes No If yes enter 1 _____

10. Did a household member go to prison?

Yes No If yes enter 1 _____

Now add up your "Yes" answers: _____ This is your ACE Score.

APPENDIX D: DEMOGRAPHIC QUESTIONS

What is your current gender?

- Woman
- Man
- Transgender
- A gender not listed here
- Prefer not to answer

How would you describe yourself? Select all that apply.

- American Indian or Alaska Native
- Asian
- Black or African American
- Native Hawaiian or other Pacific Islander
- White
- Other (please specify)

Are you of Hispanic, Latino, or Spanish origin?

- Yes
- No

What is your gross household income (before taxes)?

- \$15,000 or less
- \$15,001-\$25,000
- \$25,001-\$35,000
- \$35,001-\$45,000
- \$45,001-\$55,000
- \$55,001-\$65,000
- \$65,001-\$75,000
- Over \$75,000

What is the highest degree or level of school you have completed?

- Less than a high school diploma
- High school degree or equivalent
- Some college, no degree
- Associates degree
- Bachelor's degree
- Graduate degree
- Trade school or other certification

APPENDIX E: SEXUAL PARTNERS/ SEXUAL RISK

How many people have you been sexual with in the past year?

- 0
- 1
- 2-3
- 4-10
- More than 10

Have you been a victim of unwanted sexual contact occurring when you were unable to provide consent or stop what is happening because you were passed out, drugged, drunk, incapacitated, or asleep?

- Yes
- No

APPENDIX F: IRB LETTER



UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board

FWA00000351
IRB00001138, IRB00012110
Office of Research
12201 Research Parkway
Orlando, FL 32826-3246

NOT HUMAN RESEARCH DETERMINATION

October 26, 2021

Dear [Laura Lightfoot](#)

On 10/26/2021, the IRB reviewed the following protocol:

Type of Review:	Initial Study
Title of Study:	Deadly Drug Combination: Factors That Predict Simultaneous Use
Investigator:	Laura Lightfoot
IRB ID:	STUDY00003596
Funding:	None
Grant ID:	None
Documents Reviewed:	<ul style="list-style-type: none"> • HRP-251- FORM - Faculty Advisor Scientific-Scholarly Review fillable form.pdf, Category: Faculty Research Approval; • CARA survey final.docx, Category: Survey / Questionnaire;

The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are research involving human in which the organization is engaged, please submit a new request to the IRB for a determination. You can create a modification by clicking **Create Modification / CR** within the study.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu Please include your project title and IRB number in all correspondence with this office.

Sincerely,

Kamille Birkbeck
Designated Reviewer

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