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Risk Factors for Polysubstance Abuse: A National Secondary Data Analysis Study

Dakota McMurray
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Walden University

College of Health Sciences

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Dakota Eugene McMurray

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Walden University
2020

Abstract

Risk Factors for Polysubstance Abuse: A National Secondary Data Analysis Study

By

Dakota Eugene McMurray

MPH, Walden University, 2016

PharmD, University of South Carolina, Columbia, 2013

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of Doctor of Philosophy

Public Health Epidemiology

Walden University

August 2020

Abstract

Substance abuse is a serious public health problem in the United States and globally. Abuse of more than one substance is considered polysubstance abuse and can cause more harm than abuse of only one substance. Polysubstance abuse compounds the problems of addiction because of the variety of substances that may be used and the resulting side effects. This quantitative cross-sectional secondary data analysis, guided by the socio-ecological theory, assessed patient characteristics and how predictive they were for polysubstance abuse. The study sample of 986 patients was analyzed by binomial logistic regression to assess the association between patient-related factors and polysubstance abuse. Selected patient related independent variables were sex, race, age, education level, health insurance status, living arrangements, employment status, prior treatment for substance abuse, diagnosed mental illness, and alcohol abuse. The dependent variable was whether patients exhibited polysubstance abuse upon admission to a drug rehabilitation facility. Results of the study found that 54% of the study population exhibited polysubstance abuse upon admission to a drug rehabilitation facility. The following patient factors were statistically significant predictors of polysubstance abuse, $p < 0.05$: age, education level, employment status, diagnosed mental illness, and alcohol. Recommendations include training public health professionals on patients that are more likely to exhibit polysubstance abuse and creating policy changes for better access to mental health services. The implications for social change are that substance abuse issues should not be treated criminally and that getting patients the care they need, especially in relation to mental health services, can help lower rates of polysubstance abuse.

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Dedication

This dissertation is dedicated to:

My family: Jovan Washington, Lynn McMurray and Eugene McMurray. Each one of you has listened to me discuss this journey, talked me out of quitting, and encouraged me along the way. Without you all, this dissertation process would not have been completed.

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Chapter 1: Introduction to the Study

Introduction

According to a 2016 nationwide survey conducted by the Substance Abuse and Mental Health Services Administration (SAMHSA), approximately 20.1 million people aged 12 and older in the United States had some form of substance use disorder in the past year (Ahrnsbrak et al., 2017). In this survey, a diagnosis of substance use disorder included people who met the criteria for either dependence or abuse of alcohol or illicit drugs (Ahrnsbrak et al., 2017). Of those with a substance use disorder, alcohol was the primary substance that was abused or dependent upon, with approximately 15.1 million people reporting abuse/dependence (Ahrnsbrak et al., 2017). The study did not look at rates of polysubstance use. The Centers for Disease Control and Prevention (2017) estimates that in 2016, more than 60,000 Americans died from drug overdoses. The National Institute on Drug Abuse (2017) estimates that the abuse of tobacco, alcohol, and illicit drugs in the United States costs the nation more than \$740 billion annually. This cost is encompassing of direct medical costs, including emergency room visits and rehabilitation facilities, and indirect costs, including costs related to crime and lost work productivity (National Institute on Drug Abuse, 2017).

Substance use disorders, and more specifically polysubstance abuse, have many complications that impact society. Jones, Striley, and Cottler (2017) identified that substance abuse was associated with an increased rate of sexually transmitted infections in Central Florida. It was also noted that substance abuse increased the risk of homelessness. Morley, Lynskey, Moran, Borschmann, and Winstock (2015) noted that

high-risk behaviors (defined as violence and unprotected sex) increased the risk that adolescents would engage in polysubstance abuse.

I conducted this study because a large number of Americans have some form of substance use disorder and the costs to society caused by this disease are high. By examining and identifying risk factors for polysubstance abuse in those admitted to a drug rehabilitation facility, positive social change can be enacted by resource allocation.

Chapter 1 is divided into 10 sections. The introduction and background sections contain a small review of literature related to the impact of substance abuse. In the problem statement and purpose of the study sections, I will explore the social problem of substance abuse and discuss the intent of the study. The next section includes the research question and hypothesis where I will explore the null and alternative hypotheses for each research question. The next section is the theoretical framework. This section will contain information about the theory that I used for the study and how it relates to the study content. Nature of the study will include the rationale for the study method and design. The definitions section will include definitions of the variables that I used. I will explain my assumptions regarding the secondary database and. Lastly, a summary and conclusion section will end the chapter with a wrap-up and insight as to how the study will fill a gap in the literature.

Background

Substance abuse has grown into a serious public health problem across not only the United States but globally. The most known type of substance abuse is the opioid epidemic, which has been declared a public health emergency by United States President Donald Trump (U.S. Department of Health and Human Services [USDHHS], 2018). But

opioids are not the sole substance of abuse, and many overdose deaths have multiple substances involved.

Abuse of more than one substance is considered polysubstance abuse and can cause much more harm than abuse of only one substance. For instance, the risk of death in veterans who received concomitant benzodiazepine therapy and opioid therapy was more than two times higher than veterans who were only receiving opioid medications (Park et al., 2015). Park et al. (2015) conducted their study with United States veterans who were receiving chronic opioid therapy. Benzodiazepines are relatively safe by themselves, but the risk of oversedation and central nervous system depression increases when combined with opioid therapy (Park et al., 2015). The study showed that 27% of veterans on opioid therapy for pain management were also given a benzodiazepine (Park et al., 2015). In patients with a former prescription of a benzodiazepine, the risk of death was 2.33 times greater than receipt of opioids alone (Park et al., 2015). In patients with a current prescription, the risk of death was 3.86 times greater than receipt of opioids alone (Park et al., 2015). This study was one of the first large-scale studies to show that a combination of benzodiazepines and opioids, even while being prescribed by a licensed medical provider, resulted in a greater risk of overdose death (Park et al., 2015).

Gabrielian et al. (2015), Morley et al. (2015), and Begun et al. (2016), reviewed patients diagnosed with polysubstance abuse and concurrent mental illness. Each study determined that mental illness was present in a large portion of patients who suffered from polysubstance abuse. Tsai et al. (2014) and Polcin (2016) explored the correlation between homelessness and substance abuse. Polysubstance abuse was not a specific factor, but substance abuse was linked to an increased risk of homelessness.

The gap in knowledge that I explored in this study are the risk factors that lead to a person abusing more than one substance versus only one substance. Many studies have shown risk factors for substance abuse, including family history, mental illness, and homelessness, but none have specifically looked at polysubstance abuse versus monosubstance abuse to compare risk factors. Polysubstance abuse is far deadlier, and risk factors for this condition should be explored.

Problem Statement

Substance abuse is a large public health problem both in the United States and globally (Ogbu, Lotfipour, & Chakravarthy, 2015). The opioid epidemic, a small piece of substance abuse, in the United States has been called a public health emergency by the current political administration (United States Department of Health and Human Services [USDHHS], 2017). Polysubstance abuse is a subset of this overarching theme, where a patient is abusing or addicted to more than one substance (Ogbu et al., 2015). Polysubstance abuse may be a combination of illicit drugs, legal substances, and over the counter medications (Ogbu et al., 2015). Polysubstance abuse presents a unique challenge above that of normal substance abuse because many substances of abuse can have additive effects, leading to an increase in central nervous system depression and a heightened risk of overdose (Ogbu et al., 2015). A 2012 study published by the SAMHSA (2013) shows that the top five commonly abused drugs are alcohol, tobacco, marijuana, prescription pain medications, and prescription antidepressants. Many combinations can exist with polysubstance abuse, including multiple depressants or a combination of stimulants and depressants (SAMHSA, 2013).

Substance abuse, as mentioned above, is one of the largest public health concerns that is currently being faced in the United States. Polysubstance abuse further compounds the problems of drug abuse and addiction because of the variety of substances that may be used. The population could use two or more stimulants or depressants that work together to increase the number of side effects from each, or a combination of stimulants and depressants where the side effects may not even be known. It is my hope that by researching risk factors for polysubstance abuse, policy changes could be enacted, and resources could be used to target the areas of the population that are the most at risk for polysubstance abuse. The population that I used in my study are those who have been admitted to a drug rehabilitation facility. I selected this population because of the wealth of data collected on these patients when they enter a federally funded rehabilitation center. My goal for this research was to promote social change by finding characteristics that lead a patient to exhibit polysubstance abuse. These characteristics can be used to determine areas of increased funding and resource needs to lower the incidence of polysubstance abuse.

Purpose of the Study

For this research study, I used a retrospective quantitative methodology to explore the relationship of sociodemographic variables and how these variables may or may not lead to polysubstance abuse in patients admitted to a drug rehabilitation facility. I used secondary data analysis. The independent variables that I used were patient's sex, age, race, education level, employment status, insurance status, living arrangements, prior treatment for substance abuse, alcohol as one of the substances, and diagnosed mental

illness. The dependent variable that I used was whether a patient exhibits polysubstance abuse.

Research Questions and Hypothesis

The primary research question is whether each independent variable is associated with the presence of polysubstance abuse.

Research Question 1 (RQ1): To what extent does treatment for substance abuse, alcohol use, and diagnosed mental illness contribute to polysubstance abuse among patients admitted to a drug rehabilitation facility?

Null Hypothesis (H_01): There is not an association between treatment for substance abuse, alcohol use, and diagnosed mental illness with polysubstance abuse among patients admitted to a drug rehabilitation facility.

Alternative Hypothesis (H_a1): There is an association between treatment for substance abuse, alcohol use, and diagnosed mental illness with polysubstance abuse among patients admitted to a drug rehabilitation facility.

Research Question 2 (RQ2): Is there an association between sex, age, race, education level, employment status, insurance status, living arrangements with and polysubstance abuse?

Null Hypothesis (H_02): There is not a collective association between patient's sex, age, race, education level, employment status, insurance status, and living arrangements, and polysubstance abuse among patients admitted to a drug rehabilitation facility.

Alternative Hypothesis (H_a2): There is a collective association between patient's sex, age, race, education level, employment status, insurance status, and living

arrangements, and polysubstance abuse among patients admitted to a drug rehabilitation facility.

Research Question 3 (RQ3): To what extent do prior treatment for substance abuse, alcohol use, and diagnosed mental illness contribute to polysubstance abuse among patients admitted to a drug rehabilitation facility, after adjusting for patient sex and age?

Null Hypothesis (H_03): There is not an individual association between prior treatment for substance abuse, alcohol use, and diagnosed mental illness contribute to polysubstance abuse among patients admitted to a drug rehabilitation facility, after adjusting for patient sex and age.

Alternative Hypothesis (H_{a3}): There is an individual association between prior treatment for substance abuse, alcohol use, and diagnosed mental illness contribute to polysubstance abuse among patients admitted to a drug rehabilitation facility, after adjusting for patient sex and age.

Theoretical Framework

The theoretical framework that I used for this study was the socio-ecological theory. The socio-ecological theory is a framework encompassing multiple levels, from intrapersonal to policy, that can be used to understand the interactive effects of people and their environment (McLeroy, Bibeau, Steckler, & Glanz, 1988). In most depictions of the socio-ecological model, there are five levels (individual, interpersonal, organizational, community, and policy/enabling environment; McLeroy et al., 1988). The takeaway point from this theory is that every person interacts with their environment

in a different way and this shapes the relations they have with that environment (McLeroy et al., 1988).

The intrapersonal level encompasses the individual patient characteristics that can influence health behaviors (McLeroy et al., 1988). Patient factors such as knowledge levels, skills, and belief in one's self are all part of the intrapersonal level. The interpersonal level encompasses people that a patient may interact with that could affect the health behaviors they choose (McLeroy et al., 1988). The interpersonal level makes up the support system of the patient. A patient's family, friend groups, and social circles are all a part of the interpersonal level. The organizational level encompasses parts of the community that coerce or promote healthy behaviors (McLeroy et al., 1988). Most community organizations, civic groups, and religious organizations make up the organizational level. The community level encompasses the cultural structure that is represented by the patient (McLeroy et al., 1988). Cultural norms shape health behaviors because certain behaviors may be taboo at the community level. The final level is the policy level. The policy level encompasses policy and law that are in place to support or restrict behaviors that influence one's health (McLeroy et al., 1988). The policy level is the broadest of the levels because it can exist at the local, state, or federal level.

I used this theory for this research because in looking for risk factors of polysubstance abuse, it is necessary to look beyond individual factors and determine how each level of the socio-ecological model may play a role. Whether it is mental health and lack of access to healthcare, friendships that have been developed, or poverty, each piece can add weight to the study of polysubstance abuse.

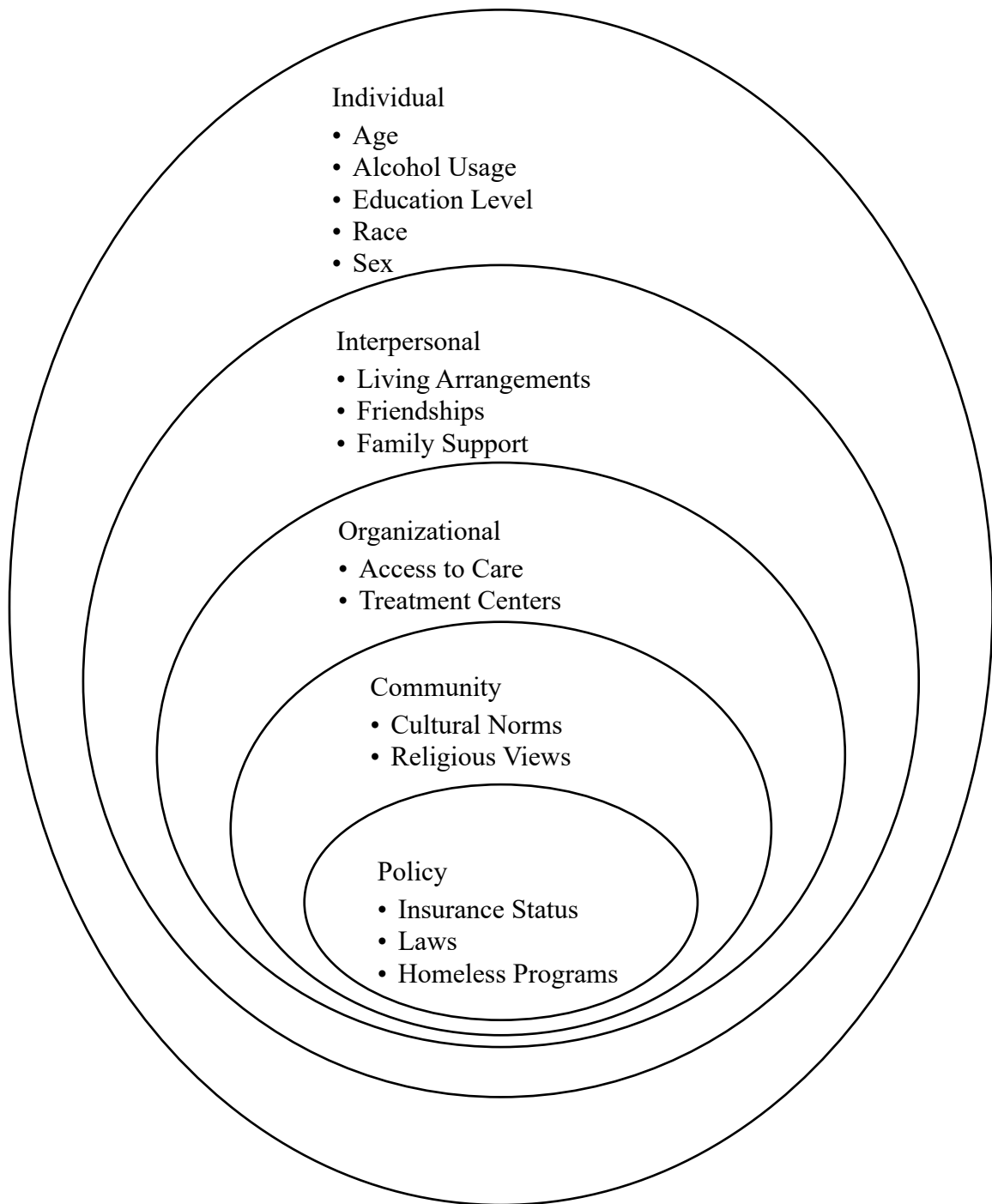


Figure 1. Socio-ecological model of polysubstance abuse

Nature of the Study

The nature of the study was quantitative. Quantitative research is consistent with understanding patient factors that can lead to different health outcomes and behaviors. To determine what patient factors (independent variables: patient's sex, age, race, education level, employment status, insurance status, living arrangements, prior treatment for substance abuse, alcohol as one of the substances, and diagnosed mental illness) are associated with polysubstance abuse (dependent variable), I used binomial logistic regression. All data collected for this study were from secondary data analysis of the Treatment Episode Data Set Admissions (TEDS-A), 2014 dataset (SAMHSA, 2015). This publicly available dataset is produced by the SAMHSA and contains information collected after the admission to a federally funded drug treatment facility (SAMHSA, 2015). My analysis will pinpoint where resources should be allocated to help treat this disease state more efficiently.

Definitions

Age: Self reported as to how old a person is in years on a given day with no mention of number of months

Alcohol abuse: Measure of whether alcohol is one of the substances causing the rehabilitation stay.

Education level: Self reported as Middle School, Some High School, Completed High School, Some College, or Completed College

Employment status: Self reported as Full-time employee, Part-time employee, Unemployed, or Not in Labor Force. Not in Labor Force includes those patients who are students, disabled, retired, or an inmate of an institution.

Insurance status: Private insurance, Medicaid, Medicare/Tricare, or None

Living arrangements: Self reported as Homeless, Dependent living, or Independent living.

Mental Illness: The mental illnesses coded for in the dataset are anxiety disorders, depressive disorders, schizophrenia, bipolar disorders, attention deficit/disruptive behavior disorders, and other mental health conditions (SAMHSA, 2015). The dataset also has a separate variable that indicates whether the patient exhibits any psychiatric problem in addition to the understated substance abuse disorder (SAMHSA, 2015).

Polysubstance Abuse: Abuse or addiction to more than one substance. The Diagnostic and Statistical Manual of Mental Disorders 5th edition as eliminated polysubstance abuse/dependence and has created a broad category of substance use disorders (Hasin et al., 2013). The term was used in this study to note patients who were admitted to a drug rehabilitation facility and admitted to abusing more than one substance or had laboratory confirmation of more than one substance being used.

Prior treatment for substance abuse: Measure of relapse. If a patient has been treated before this variable will be positive.

Race: Self reported as Alaska Native/American Indian, Pacific Islander, Black, White, Asian, or Other

Sex: Self identified Male or Female with no category of other identifications

Scope and Delimitations

Substance abuse is an umbrella term that holds many different conditions. In this study, I focused on polysubstance abuse. I focused on polysubstance abuse to determine risk factors for patients who may be most at risk of death due to combinations of

substances being used. I used secondary data analysis on patients admitted to a federally funded drug rehabilitation facility during the time frame of 2014 to 2015. I used these older databases because that is the latest dataset available from SAMHSA. Patients admitted to private facilities were not included. The study included patients from across the United States who were ages 12 and older.

Assumptions

All assumptions and limitations come from the use of a publicly available dataset. This dataset was not intended for the purposes of this research. The researchers involved with the creation of this dataset assumed that each listed individual is a unique individual, but this cannot be truly determined because of confidentiality purposes (SAMHSA, 2015). Because the funds for these facilities are public, some states may have constraints that direct selectivity for special populations (SAMHSA, 2015). I am assuming that the substances of abuse that are listed are the substances that led to the rehabilitation stay and may not represent all substances that a patient actively uses.

Limitations

One limitation of this study was that this dataset does not capture all patients who are admitted to a drug rehabilitation facility (SAMHSA, 2015). Only patients admitted to a federally funded facility were reported to SAMHSA and therefore included in this study (SAMHSA, 2015). Another limitation of the study is the focus on patients admitted to a drug rehabilitation facility, which could lead to under-representation of the population of people who abuse substances. The last limitation of the study is the secondary data analysis itself. Because the data were not collected for the purposes of this study, certain

variables, namely income level, cannot be determined because it is not included in the original dataset.

Significance

As shown above, substance abuse is one of the leading public health issues facing the global community. Risk factor identification for the most afflicted, those with polysubstance abuse, could help direct federal funding and resources to the population that needs help the most. Because of risk factor identification, physicians and mental health practitioners could better fight this disease and help identify patients who may need more help than others. Positive social change implications of this study are that the amount of substance abuse could be lowered, and the risk of death could be cut. Policy changes could be put in place to help aid in access to care, mental health services, and increased funding in areas that need it most. Risk factor identification could decrease the amount of money spent on treating substance abuse as well as create a healthier society. My goal is that this study will bring attention to areas such as mental health and homelessness as possible contributors to the substance abuse epidemic that is currently affecting the United States. More public resources for patients with mental illness and those who are affected by homelessness could potentially create social change for these patients and reduce the risk of substance use and abuse. Utilizing the patient population of those who have been admitted to a drug treatment facility could also bring attention to those more likely to need these services and create ways to prevent the necessity of treatment.

Summary

Described above is an introduction to substance abuse disorders, particularly polysubstance abuse. Polysubstance abuse can increase the risk of death in patients, both those in medical care and those who obtain the substances of abuse illegally. Substance abuse costs the United States more than \$740 billion annually in direct and indirect costs. A brief background of the study was presented, including the gap in the literature and study methods. In this study, I focused on those individuals who have been admitted to a drug rehabilitation facility because if risk factors can be determined, maybe the necessity of this type of treatment could be prevented. Chapter 2 will feature a full literature review of polysubstance abuse.

Chapter 2: Literature Review

Introduction

Problem Statement

Substance abuse is a large public health problem both in the United States and globally (Ogbu, Lotfipour, & Chakravarthy, 2015). The opioid epidemic in the United States has been called a public health emergency by the current political administration ([USDHHS], 2017). Polysubstance abuse is when a patient is abusing or addicted to more than one substance (Ogbu et al., 2015). Polysubstance abuse may be a combination of illicit drugs, legal substances, and over the counter medications (Ogbu et al., 2015). Polysubstance abuse presents a unique challenge above that of normal substance abuse because many substances of abuse can have additive effects, leading to an increase in central nervous system depression and a heightened risk of overdose (Ogbu et al., 2015). A 2012 study published by SAMHSA (2013) shows that the top five commonly abused drugs are alcohol, tobacco, marijuana, prescription pain medications, and prescription antidepressants. Many combinations can exist with polysubstance abuse, including multiple depressants or a combination of stimulants and depressants (SAMHSA, 2013).

Substance abuse, as mentioned above, is one of the largest public health concerns that is currently being faced in the United States. Polysubstance abuse further compounds the problems of drug abuse and addiction because of the variety of substances that may be used. The population could use two or more stimulants or depressants that work together to increase the number of side effects from each, or a combination of stimulants and depressants where the side effects may not even be known. My goal for this study regarding risk factors for polysubstance abuse is that policy

changes could be enacted, and resources could be used to target the areas of the population that are the most at risk for polysubstance abuse.

The population that I used in the study are those who have been admitted to a drug rehabilitation facility. I selected this population because of the wealth of data collected on these patients when they enter a federally funded rehabilitation center. My goal for this research is promote social change by finding characteristics that lead a patient to exhibit polysubstance abuse. These characteristics can be used to determine areas of increased funding and resource needs to lower the incidence of polysubstance abuse potentially.

Synopsis of the Literature

Little research has been done to determine socioeconomic and sociodemographic risk factors for polysubstance abuse outside of the adolescent and youth populations. The purpose of this study was to serve as a cornerstone so more research can be conducted in this area. One key study was conducted in veterans, which showed when United States veterans were prescribed opioids and benzodiazepines, they experienced death rates that were 3.86 times greater than those who were only given one prescription or the other (Park et al., 2015). Other studies have looked at homelessness and mental health and the connections that exist between each condition and polysubstance abuse.

Chapter Overview

I will begin the literature review chapter with the literature search strategy that was used, to include the databases that were searched and the key words that were used in those searches. I will describe the scope of the literature, including the years that articles were published along with any seminal literature that was utilized. Due to the relatively

small amount of literature focusing on polysubstance abuse, I will describe the methods that were used to overcome this. I will describe the theoretical foundation in relation to polysubstance abuse and key literature focusing on each major variable. Lastly, I will provide a summary of the literature as well as how the current study fills a gap in the literature.

Literature Search Strategy

In conducting this literature review, I used peer reviewed articles dated over the past 10 years. I made an effort to limit research to the past five years, but very few articles were found that were specific enough on the topic of polysubstance abuse to be of any use. Databases and websites that I used in the search for literature included PubMed, CINAHL, the Walden University Library, Google Scholar, and the SAMHSA website. Key terms that I used were as follows: *polysubstance abuse*, *risk factors*, *epidemiology*, *mental health*, *homelessness*, *sociodemographic*, and *rehabilitation*. See Table 1 below for specific search terms that were used in relation to each variable.

Table 1

Key Words used in Literature Search

Variable	Key Words Searched
Polysubstance Abuse	Polysubstance abuse Substance Abuse Substance use disorder (SUD)
Age	Age
Alcohol Abuse	Alcohol use Alcoholic
Education Level	Education
Employment	Employment Job Status
Insurance Status	Insurance Insured Medicaid Medicare
Living Arrangements	Homeless Homelessness
Mental Illness	Psychiatric Depression PTSD Schizophrenia
Prior Treatment	Prior treatment
Race	Race African American Hispanic
Sex	Male Female

I conducted another search to find articles related to how the theoretical foundation, the socio-ecological theory, related to polysubstance abuse. I combined each of the search terms mentioned above with the main search term polysubstance abuse to find articles relating the major purpose and variables of the study. For background information I used information from CDC and SAMHSA.

I obtained very few results specifically relating to polysubstance abuse. I found many articles discussing substance abuse in general, but as general substance abuse was not the purpose of this study, I dismissed those articles. I used the fact that few articles are published on risk factors for polysubstance abuse to show the gap in the literature and why this study was needed. The most pertinent articles I found are presented below to showcase the literature already in existence.

Theoretical Foundation

Socio-ecological Theory

The theoretical foundation of this study is the socio-ecological theory. The socio-ecological theory was first developed by Urie Brofenbrenner in 1977 and continually revised until his death in 2005 (McLeroy et al., 1988). This theory has been used to explain why individuals function the way that they do (McLeroy et al., 1988). In Brofenbrenner's theory, human behavior develops through interactions with multiple levels of environmental influences (McLeroy et al., 1988). These levels are known as micro-, meso-, exo-, and macrosystems (McLeroy et al., 1988). By including an individual level into this model, a new theory, developed by McLeroy et al., was developed to show that not only are there interactions between a person and their environment, but also innate differences in between people as a result of genetics

(McLeroy et al., 1988). This modified theory/model is a set of concentric circles with the inner-most circle being the individual (McLeroy et al., 1988). In most depictions of the socio-ecological model, there are five levels (individual, interpersonal, organizational, community, and policy/enabling environment; McLeroy et al., 1988). Each level comprises more of the environment that an individual interacts with and sets up the behaviors that the individual will exhibit. By utilizing the socio-ecological model, it is possible to understand the complex interactions that an individual has, not only between people, but between people, organizations, communities, and various policies that are enacted, which the individual must follow. The interactions between each one of these levels lead a person to exhibit specific patterned behaviors (McLeroy et al., 1988). The main assumption of the theory is that health promotion interventions should be based on a person's beliefs and understandings, and that the five levels of the model reflect the range of strategies that could be used to change health-related behaviors (McLeroy et al., 1988). One specific usage of this theory is to understand the cause of health-related behaviors. If the cause of the behavior is known, interventions could then be employed to modify that behavior.

Socio-ecological Model in Action

The socio-ecological model has been used in an array of substance abuse research to determine prevention strategies for various health-related behaviors. One study utilized the socio-ecological model to determine patterns of substance abuse among high school students (Connell, Gilreath, Aklin, & Brex, 2010). Using a sample of ninth and 10th graders from non-metropolitan regions of New England high schools, the researchers found that 39% of the students were occasional or frequent polysubstance abusers

(Connell, et al., 2010). Areas of interest, according to the socio-ecological model used, were whether peers used substances, gender, family characteristics, and community characteristics were all part of why these health-related behaviors had formed (Connell, et al., 2010). The largest effect noted in this study was that of peer usage (Connell, et al., 2010). Those students who had peers who partook in substances of abuse were more likely to also partake in substance abuse (Connell, et al., 2010).

Another study used the socio-ecological model to find barriers to cervical cancer screening across the state of Florida (Daley, et al., 2010). In this qualitative study, researchers used a semistructured interview amongst medical providers in Florida to determine what they felt were the main barriers to cervical cancer screening in the patient population that they treated (Daley, et al., 2010). A theme-based analysis was conducted, and results were reported using the socio-ecological model as a basis (Daley, et al., 2010). Individual beliefs and behaviors, access to care, cultural differences and fear of deportation, along with inconsistent policies and funding levels were the main barriers that were identified (Daley, et al., 2010). It is important to note that each of these barriers fits into a different classification level of the socio-ecological model (Daley, et al., 2010). Researchers are able to use this research to determine where resources should be utilized to help increase cervical cancer screenings (Daley, et al., 2010).

Theory Rationale

As noted above, the socio-ecological theory can be used to determine why a specific health-related behavior develops. It uses the way a person interacts with various levels of society to show where interventions could be made to potentially decrease a public health problem. Many researchers have used this model to map out interventions

for adolescent substance abuse, teen pregnancies, obesity, and many other public health problems (Connell, et al., 2010; Fasula, et al, 2019; Park & Kim, 2008). For this reason, I used this theory in the present study. Determining which risk factors have the largest impact on who is more likely to exhibit polysubstance abuse was the purpose of this study. By using the socio-ecological model, I was able to map out the problem and identify risk factors. These risk factors could then be paired with interventions to help decrease polysubstance abuse, which is linked to an increased risk of death. Linking factors that lead to higher rates of polysubstance abuse to interventions to decrease those factors results in positive social change and a better society (Max, Sedivy, & Garrido, 2015).

Literature Review Related to Key Variables

The next section of the literature review includes the key variables that I used in the study and how each variable is related to substance abuse, and more specifically, polysubstance abuse.

Polysubstance Abuse in General

The first section of this literature review includes studies that combine variables together to paint a picture of what polysubstance abuse looks like overall. Bahdila et al. (2020) looked at the relationship between cocaine and polysubstance abuse with outcomes related to oral health. Bahdila et al. (2020) specifically selected cocaine because it is the second most abused illicit drug in the United States. This research used data from the 2009–2014 National Health and Nutrition Examination Survey (NHANES; Bahdila, et al., 2020). Overall researchers found that 17% of adults in the United States had ever used cocaine (Bahdila, et al., 2020). Risk factors for cocaine use were male sex,

being a non-Hispanic White, and living in poverty (Bahdila, et al., 2020). The risk of having oral health problems was higher in patients that used more than one substance but did not reach a significant level until three or more substances were used (Bahdila, et al., 2020). Oral health problems were seen most in people who used cocaine concurrently with cigarettes or methamphetamine (Bahdila, et al., 2020).

Schmitz (2016) conducted a literature review which sought to define benzodiazepine use, misuse, and abuse, while also looking at benzodiazepine use with other drugs. This review found that prevalence of benzodiazepine use was between four and five percent, and that usage increases with age and that women are prescribed this particular drug twice as often as men (Schmitz, 2016). Benzodiazepine abuse rarely occurs alone though, as Schmitz's (2016) literature review found that benzodiazepines were normally the secondary drug of abuse to both opioids and alcohol. The resulting polysubstance abuse is particularly dangerous, because each one of these substances is a central nervous substance depressant and has additive effects (Schmitz, 2016). Benzodiazepines have a relatively low level of abuse but combined with other drugs of abuse they can become particularly dangerous (Schmitz, 2016).

Winkelman, Chang, and Binswanger (2018) sought to determine health related outcomes associated with polysubstance abuse, along with criminal justice involvement. Winkelman et al. (2018) specifically looked at patients who had some level of opioid use. In this study, researchers relied on self-report of mental and physical health using the 2015–2016 National Survey on Drugs Use and Health (Winkelman, et al., 2018). The researchers found that those people who reported any level of opioid use were significantly more likely to be of non-Hispanic Caucasian descent, have a lower

socioeconomic level, and report some form of chronic condition (Winkelman, et al., 2018). Any level of opioid use was associated with a higher risk of involvement with the criminal justice system (Winkelman, et al., 2018). The researchers also stratified the data based off level of opioid use and compared this to the percentage of patients who were using more than just opioids (Winkelman, et al., 2018). 68% of patients who were involved in prescription opioid misuse were also using other drugs of abuse, compared to only 24% of patients who were not misusing opioids (Winkelman, et al., 2018). This shows that those who are involved in prescription opioid misuse are highly likely to be using other substances.

Barocas, et al. (2019) focused on the impacts of the opioid epidemic targeted patients specific to Massachusetts, in an effort to determine social determinants and sociodemographic factors with opioid-related deaths. The researchers specifically looked at deaths where opioids were the only substance compared to deaths where multiple drugs were involved (Barocas, et al, 2019). The researchers found that in substance abuse deaths in Massachusetts, only 17% of deaths were related to opioids only (Barocas, et al, 2019). 36% of deaths had a mixture of opioids and some stimulant and 47% had a mixture of opioids and non-stimulants (Barocas, et al, 2019). The vast majority of deaths were seen in men (Barocas, et al, 2019). In looking at age group differences, significantly more people aged 25 and older were victims of substance abuse death than those 24 and younger (Barocas, et al, 2019). Metropolitan or suburban living was a contributing factor to death because patients who lived in rural areas were less likely to be found on multiple substances as compared to just opioids alone (Barocas, et al, 2019). The researchers also linked mental illness to polysubstance abuse and found that those

with mental illness were more likely to have polysubstance abuse issues than those who only used opioids (Barocas, et al, 2019). This study is most like the study I conducted below but it is different because the researchers only includes data from one state and are comparing opioid only abuse to polysubstance abuse (Barocas, et al, 2019).

The last study I will cover about general polysubstance abuse is an overview of prevalence and patterns of polysubstance abuse in women who are of reproductive age in the United States (Jarlenski, et al., 2017). The researchers only looked at women who have opioids as one of the drugs of abuse though, and these women had to be using opioids for nonmedical reasons (Jarlenski, et al., 2017). The researchers found that out of all women surveyed (n=4498) only 11% had an opioid only use disorder (Jarlenski, et al., 2017). Polysubstance abuse was found to be significantly higher in non-Hispanic white women, and those women who had lower educational levels (Jarlenski, et al., 2017). The researchers considered cigarettes to be a substance of abuse, which is different than the current study because cigarettes were included in this current study as a drug of polysubstance abuse (Jarlenski, et al., 2017). The researchers found that cigarettes, alcohol and marijuana were the most common substances that were used in addition to opioids by reproductive aged women in the United States (Jarlenski, et al., 2017). Age was not a determining factor for polysubstance abuse, as women across all age categories tested were found to be equally affected (Jarlenski, et al., 2017).

Sex and Polysubstance Abuse

Multiple researchers have looked at the difference between males and females and the rates of polysubstance abuse each face. Frem, Torrens, Domingo-Salvany, and Gilchrist (2017) studied the difference between gender and history of psychiatric

disorders among patients who use substances in Barcelona, Spain. The researchers used a secondary analysis of several cross-sectional studies conducted in Barcelona, Spain (Frem, et al., 2017). There were no gender differences reported in first age of usage or in the age of onset of habitual substance use (Frem et al., 2017). Males had a greater number of lifetime substance use disorders than females and also were significantly more likely to have polysubstance abuse (Frem et al., 2017). Even after adjusting for age, males still had a significantly higher rate of polysubstance abuse (Frem et al., 2017).

Ghaderi, Motmaen, Abdi, and Rasoli-Azad (2017) conducted a study to examine the difference in age and substance abuse patterns. The researchers hoped to determine if prevalence rates of substance abuse among men and women were changing, as researchers noticed a trend of increased use of substances by women in Iran (Ghaderi, et al., 2017). The Iranian researchers chose a city close to the Afghanistan-Iran border due to the high availability of opium in the region (Ghaderi et al., 2017). The researchers showed large gender differences in this population that can be attributed to the culture of the region (Ghaderi et al., 2017). Most men were single and employed whereas most women were married and unemployed (Ghaderi et al., 2017). The researchers showed that men were more likely to abuse multiple substances ($p = 0.015$) (Ghaderi et al., 2017). Interestingly enough, men were significantly more likely to use all substances tested except opioids and benzodiazepines, which were almost equal amongst the sexes (Ghaderi et al., 2017).

Evans, Grella, Washington, and Upchurch (2017) found specific gender differences related to polysubstance abuse. The researchers used data from the National Epidemiologic Survey on Alcohol and Related Conditions to relate gender and

racial/ethnic differences to polysubstance abuse (Evans, et al., 2017). Polysubstance abuse was significantly higher in the males that were studied versus the females (Evans et al., 2017). Also rates of polysubstance abuse persisted longer in males than in females during the course of this study (Evans et al., 2017).

Using the above literature as a guide, males are at a much larger risk of developing polysubstance abuse than females. None of the researchers utilized patients that had been admitted to a drug rehabilitation facility and only one set of researchers studied patients in the United States. This shows a gap in the literature related to gender and polysubstance abuse as it relates to the current study.

Age and Polysubstance Abuse

Looking at the relationship between age and polysubstance abuse in the literature resulted in no studies that look at age comparisons. The lack of literature comparing age ranges and risk of polysubstance abuse shows another gap in the literature that the current study hopes to fill. Multiple researchers have looked at youth and polysubstance abuse so those will be discussed below.

Moss, Chen, and Yi (2014) reported patterns of substance abuse prior to age 16, including projections of substance abuse into young adulthood. The researchers conducted the study on United States adolescents by using a secondary data analysis of the Add Health Survey (Moss et al., 2014). Moss et al. (2014) found that there was an overwhelming amount of polysubstance abuse (approximately 45% of adolescents) when substances were restricted to alcohol, marijuana, and cigarettes. Regular early use of these substances also led to an increased risk of continued use through early adulthood (Moss et al., 2014).

Kliewer and Murrell (2007) also looked specifically at adolescents and tried to identify risk factors and protective factors for substance use in Central American countries. Kliewer and Murrell (2007) used survey results from over 17,000 students in Panama, Costa Rica, and Guatemala on the lifetime use of alcohol, tobacco, marijuana, inhalants, tranquilizers, cocaine, crack, and ecstasy. Substance use was then compared to various risk factors and protective factors (Kliewer & Murrell, 2007). Risk factors included dysregulation, family problems with drugs/alcohol, peer deviance, and exposure to community violence, while protective factors included positive family interactions and positive student-teacher interaction (Kliewer & Murrell, 2007). Risk factors were more strongly associated with substance use than protective factors (Kliewer & Murrell, 2007).

Employment and Polysubstance Abuse

Employment status has been rarely studied in relation to polysubstance abuse. The studies below represent the literature that is available in finding differences between employment status and substance abuse, in general, with special notations for studies who had a polysubstance abuse arm.

Dada, Burnhams, Laubscher, Parry, and Myers (2018) looked at patient characteristics for women seeking substance abuse treatment in Western Cape, South Africa. The researchers hoped to find risk factors for women so that targeted interventions could be created by the public health community to help lower the burden of substance abuse in the community (Dada, et al., 2018). Specific to employment, 54.8% of study participants were unemployed at the time of study entry, followed by 24.9% having full employment (Dada et al., 2018). The researchers reported numbers

and percentages for women who exhibited polysubstance abuse but did not state whether any group was significantly different (Dada et al., 2018). However, the researchers did show that for substance abuse in general, women who were not working were significantly more at risk of being victims of substance abuse, when compared to those who worked full time, part time, or were students (Dada et al., 2018).

Timko, Han, Woodhead, Shelley, & Cucciare (2018) looked at polysubstance use amongst those who used stimulants and sought to review health outcomes over a three-year follow-up period (Timko, et al., 2018). The researchers did not look specifically at employment status, but it was a variable collected (Timko et al., 2018). Researchers found that amongst stimulant users, no differences were found in employment status when comparing different polysubstance abuse classes (Timko et al., 2018).

As mentioned above, very few researchers have specifically looked at use of multiple substances to determine if employment is protective of substance abuse behaviors. This shows another gap in the literature, especially when looking at those patients admitted to a drug rehabilitation facility, who likely need the most help, and could also be underrepresented in studies.

Insurance and Polysubstance Abuse

A review of the literature resulted in no studies where insurance status was discussed as a factor for developing polysubstance abuse. Ali, Teich, and Mutter (2017) sought to determine reasons why patients may or may not seek treatment for substance abuse disorders and found that financial barriers was one of the largest reasons for not finding treatment (Ali, et al., 2017). Among those who were privately insured, patients stated they were not ready to quit using or were not ready to face the stigma of accepting

help (Ali, et al., 2017). Amongst those not insured, financial barriers were the number one reason why patients did not seek treatment (Ali, et al., 2017). Also, among those patients who were covered by Medicaid, financial reasons still remained the top reason why treatment was not sought (Ali, et al., 2017). In another study, Feder et al. (2019) found that having health insurance was associated with a higher rate of patients entering treatment as compared to those who did not have insurance (Feder et al., 2019). Feder et al. (2019) specifically looked at those patients who injected drugs (Feder et al., 2019). Patients are more likely to obtain treatment after they are given insurance and continue to exhibit more stable medical care after becoming insured (Feder et al., 2019). Differences in type of insurance (private versus Medicaid/Medicare) showed that public programs increase treatment use more than private commercial insurance (Feder et al., 2019). Researchers noted that expanding public insurance programs could help to create a healthier nation with less substance abuse problems (Feder et al., 2019).

Living Arrangements

Several researchers have shown that those people who are homeless exhibit substance abuse problems more regularly than those who have a place to call home. This section will delve into available literature, focusing on polysubstance abuse when available.

Choi and Dinitto (2019) noted patients who were admitted to drug rehabilitation facilities but focused only on those who used marijuana. They noted that more than 75% of users exhibited polysubstance abuse (Choi & Dinitto, 2019). The researchers did not break down the data in terms of those who were polysubstance users versus those who were not but broke the data down in specific terms to marijuana as a primary, secondary,

or tertiary drug upon admission compared to marijuana only (Choi & Dinitto, 2019).

Choi and Dinnito (2019) showed that those who had marijuana as a drug of abuse along with any other drug were at least twice as likely to be homeless than those who only exhibited abuse of marijuana.

Rosenthal, Mallett, Milburn, & Rotheram-Boris (2009) sought to determine patient characteristics amongst homeless young people in the greater Los Angeles area. While the researchers had no direct comparisons between homeless status and substance abuse, they presented a summary of the homeless population in Los Angeles as compared to Melbourne, Australia, and how these populations compare with homelessness and substance abuse (Rosenthal et al., 2009). The researchers found that the length of homelessness was associated with greater risk of substance abuse, with those who had been homeless longer having higher rates of substance abuse (Rosenthal et al., 2009). The researchers also found that those who were experienced homeless had a significantly higher mean number of drugs used versus those who were newly homeless (Rosenthal et al., 2009).

Schneider, Park, Allen, Weir, and Sherman (2019) found that homelessness was related to substance abuse in Baltimore, Maryland. The researchers found that of those people who exhibit polysubstance abuse in Baltimore, 34% were homeless, while 38% owned their own home/apartment, and the remaining 28% lived in someone else's place (Schneider et al., 2019). The researchers used a latent class analysis and found that those patients who fit into the heroin/cocaine class were more likely to be homeless than those who fit into other classes (Schneider et al., 2019). Of note, the heroin/cocaine class was considered to be the highest risk class (Schneider et al., 2019).

As noted by the studies above, homelessness is a risk factor for the development of polysubstance abuse. Researchers have noted that substance abuse does not start while being newly homeless but can develop the longer a person is homeless. Another theory is that substance abuse can cause situations where people become homeless. None of these studies were conducted in patients who had been referred to substance abuse facilities, so again the gap in the literature is there and will hopefully be filled by the current study.

Mental Illness and Polysubstance Abuse

Diagnosed mental illness has been studied by multiple researchers to determine how these complex medical conditions contribute to substance abuse, and more specifically polysubstance abuse. Below will be an overview of the available literature to show the relationship between these two medical conditions.

Ibrahim, Hussain, Alnasser, Almohandes, and Sarhandi (2018) conducted a study in Saudi Arabia, in a population much like the current study, in that these patients were inhabitants of a psychiatric rehabilitation center. Although polysubstance abuse was not an inclusion factor in the study, 60% of patients were polysubstance abusers (Ibrahim et al., 2018). The researchers found there was actually no correlation between diagnosed mental illness and the presence of substance abuse (Ibrahim et al., 2018).

Timko, Ilgen, Haverfield, Shelley, and Breland (2017) conducted a study in psychiatry inpatients to look at the correlations between patients having co-occurring mental health and substance use disorders. The reasons for admission to the psychiatric hospital included depression (78.1%), PTSD (41.3%), other anxiety disorder (63.4%), schizophrenia or schizoaffective disorder (29.1%), and bipolar disorder (16.9%) (Timko et al., 2017). Patients who were in the polysubstance group tended to have more severe

alcohol and drug use problems, more support for abstinence, and less self-efficacy to maintain abstinence (Timko et al., 2017). When comparing those who did not have polysubstance abuse to those who did, there was no difference noted in severity of psychiatric symptoms, except in the alcohol only group (Timko et al., 2017). This group had more severe social anxiety (Timko et al., 2017). This study contains a lot of parallels to the current study, except for the fact that all participants had some form of mental illness. The current study seeks to see if presence of mental illness is a risk factor for polysubstance abuse.

Delving into more specific mental health issues, it appears that post-traumatic stress disorder (PTSD) has been linked to substance abuse and polysubstance abuse the most. Kearns, Cloutier, Carey, Contractor, and Blumenthal (2019) noted that patients who were polysubstance abusers had greater PTSD-associated negative cognition (anhedonia, mostly) and hyperarousal symptoms (irritability/aggression, risky behaviors) than those who were not polysubstance abusers. Jeffirs et al. (2019) conducted another study specific to PTSD, but this time in a veteran population, and found that those patients who were being treated for PTSD and also had some degree of substance abuse, polysubstance users had greater reductions in frequency of use and sustained levels of PTSD symptoms as compared to patients who only use one substance. It is important to note that baseline frequency of use and PTSD symptoms did not differ at the beginning of PTSD treatment (Jeffirs et al, 2019).

Race and Polysubstance Abuse

Most researchers have not specifically looked at racial differences in substance abuse populations, but this variable is often collected and reported on with each study.

Silveira, Green, Iannaccone, Kimmel, and Conway (2019) conducted a latent class analysis on students aged 15–17 to determine patterns of polysubstance abuse in United States youth. Using white, non-Hispanic children as the reference race, both black and Hispanic students were more likely to fit into the polysubstance class than their white peers (Silveira et al., 2019). It is important to note that the researchers only included children though, so differences in the adult population may exist.

Evans et al. (2017) found that African Americans were more likely to exhibit polysubstance abuse as compared to Hispanics, and non-Hispanic whites. It was also noted that Hispanics experienced polysubstance abuse more than non-Hispanic whites (Evans et al., 2017). Other researchers have shown that non-Hispanic whites experience polysubstance abuse more than other racial classes (Choi et al, 2019; Timko et al, 2018).

As noted above there is no consensus in studies as to which race experiences the most polysubstance abuse. Hopefully the current study can help add more guidance on which race is affected more so that more resources can be developed for the most affected races.

Other Variables

The last three variables (alcohol as a substance, education level, and prior treatment episodes) have not been included in any usable way in the literature found. Alcohol usage was compared as a single substance but not when being taken into account as one of the substances of polysubstance abuse. Education level resulted in no matches that would fit the topic, and prior treatment episodes have not been looked at either. Including these variables will begin foundational work to determine what differences

may exist in terms of risk for polysubstance abuse and could contribute to positive social change if differences are found.

Social Change and Polysubstance Abuse

When discussing substance abuse of any kind, any interventions that are done or any risk factors that are noted have the potential to cause vast positive social change. The determination of risk factors that could lead to polysubstance abuse could help create new programs specific to those risk factors. Without a knowledge of the risk factors involved, local, state, and federal public health partners may not be able to target the right sets of patients to create the best improvement in outcomes. Each variable discussed above, if found to have a significant risk for causing polysubstance abuse, could result in new programs and resources being created which would have a profound impact on social change. The ability to have targeted resources and programs for patients who have a polysubstance problem could help treat these patients and prevent relapse.

On a much larger scale, substance abuse disorder has been met with a much larger criminal justice approach than a public health approach in the past. The resulting criminalization of drug use has led to many arrests with no thoughts of how to successfully treat each patient. The public health world has become increasingly present in the treatment and prevention of substance abuse disorder (Volkow, Poznyak, Saxena, & Gerra, 2017). The 2016 United Nations General Assembly Special Session on drugs recognized drug addiction as a health disorder that is preventable and treatable and not a result of moral failure (Volkow et al, 2017). This recommended push to maintain substance abuse disorder as a public health problem led to many areas of social change, to include processes to eliminate stigma and discrimination, implementing evidence-

based prevention and treatment programs, collecting and utilizing scientific data in policy making, and engaging stakeholders in coordinating policy making (Volkow et al, 2017). The more research that is conducted on substance abuse disorder, the more likely these programs are able to take hold and create positive social change for those who succumb to this disease (Volkow et al, 2017).

Summary and Conclusions

The above section contained a guide of the available literature relating to the theoretical framework and the variables being used in the study. It is important to note that no researchers have combined all of these variables together to show which ones interact and lead to an increased risk for polysubstance abuse. Using the above as a guide, differences have been found in whether males or females have greater risk and what races exhibit a greater risk of polysubstance abuse. No researcher has readily compared adults to youth to determine if polysubstance abuse could be caught early and whether early detection and treatment could lead to greater remission. The current study hopes to fill all these gaps and note the degree that each one of these patient characteristics contributes to development of polysubstance abuse in patients who have been admitted to drug rehabilitation facilities nationally. The next section provides an overview of the study methodology to obtain the answers to the above questions.

Chapter 3: Research Methods

Introduction

I conducted a retrospective quantitative research study to explore the relationship of sociodemographic variables and how these variables may or may not lead to polysubstance abuse in patients admitted to a drug rehabilitation facility. I used secondary data analysis. The independent variables that I used were patient's sex, age, race, education level, employment status, insurance status, living arrangements, prior treatment for substance abuse, alcohol as one of the substances, and diagnosed mental illness. The dependent variable that I used was whether a patient exhibits polysubstance abuse. I used a binomial logistic regression to show whether any of these variables were associated with polysubstance abuse.

This chapter will be divided into four sections. In the introduction section, I will briefly describe the study problem and purpose. In the research design and rationale section, I will describe study variables and explain the research design that I used and why I selected it. In the methodology section, I will describe the patient population that I used, sampling procedures, a description of the archived data that I used, and a data analysis plan. Lastly, in the threats to validity section, I will describe threats to both external and internal validity.

Research Design and Approach

I used a quantitative retrospective research design to determine if there was an association between various sociodemographic factors and the risk of having polysubstance abuse. The independent variables that I used were patient's sex, age, race, education level, employment status, insurance status, living arrangements, prior treatment

for substance abuse, alcohol as one of the substances, and diagnosed mental illness. The dependent variable that I used was whether a patient exhibits polysubstance abuse.

This study is a retrospective study because of its use of archived data by SAMHSA. I used this research design to answer the research question of determining the extent patient characteristics (patient's sex, age, race, education level, employment status, insurance status, living arrangements, prior treatment for substance abuse, alcohol as one of the substances, and diagnosed mental illness) individually contribute to polysubstance abuse among patients admitted to a drug rehabilitation facility. The data provided by SAMHSA are publicly available for use. I conducted bivariate analyses for each independent variable to determine the association with the dependent variable.

Methodology

Study Population

The target population for this study was anyone who had been diagnosed with a substance abuse disorder and had been admitted to a publicly funded substance abuse treatment facility. I selected this target population because state laws require publicly funded substance abuse treatment facilities to report admissions to SAMHSA and the data are made publicly available. The data covered all the United States and the years that I used were 2013 to 2015 as these are the last 3 years of data available. The study population available in the dataset is over 5,000,000 patients.

Sampling and Sampling Procedures

Utilizing the dataset mentioned above, I selected a sample of patient records for inclusion in the study. To obtain this sample, I used simple random sampling. I assigned each entry a random number value using Microsoft Excel. I then sorted these random

numbers from smallest to largest and chose the sample from the random numbers. I chose simple random sampling for this study because it allows for each entry in the database to have an equal chance of being selected and therefore the study sample was completely random and had the highest probability of representing the entire study population. Exclusion criteria for the study were anyone who has missing values for the variables listed above and anyone who had a listing of zero substances upon admission to a substance abuse treatment facility.

I used the G*Power software tool to calculate sample size for this study. I selected the effect size of 0.3 to cover for a small to medium effect. I set power to a standard 0.8 and the alpha level at 0.05, in accordance with standard social science practices. Given the use of 10 independent variables, the sample size needed to obtain statistical power resulted in 986 patients. This number was fully supported by the database that I used.

Characteristics of Archived Data

As mentioned above, I used archived data from SAMHSA. The specific dataset that I used was the Treatment Episode Data Set: Admissions (TEDS-A). I used the last 3 years of data and concatenated them together. These years are 2013, 2014, and 2015. The data were made publicly available and no special procedures were needed to utilize the data. SAMHSA collects this data from substance abuse treatment programs that use public funds. SAMHSA noted that some states collect only their publicly funded admissions, whereas as other states collect data from both publicly and privately-run facilities. Because of this, not all admissions to substance abuse treatment facilities are reported, but what is reported represents the public burden of substance abuse treatment.

The states utilize administrative systems that transmit the data to SAMHSA, which creates the dataset known as TEDS-A. TEDS-A contains records on admissions to substance abuse treatment facilities in those aged 12 years and older. Information in the database includes patient demographics and substance abuse characteristics. The records represent admissions to a treatment facility and not an individual patient. This could mean that one patient may be represented multiple times in the database if the patient had been admitted more than once over the time period being reported. The data are provided by the facility directly to SAMHSA and is inclusive of all patients admitted to the facility over the year. Given this, the data are valid and reliable as it contains all data the facility collects.

To access the data, users must agree to the terms of use agreement as defined by SAMHSA. To be able to use the data, users agree to (a) use the dataset solely for research or statistical purposes and not for re-identification of specific research subjects, and (b) make no use of the identity of any research subject discovered inadvertently. Lastly, users agree to reference the recommended bibliographic citation in any publications that use SAMHSA data and to send citations of published works to SAMHSA for inclusion in a database of related publications. These are the only procedures for gaining access to the data and the data codebook.

The dataset does not contain any identifying information and multiple measures were taken to protect the confidentiality of records. Variables that could identify individuals, such as age as a continuous variable, were recoded into various categorical variables so that individuals could not be identified. SAMHSA used disclosure analyses to identify records that remained unique after decoding. These records underwent data

swapping in order to satisfy stringent confidentiality standards. It is for these reasons that the secondary analysis of this previously collected data is ethically sound. Before I conducted this research study, the proposal was submitted to the Walden University Institution Review Board (IRB) and I received approval.

Manipulation of Archived Data

Due to the archived data structure, I recoded several variables in the original dataset to be useful for the current study. The first variable that I recoded was the number of substances variable. This variable in the original dataset measured how many substances were being used at admission to the treatment facility. To create the polysubstance abuse variable for this study, I recoded this variable where anybody using one substance was considered a mono-substance abuser and anyone using more than one substance was considered a polysubstance abuser. The next variable that I needed to recode was age. Age in the original dataset was coded by 5-year intervals. For this study, I recoded age into categories for under 18, 18–54, and 55 and older. The last variable that I recoded was the number of prior treatment episodes. This variable was reported as a numeric value of one to five or more. For the purposes of the current study this I recoded this variable where zero was changed to a value of No and one or more was changed to a value of Yes. This allowed for research into whether a prior treatment led to an increase in polysubstance abuse.

Operationalization of Variables

In the following section, I will describe each variable that I used in the study, to include its definition and how it was measured. Patient's sex was treated as a dichotomous variable and defined as self-identification as male or female with no

category of other identifications. Age was treated as an ordinal variable and defined as 1 = under 18, 2 = 18–54, and 3 = 55 and older. Race was treated as a categorical variable and was defined as self-identification of Alaska Native/American Indian, Pacific Islander, Black, White, Asian, or Other. Education level was treated as a categorical variable and was defined as self-report of Middle School, Some High School, Completed High School, Some College, or Completed College. Employment status was treated as a categorical variable and was defined as self-report of full-time employee, part-time employee, unemployed, or not in labor force. Insurance status was treated as a categorical variable and was defined as having private insurance, Medicaid, Medicare/Tricare, or no insurance. Living arrangements was treated as a categorical variable and defined as self-report of homeless, dependent living, or independent living. Prior treatment for substance abuse was a dichotomous variable and was defined as yes versus no. Alcohol as one of the substances was a dichotomous variable and was defined as yes versus no. Diagnosed mental illness was a dichotomous variable and was defined as yes versus no. The dependent variable that was used was whether a patient exhibits polysubstance abuse as a yes or no response.

Data Analysis Plan

My goal for this study was to determine if various patient characteristics can lead to a patient exhibiting polysubstance abuse using a quantitative method design. The overall objective was to understand the association between the independent variables of patient's sex, age, race, education level, employment status, insurance status, living arrangements, prior treatment for substance abuse, alcohol as one of the substances, and diagnosed mental illness and the dependent variable of polysubstance abuse. Each

variable listed above will have descriptive statistics ran to include frequencies and percentages. The research questions and hypotheses that were used to test this objective are as below.

RQ1: To what extent does treatment for substance abuse, alcohol use, and diagnosed mental illness contribute to polysubstance abuse among patients admitted to a drug rehabilitation facility?

H_0 1: There is not an association between treatment for substance abuse, alcohol use, and diagnosed mental illness with polysubstance abuse among patients admitted to a drug rehabilitation facility.

H_a 1: There is an association between treatment for substance abuse, alcohol use, and diagnosed mental illness with polysubstance abuse among patients admitted to a drug rehabilitation facility.

Table 2 below shows the relationship between the variables used for RQ1.

Table 2

Dependent and Independent Variables used for Research Question 1

<u>Independent Variable</u>	<u>Dependent Variable</u>
Prior treatment for substance abuse	Polysubstance Abuse
Alcohol as one of the substances	
Diagnosed mental illness	

The secondary research question explores combinations of variables using the literature as a guide. This leads to the creation of the below hypotheses associated with the question.

RQ2: Is there an association between sex, age, race, education level, employment status, insurance status, and living arrangements with polysubstance abuse?

H_02 : There is not a collective prediction between patient's sex, age, race, education level, employment status, insurance status, and living arrangements, and polysubstance abuse among patients admitted to a drug rehabilitation facility.

H_a2 : There is a collective prediction between patient's sex, age, race, education level, employment status, insurance status, and living arrangements, and polysubstance abuse among patients admitted to a drug rehabilitation facility.

Table 3 below shows the relationship between the variables used for RQ2.

Table 3

Dependent and Independent Variables used for Research Question 2

Independent Variable	Dependent Variable
Sex	Polysubstance Abuse
Age	
Race	
Education Level	
Employment Status	
Insurance Status	
Living Arrangements	

The third research question poses the same question as RQ1 but attempts to adjust for patient sex and age.

RQ3: To what extent do prior treatment for substance abuse, alcohol use, and diagnosed mental illness contribute to polysubstance abuse among patients admitted to a drug rehabilitation facility, after adjusting for patient sex and age?

H_{03} : There is not an individual association between prior treatment for substance abuse, alcohol use, and diagnosed mental illness to polysubstance abuse among patients admitted to a drug rehabilitation facility, after adjusting for patient sex and age.

H_{a3} : There is an individual association between prior treatment for substance abuse, alcohol use, and diagnosed mental illness to polysubstance abuse among patients admitted to a drug rehabilitation facility, after adjusting for patient sex and age.

[[The above was the last page I edited thoroughly, so please be sure to continue through this chapter and make the appropriate changes, as they are indicated above.]]

To answer these questions, I conducted inferential statistics using a binomial logistic regression. I used multivariate analyses to identify if the combination of independent variables were strong predictors of polysubstance abuse. I used the logistic regression methodology because this type of statistical testing is valid when the dependent variable is of a dichotomous nature. I used SPSS version 25 to conduct all statistical testing. Before logistic regression could be done for this study, I tested all assumptions of logistic regression. I tested for multicollinearity by using SPSS and the tolerance and variance inflation factor (VIF) test. VIF values greater than 10 and tolerance values less than 0.2 were indicative of the presence of multicollinearity. The next assumption is that no outliers can be present. I examined the data to determine if outliers were present and whether these outliers were errors. Lastly, there should be a linear relationship between the log odds and independent variables. I checked linearity using SPSS and the B-coefficient. The B coefficient measures the degree of change in the outcome variable for every one-unit change in the predictor variable. It is essentially the slope of the line and should be linear between the log odds for logistic regression.

For RQ1, I compared each independent variable (prior treatment for substance abuse, alcohol as one of the substances, diagnosed mental illness) to whether a patient exhibits polysubstance abuse on admission to a drug rehabilitation facility. For the variable “Prior treatment for substance abuse”, no was the reference category. For the variable “alcohol as one of the substances”, no was the reference category. For the variable “diagnosed mental illness”, no was the reference category. I analyzed results of the logistic regression by the resulting odds ratio and overall model of significance to see

if each predictor variable was associated with polysubstance abuse. An odds ratio of approximately 1 means that the independent variable causes equal risk for the dependent variable, whereas an odds ratio less than one means less risk, and an odds ratio more than 1 means greater risk.

For RQ2, I compared the collective association of independent variables (patient's sex, age, race, education level, employment status, insurance status, living arrangements) to whether a patient exhibits polysubstance abuse on admission to a drug rehabilitation facility. Again, I conducted a binomial logistic regression and interpreted the results as in RQ1 above. For the variable "sex", female was the reference category. For the variable "age", under 18 was the reference category. For the variable "race", white was the reference category. For the variable "education", middle school was the reference category. For the variable "employment", full time was the reference category. For the variable "insurance", no insurance was the reference category. For the variable "living arrangements", independent living was the reference category.

For RQ3, I compared each independent variable (prior treatment for substance abuse, alcohol as one of the substances, diagnosed mental illness) to whether a patient exhibits polysubstance abuse on admission to a drug rehabilitation facility, with added adjustments for sex and age. Again, I conducted a binomial logistic regression and interpreted the results as in RQ1 above. For the variable "Prior treatment for substance abuse", no was the reference category. For the variable "alcohol as one of the substances", no was the reference category. For the variable "diagnosed mental illness", no was the reference category. I used binomial logistic regression to determine if independent variables were predictive of the dependent variable that was of a

dichotomous nature. Using the above variables with reference categories listed, I was able to predict which patient characteristics were more likely to lead to polysubstance abuse.

Threats to Validity

The internal validity may be compromised because of the use of logistic regression. It was impossible to test all combinations of variables that may exist and could contribute to polysubstance abuse because of the use of archived data. The only variables that were able to be tested were those that were present in the original dataset. Manipulation of variables may have also led to a decrease in internal validity due to the loss of data when moving from a higher level of measurement to a lower level of measurement.

The use of archival data also led to threats to external validity. This is because it is impossible to determine if the study sample rightly fits with the entire population because the data had already been collected. Accuracy and validity of the initial dataset aided in establishing external validity. The fact that every state is required to report data to SAMHSA through state reporting systems decreased the risk of external validity issues and greatly allowed for generalizability of the current study.

Summary

I presented in the above chapter a description of the study methodology. I showcased the research purpose and design, descriptive methodology to allow for repeat studies to be conducted, the population description, and data analysis plan. I also showed how the archived data was manipulated to allow for use in this study. Chapter four will describe the results of the study.

Chapter 4: Results

Introduction

The purpose of the research study was to explore the relationship of sociodemographic variables and how these variables may or may not lead to polysubstance abuse in patients admitted to a drug rehabilitation facility using secondary data analysis. The research questions and hypotheses I used for this study were:

RQ1: To what extent does treatment for substance abuse, alcohol use, and diagnosed mental illness contribute to polysubstance abuse among patients admitted to a drug rehabilitation facility?

H_01 : There is not an association between treatment for substance abuse, alcohol use, and diagnosed mental illness with polysubstance abuse among patients admitted to a drug rehabilitation facility.

H_a1 : There is an association between treatment for substance abuse, alcohol use, and diagnosed mental illness with polysubstance abuse among patients admitted to a drug rehabilitation facility.

RQ2: Is there an association between sex, age, race, education level, employment status, insurance status, living arrangements with and polysubstance abuse?

H_02 : There is not a collective association between patient's sex, age, race, education level, employment status, insurance status, and living arrangements, and polysubstance abuse among patients admitted to a drug rehabilitation facility.

H_a2 : There is a collective association between patient's sex, age, race, education level, employment status, insurance status, and living arrangements, and polysubstance abuse among patients admitted to a drug rehabilitation facility.

RQ3: To what extent do prior treatment for substance abuse, alcohol use, and diagnosed mental illness contribute to polysubstance abuse among patients admitted to a drug rehabilitation facility, after adjusting for patient sex and age?

H_03 : There is not an individual association between prior treatment for substance abuse, alcohol use, and diagnosed mental illness to polysubstance abuse among patients admitted to a drug rehabilitation facility, after adjusting for patient sex and age.

H_{a3} : There is an individual association between prior treatment for substance abuse, alcohol use, and diagnosed mental illness to polysubstance abuse among patients admitted to a drug rehabilitation facility, after adjusting for patient sex and age.

Chapter 4 is divided into four sections. In the introduction section above, I described the purpose of the study and stated the research questions and related hypotheses. In the data collection section, I will describe how the data was collected and otherwise manipulated to create the population that the study sample was derived. I will also present baseline demographics for the sample. In the results section, I will include the data analysis and findings, including inferential statistics utilizing a binomial logistic regression model. In the summary section, I will answer the research questions and lead into Chapter 5: Conclusions.

Data Collection

This study was a quantitative retrospective study utilizing secondary data from the SAMHSA. The particular dataset that was used was the TEDS-A. This dataset is published yearly, but for the purposes of this study I used years 2013, 2014, and 2015. I analyzed the data to determine if there were any specific variables or any combinations of

variables that would predict a patient being admitted to a substance abuse treatment facility as a polysubstance user.

Starting with the data sets for each year mentioned above, I concatenated each dataset together using SPSS. The dataset for 2013 contained 1,683,451 entries. The dataset for 2014 contained 1,614,358 entries. The dataset for 2015 contained 1,537,025 entries. The total population being studied was 4,834,834 entries. After I concatenated the datasets together, application of the exclusion criteria took place. After I removed all patients who reported no substances of abuse upon admission to a substance abuse rehabilitation facility, the study population was 4,760,176. After I removed all patients who had missing values for the study variables being used, the study population that remained was 1,479,903. I took a study sample from this total population to conduct the study. The total number of patients used for the study was 986, in order to make power. I obtained this study sample by random number sampling, as mentioned in Chapter 3. From the methodology presented in Chapter 3, there were no discrepancies in data collection. I followed all procedures as presented and nothing needed to be changed for the study.

Sample Characteristics

The independent variables, which included various patient characteristics, had varying degrees of variability. Some were split evenly, and others had wide ranges in values. 88.1% of all participants were aged 18–54 years old, and only 4.3% were below 18, while 7.6% were older than 55. Sex was split up so that 66.1% of all study sample participants were male and 33.9% were female. Race for the study sample showed that 3.7% were Alaska Native/American Indian, 1% was Pacific Islander, 17.4% was Black,

72.6% was White, 0.7% was Asian, and 4.7% were other. For education status, the study sample broke down as follows: 6.9% had a middle school education, 21.5% had attended high school, 47.3% graduated from high school, 18.7% had some college experience, and 5.7% had graduated college. Employment status showed that 18.8% of the sample worked full time, 6.4% worked part time, 42.2% were unemployed, and 32.7% were not in the labor force. 34.3% of the study sample had no prior substance abuse treatment, whereas 65.1% has been treated before. For the variable living arrangements, 17.8% of the sample were homeless, 17.6% had dependent living, and 64.5% had independent living. Alcohol being one of the substances of abuse was reported in 41.2% of sample patients and not reported in 58.8% of sample patients. For the variable psychiatric problems, 41.2% of the sample had some form of psychiatric problem and 58.8% did not. The last variable was health insurance status. 15% had private insurance, 33.6% for Medicaid, 7.1% had some other form of public insurance (Medicare, Tricare, etc.), and 44.3% of the sample had no insurance. The frequencies and percentages associated with these variables are shown in Table 4 below.

Table 4

Study Sample Characteristics: Independent Variables

Independent Variables	Frequency	Percentage
<i>Age</i>		
Less than 18	42	4.26%
18-54	869	88.13%
55 and older	75	7.61%
<i>Sex</i>		
Male	652	66.13%
Female	334	33.87%
<i>Race</i>		
Alaska Native/American Indian	36	3.65%
Pacific Islander	9	0.91%
Black	172	17.44%
White	716	72.62%
Asian	7	0.71%
Other	46	4.67%
<i>Education (in years)</i>		
8 years or less	68	6.90%
9-11 years	212	21.50%
12 years	466	47.26%
13-15 years	184	18.66%
16 years or more	56	5.68%
<i>Employment Status</i>		
Full Time	185	18.76%
Part Time	63	6.39%
Unemployed	416	42.19%
Not in Labor Force	322	32.66%
<i>Prior Treatment</i>		
No	338	34.28%
Yes	648	65.72%

Table 4 (cont.)

Independent Variables	Frequency	Percentage
<i>Living Arrangement</i>		
Homeless	176	17.85%
Dependent Living	174	17.65%
Independent Living	636	64.50%
<i>Alcohol Use</i>		
No	460	46.65%
Yes	527	53.45%
<i>Psychiatric Problem</i>		
No	580	58.82%
Yes	406	41.18%
<i>Health Insurance</i>		
Private Insurance	148	15.01%
Medicaid	331	33.57%
Other public	70	7.10%
None	437	44.32%

For the dependent variable, polysubstance abuse, the study sample was almost evenly distributed between those who were polysubstance users and those who were not. 45.9% of study participants were monosubstance abusers versus 54.1% who were polysubstance abusers. This is shown in Table 5 below.

Table 5

Study Sample Characteristics: Dependent Variables

Dependent Variable	Frequency	Percentage
<i>Polysubstance Abuse</i>		
No	453	45.94%
Yes	533	54.06%

In looking at the study sample frequency tables and knowing that a random sample was selected from the larger dataset, the study sample was a solid representation of the full population in the dataset, so continuation into the research questions and the results for those is warranted.

Results

This section will be divided into three subsections, corresponding to the three research questions that will be answered. Each subsection will show the statistical assumptions that I tested before the actual statistical test could take place followed by the results of each test.

Relationship between Polysubstance Abuse and Prior Treatment, Alcohol Use, and Mental Illness

Looking at the data for RQ1, several of the assumptions can be answered immediately. The dependent variable was dichotomous, and no outliers were present. To test for multicollinearity, I used the VIF test in SPSS. The VIF test showed that no multicollinearity was present in the study variables for research question one due to the tolerance being greater than 0.2 and the VIF being less than 10. See Table 6 below for VIF statistics for RQ1.

Table 6

VIF for Research Question 1

Variable	Tolerance	VIF
Prior Treatment	0.988	1.012
Alcohol abuse	1	1
Mental Illness	0.988	1.012

The last assumption that needed to be tested was the assumption that there is a linear relationship between the log odds and independent variables. This assumption is only for when continuous variables are used and since none of the variables in this research question are continuous it was not necessary for me to test for this assumption. As all the assumptions for this model were met, the binomial logistic regression model was carried out.

Before conducting the binomial logistic regression, it was necessary to explain the reference categories for each independent variable. People who had not been treated for substance abuse before were the reference category for prior treatment. People who did not have a history of mental illness were the reference category for mental illness. Lastly, people who did not exhibit alcohol abuse were the reference category for alcohol use. In conducting the binomial logistic regression model, I found the model to be statistically significant ($p < 0.01$). The R^2 of the model was between 3.3% (Cox and Snell) and 4.5% (Nagelkerke), meaning that this particular model did not explain much of the variance in predicting polysubstance abuse. Getting down to the individual variables in the model, I found all variables significantly predicted polysubstance abuse with the exception of prior treatment. Prior treatment had a significance of 0.298, which is not less than 0.05, so I excluded it from further analysis. Alcohol use led to 1.639 times higher odds to exhibit polysubstance abuse than those who did not abuse alcohol ($p < 0.01$). Any mental health diagnosis led to 1.747 times higher odds to exhibit polysubstance abuse than those who did not have a mental health diagnosis ($p < 0.01$). See Table 7 below for all statistics associated with RQ1.

Table 7

Logistic Regression Predicting Likelihood of Polysubstance Abuse based on Prior Treatment, Alcohol Use, and Mental Illness

	<i>B</i>	S.E.	Wald	<i>df</i>	<i>p</i>	Odds Ratio	95% CI for Odds Ratio	
							Lower	Upper
Prior Treatment	0.14	0.14	1.08	1	0.30	1.15	0.88	1.51
Alcohol reported at admission	0.49	0.13	14.35	1	0.00	1.64	1.27	2.12
Mental Health Illness	0.56	0.13	17.43	1	0.00	1.75	1.34	2.27
Constant	-0.42	0.14	9.00	1	0.00	0.66		

Relationship between Polysubstance Abuse and Sex, Age, Race, Education Level, Employment Status, Insurance Status, and Living Arrangements

Looking at the data for research question two, several of the assumptions were answered immediately. The dependent variable is dichotomous, and no outliers are present. To test for multicollinearity, I used the VIF test in SPSS. The VIF test showed that no multicollinearity was present in the study variables for RQ2 due to the tolerance being greater than 0.2 and the VIF being less than 10 for all variables. See Table 8 below for VIF statistics for RQ2.

Table 8

VIF for Research Question 2

Variable	Tolerance	VIF
Age	0.950	1.052
Sex	0.967	1.035
Race	0.986	1.014
Education	0.928	1.078
Employment Status	0.921	1.086
Living Arrangements	0.933	1.071
Health Insurance	0.978	1.022

The last assumption that I tested was the assumption that there is a linear relationship between the log odds and independent variables. This assumption is only for when continuous variables are used and since none of the variables in this research question were continuous it was not necessary to test for this assumption. As all the assumptions for this model were met, the binomial logistic regression model was carried out.

Before conducting the binomial logistic regression, it was necessary to explain the reference categories for each independent variable. For the variable “sex”, female was the reference category. For the variable “age”, under 18 was the reference category. For the variable “race”, white was the reference category. For the variable “education”, middle school was the reference category. For the variable “employment”, full time was the reference category. For the variable “insurance”, no insurance was the reference category. For the variable “living arrangements”, independent living was the reference category.

In conducting the binomial logistic regression model, I found the model to be statistically significant ($p < 0.01$). The R^2 of the model was between 6.2% (Cox and Snell) and 8.2% (Nagelkerke), meaning that this particular model did not explain much of the variance in predicting polysubstance abuse. Getting down to the individual variables in the model, I found that most variables did not significantly predict polysubstance abuse. These variables included sex, race, living arrangements, and health insurance status. The variables that were predictive of polysubstance abuse were age, education level, and employment status. Sex ($p = 0.116$), race ($p = 0.211$), living arrangements ($p = 0.283$), and health insurance ($p = 0.164$) all had significance levels that were not less than 0.05, so they were excluded from further analysis.

Age was a predictor of polysubstance abuse ($p = 0.017$), but there were no differences found between those aged 18-54 ($p = 0.353$) and those aged greater than 55 ($p = 0.424$) when compared to those aged less than 18.

Education level was highly predictive of polysubstance abuse ($p = 0.005$). When looking at categorical comparisons, those that had some level of high school education had 2.102 times higher odds of exhibiting polysubstance abuse than those who had spent no time in high school ($p = 0.015$). Those that had completed high school education had 2.102 times higher odds of exhibiting polysubstance abuse than those who had spent no time in high school ($p = 0.015$). Those that had some level of college education had 2.158 times higher odds of exhibiting polysubstance abuse than those who had spent no time in high school ($p = 0.015$). There were no differences found between those who had completed college and those who had spent no time in high school ($p = 0.732$).

Employment status was highly predictive of polysubstance abuse ($p = 0.001$).

When looking at categorical comparisons, those that worked part-time had 1.832 times higher odds of exhibiting polysubstance abuse than those who worked full-time ($p = 0.046$). Those that were unemployed had 1.888 times higher odds of exhibiting polysubstance abuse than those who worked full-time ($p = 0.001$). Those that were not in the labor force had 2.358 times higher odds of exhibiting polysubstance abuse than those who worked full-time ($p < 0.001$). See Table 9 below for all statistics associated with RQ2.

Table 9

Logistic Regression Predicting Likelihood of Polysubstance Abuse based on Sex, Age, Race, Education Level, Employment Status, Insurance Status, and Living Arrangements

Independent Variable	B	S.E.	Wald	df	p	Odds Ratio	95% C.I. for Odds Ratio	
							Lower	Upper
Age for study			8.12	2	0.02			
Age for study(1)	0.36	0.38	0.86	1	0.35	1.43	0.67	3.02
Age for study(2)	-0.36	0.45	0.64	1	0.42	0.70	0.29	1.69
Sex (1)	-0.23	0.15	2.48	1	0.12	0.79	0.60	1.06
Race for study			7.14	5	0.21			
Race for study(1)	0.04	0.70	0.00	1	0.96	1.04	0.27	4.06
Race for study(2)	-0.17	0.18	0.92	1	0.34	0.84	0.59	1.20
Race for study(3)	-0.44	0.36	1.53	1	0.22	0.64	0.32	1.29
Race for study(4)	1.71	1.09	2.44	1	0.12	5.53	0.65	47.19
Race for study(5)	-0.54	0.33	2.70	1	0.10	0.58	0.31	1.11
Education			14.74	4	0.01			
Education (1)	0.74	0.31	5.91	1	0.02	2.10	1.15	3.83
Education (2)	0.72	0.29	6.07	1	0.01	2.05	1.16	3.63
Education (3)	0.77	0.32	5.87	1	0.02	2.16	1.16	4.02
Education (4)	-0.14	0.40	0.12	1	0.73	0.87	0.39	1.92

Table 9 (cont.)

Independent Variable	<i>B</i>	S.E.	Wald	<i>df</i>	<i>p</i>	Odds Ratio	95% C.I. for Odds Ratio	
							Lower	Upper
Employment Status			16.98	3	0.00			
Employment Status (1)	0.61	0.30	3.97	1	0.05	1.83	1.01	3.32
Employment Status (2)	0.64	0.19	10.67	1	0.00	1.89	1.29	2.76
Employment Status (3)	0.86	0.21	16.39	1	0.00	2.36	1.56	3.57
Living Arrangement			2.53	2	0.28			
Living Arrangement (1)	-0.10	0.18	0.31	1	0.58	0.90	0.63	1.30
Living Arrangement (2)	0.26	0.20	1.78	1	0.18	1.30	0.88	1.90
Health Insurance			5.12	3	0.16			
Health Insurance (1)	-0.07	0.20	0.12	1	0.73	0.93	0.63	1.39
Health Insurance (2)	-0.15	0.16	0.88	1	0.35	0.86	0.63	1.18
Health Insurance (3)	0.49	0.28	3.07	1	0.08	1.63	0.94	2.81
Constant	-1.13	0.50	5.06	1	0.02	0.32		

Relationship between Polysubstance Abuse and Prior Treatment, Alcohol Use, and Mental Illness, Adjusting for Sex and Age

Looking at the data for RQ3, several of the assumptions were answered immediately. The dependent variable was dichotomous, and no outliers were present. To test for multicollinearity, I used the VIF test in SPSS. The VIF test showed that no multicollinearity was present in the study variables for RQ3 due to the tolerance being greater than 0.2 and the VIF being less than 10. See table 10 below for VIF statistics for RQ3.

Table 10

VIF for Research Question 3

Variable	Tolerance	VIF
Prior		
Treatment	0.970	1.031
Alcohol abuse	0.979	1.021
Mental Illness	0.932	1.073
Age	0.958	1.044
Sex	0.952	1.051

The last assumption that needed to be tested was the assumption that there was a linear relationship between the log odds and independent variables. This assumption is only for when continuous variables are used and since none of the variables in this research question were continuous it was not necessary to test for this assumption. As all the assumptions for this model have been met, the binomial logistic regression model was carried out.

Before conducting the binomial logistic regression, it was necessary to explain the reference categories for each independent variable. People who had not been treated for substance abuse before were the reference category for prior treatment. People who did not have a history of mental illness were the reference category for mental illness. Lastly, people who did not exhibit alcohol abuse were the reference category for alcohol use. In conducting the binomial logistic regression model, I found the model to be statistically significant ($p < 0.01$). The R^2 of the model was between 4.3% (Cox and Snell) and 5.7% (Nagelkerke), meaning that this particular model did not explain much of the variance in predicting polysubstance abuse, but was higher than in RQ1. This low R^2 of the model means that there are many other This means that adjusting for age and sex

helped to explain more about the variance in predicting polysubstance abuse. Getting down to the individual variables in the model, all variables were found to significantly predict polysubstance abuse with the exception of prior treatment, after adjusting for age and sex. Prior treatment had a significance of 0.152, which is not less than 0.05, so it was excluded from further analysis. Alcohol use led to 1.746 times higher odds to exhibit polysubstance abuse than those who did not abuse alcohol after adjusting for age and sex ($p < 0.01$). Any mental health diagnosis led to 1.6 times higher odds to exhibit polysubstance abuse than those who did not have a mental health diagnosis after adjusting for age and sex ($p = 0.001$). See Table 11 below for all statistics associated with research question 3.

Table 11

Logistic Regression Predicting Likelihood of Polysubstance Abuse based on Prior Treatment, Alcohol Use, and Mental Illness; Adjusting for Sex and Age

	<i>B</i>	S.E.	Wald	<i>df</i>	<i>p</i>	Odds Ratio	95% Odds Ratio	
							Lower	Upper
Age for study	-0.49	0.20	6.11	1	0.01	0.61	0.42	0.90
Sex	0.28	0.14	3.80	1	0.05	1.32	1.00	1.74
Prior Treatment	0.20	0.14	2.05	1	0.15	1.22	0.93	1.60
Alcohol reported at admission	0.56	0.13	17.61	1	0.00	1.75	1.35	2.27
Mental Health Illness	0.47	0.14	11.67	1	0.00	1.60	1.22	2.09
Constant	0.17	0.45	0.14	1	0.71	1.18		

Interpretation

In this study, I found that the combination of age, education level, and employment status work together to significantly predict polysubstance abuse. I also showed that alcohol abuse and diagnosed mental illness are predictive of polysubstance

abuse. Adjustment for age and sex makes this association stronger. In chapter 5 I will include an interpretation of these findings, limitations of the study, and how this study can fit into the substance abuse research in the future.

Chapter 5: Conclusion

Introduction

The purpose of the research study was to explore the relationship of sociodemographic variables and how these variables may or may not lead to polysubstance abuse in patients admitted to a drug rehabilitation facility using secondary data analysis. In this study I determined if there were specific patient characteristics that would predict whether a patient was likely to have polysubstance abuse disorder, which can lead to a greater risk of death as opposed to those patients who only abuse one substance. The main conclusion was that alcohol abuse, mental health disorders, age, education level, and employment status were all predictive of polysubstance abuse.

Chapter 5 is divided into five sections. In the introduction above, I described the purpose of the study and briefly stated the results. In the interpretation of the findings section, I will go more in-depth on the results and attempt to build on the literature review conducted in Chapter 2. In the limitations section I will describe the limitations of the study and how those may have affected the outcomes. In the recommendations section, I will lay out what type of studies should be conducted next to further develop this area of public health. In the implications section, I will describe how this study leads to positive social change and at what levels of society this social change could occur.

Interpretations of the Findings

Relationship between Polysubstance Abuse and Prior Treatment, Alcohol Use, and Mental Illness

For the purposes of this chapter, RQ1 and RQ3 will be discussed together because they are the same question, but RQ3 has the addition of adjusting for sex and age. Before

looking at the results, I will discuss the R^2 of both models. For RQ1, The R^2 of the model was between 3.3% (Cox and Snell) and 4.5% (Nagelkerke). For RQ3, The R^2 of the model was between 4.3% (Cox and Snell) and 5.7% (Nagelkerke). This means that very little of the variance in polysubstance abuse can be explain by the variables in these research questions, and there are many more factors that help to explain why a patient may exhibit polysubstance abuse. Looking at the results above, I noted that prior treatment for substance abuse is not predictive of polysubstance abuse, even after adjusting for sex and age. Prior to adjustment, the odds ratio for prior treatment leading to polysubstance abuse was 1.15 ($p = 0.3$). As this value is greater than the alpha level set at 0.05, this variable was not found to predict polysubstance abuse. After adjusting for age and sex, the odds ratio becomes 1.22 ($p = 0.15$). This variable is still not considered significant when it comes to predicting polysubstance abuse. This reveals that someone who has been treated for substance abuse before is not more likely to exhibit polysubstance abuse on subsequent treatment episodes. Both alcohol use and diagnosed mental illness were found to predict polysubstance abuse behavior in patients admitted to a drug rehabilitation facility. When looking at alcohol use before and after adjustment for age and sex, alcohol abusers had 1.64 ($p < 0.001$) and 1.75 ($p < 0.001$) times higher odds of exhibiting polysubstance abuse than those who did not abuse alcohol, respectively. This reveals that alcohol abuse is predictive of polysubstance abuse. When looking at diagnosed mental illness before and after adjustment for age and sex, patients who had some form of mental illness had 1.75 ($p < 0.001$) and 1.60 ($p < 0.001$) times higher odds of exhibiting polysubstance abuse than those who did not have some form of mental illness, respectively. This reveals that diagnosed mental illness is predictive of

polysubstance abuse. The addition of adjustments for age and sex explained more of the variance in the model. Neither model was very predictive of polysubstance abuse, but the adjustments helped to increase this predictiveness. In this study, I found that the variable of mental health disorders was a significant predictor of polysubstance abuse. This finding supports a similar study by Ibrahim et al. (2018), which found that for patients admitted to psychiatric rehabilitation facility in Saudi Arabia, 60% had polysubstance abuse issues. In this study, I found that the variable of prior treatment for substance abuse was not a significant predictor of polysubstance abuse. In this study, I also found that the variable of alcohol abuse was a significant predictor of polysubstance abuse. In looking at the theoretical component of this study, the socio-ecological model, I conclude that availability of mental health services and alcohol abuse treatment centers is needed. These two variables can fit into more than just one level in the socio-ecological theory. Genetics, interpersonal relationships, a person's environment, and policy level changes could lead to less polysubstance abuse in society.

Relationship between Polysubstance Abuse and Sex, Age, Race, Education Level, Employment Status, Insurance Status, and Living Arrangements

For RQ2, I focused mostly on socio-demographic variables and how each one of these may or may not lead to polysubstance abuse. Before looking at the results, I will discuss the R^2 of the model. For RQ2, The R^2 of the model was between 6.2% (Cox and Snell) and 8.2% (Nagelkerke). This means that very little of the variance in polysubstance abuse can be explain by the variables in this research questions, and there are many more factors that help to explain why a patient may exhibit polysubstance abuse than those that were explored in this question. Sex, race, living arrangements, and health

insurance status were found to not contribute to polysubstance abuse for the purposes of this study. Age was found to be significant, but when comparing those aged less than 18 to those who were 18–54, and those who were 55 or older, there were no significant differences found. This shows that age is predictive of polysubstance abuse, but no comparisons can be made with the age groups selected for this study. Education level was found to be significant and a predictor of polysubstance abuse ($p = 0.005$). All groups had higher odds of exhibiting polysubstance abuse when compared to those who had a middle school education except for those who had completed college. This was the only categorical comparison that was not significant for this variable. Employment status was found to be significant and a predictor of polysubstance abuse ($p = 0.001$). All groups had higher odds of exhibiting polysubstance abuse when compared to those who worked full time.

I found age to be a significant predictor of polysubstance abuse. This finding supports the study conducted by Moss et al. (2014) which revealed that youth, aged 16 or less, were more likely to be substance abusers, and that risk carried over into adulthood. I also found that employment status was a significant predictor of polysubstance abuse ($p = 0.001$). This supports other studies in the literature that have shown that patients who were unemployed or worked only part-time were more likely to be substance abusers than those who worked full-time (Dada et al., 2018; Timko et al., 2018). I found no association between health insurance and polysubstance abuse, although other studies (Ali, Teich, & Mutter, 2017; Feder et al., 2019) found that people without insurance were less likely to seek help for substance abuse and were more likely to have more severe substance abuse disorder. Education level was a significant predictor of polysubstance

abuse ($p = 0.005$). For the theoretical foundation of the study, all of these variables relate to the first level of the socio-ecological model. Helping individual level traits can help to reduce polysubstance abuse, especially those related to the work force and education level.

Limitations

One limitation is that this dataset does not capture all patients who are admitted to a drug rehabilitation facility (SAMHSA, 2015). Only patients admitted to a federally funded facility are reported to SAMHSA and therefore included in this study (SAMHSA, 2015). Another limitation of the study is the focus on patients admitted to a drug rehabilitation facility which could lead to under-representation of the substance abuser population. Another limitation of the study is the secondary data analysis itself. Because the data were not collected for the purposes of this study, many variables that may play a part in the development of polysubstance abuse cannot be determined because they were not included in the original dataset. For instance, income level could not be used because this was not a variable collected in the dataset. The use of additional variables would have made the study stronger. The dataset and study sample presented some additional limitations that were not expected before conducting the study. The first limitation related to the dataset is the cross-sectional design. Cross-sectional designs have inherent limitations that include the inability to determine cause and effect, and the inability to analyze behavior over time. Cross-sectional studies provide a snapshot in time so this snapshot may not be representative of the population as a whole. Another limitation related to the dataset was the use of patient self-reporting. Self-reported answers have the potential to be exaggerated and also may suffer from social desirability bias. Patients

may also guess the intent of the questions and provide answers that may skew the results. The next limitation related to the dataset was that reducing the original dataset down to those that had no missing values reduced the dataset by about 75%. This loss of patients may have contributed to some of the results found in the study. The last limitation of the study was the frequency that some of the patient characteristics had. Several examples of this limitation will be presented. The comparator category for age was those that were aged less than 18, but in the sample used for the study only 4.3% of the study sample fit this age group. Race was another category that had highly underrepresented categories. Only 3.7% of the sample was Alaska Native/American Indian, less than 1% was Pacific Islander, and less than 1% were Asian. The low representation of these racial groups may have led to race not being significant in the overall model.

Recommendations

Recommendations for Future Studies

This study is only meant to be a foundational level study to determine where simple differences exist in predicting polysubstance abuse. A study that utilizes primary data collection would add an additional element to this study because then the variables could be tailored to the exact needs of the population. I also recommend building on the variables that were found to be significant in this study, especially age. Age collected as a ratio level variable would add depth to this study. I used age as an ordinal level variable in this study which limited the ability to find any differences. Lastly, the addition of different drugs of abuse could add additional depth to this study. Being able to determine if particular illicit substances are used in combination more than others and how this relates to mortality could have large social change implications.

Recommendations for Practice

This study has led to one recommendation that can be made in public health practice. The first practice level recommendation is that more time needs to be spent on getting people gainful employment. Full time employment predicted less polysubstance abuse than those patients who did not work, were not a part of the labor force, or worked part time. Employment agencies, or states employment commissions, should pursue more opportunities to keep people employed full time.

Recommendations for Policy

Having policies in place that allow for decriminalization of substance abuse is the largest recommendation for policy. In this study, I have shown that substance abuse, and more specifically polysubstance abuse, is not necessarily a criminal matter, but a complex medical condition that can be caused by many interlinking factors. Providing services for these patients instead of criminal sentences will go a long way in helping to slow down the substance abuse problem in the United States.

Recommendations for Training of Public Health Professionals

Public health professionals should obtain training specific to substance abuse. Training public health professionals on all the linked factors of what may drive someone to polysubstance abuse can help to decrease the rates we see and reduce the costs to society while saving lives. For the purposes of this study those linked factors were age, employment status, education level, alcohol abuse, and diagnosed mental illness. Training on how these factors are able to predict polysubstance abuse is needed to increase the effectiveness of public health interventions.

Implications for Social Change

This study may have multiple social change implications. As mentioned in the literature review above, being able to decrease the criminalization of drug use could create positive social change. The more research that can show substance abuse issues are not criminal in action but are directly related to socio-ecological issues as a whole will help society. Positive social change implications of this study are that the amount of substance abuse could be lowered, and the risk of death could be cut. I found that mental health, education level, alcohol abuse, age, and employment status are all predictive of polysubstance abuse. Policy changes could be put in place to increase access to care, mental health services, and funding in areas that need it most. Getting patients the care they need, especially in relation to mental health services, can help lower the amount of polysubstance abuse that is present in the United States. Keeping children in school and providing a solid educational foundation that leads to higher education could help decrease polysubstance abuse. More public resources for patients with mental illness could potentially create social change for these patients and reduce the risk of substance use and abuse. Utilizing the patient population of those who have been admitted to a drug treatment facility in this study could also bring attention to those more likely to need these services and create ways to prevent the necessity of treatment.

Conclusion

In this study, I found that age, education level, employment status, diagnosed mental illness, and alcohol abuse are all predictive of polysubstance abuse. This was a retrospective, secondary data analysis, so it is hard to say that any of these variables

actually cause polysubstance abuse. Looking at the baseline characteristic for this study, it is clear that polysubstance abuse is present in all combinations of variables present.

Using the results of this study, many changes could be made to society as a whole that could help slow the effects of the substance abuse epidemic in the United States. In this study, I created a foundation for other studies to build upon to determine who is more likely to exhibit polysubstance abuse and how to slow the spread of this condition. It is imperative that the United States begin to more effectively identify and treat patients with substance abuse disorder. This can be accomplished by targeting those most at risk, creating policy level changes, and creating more growth and opportunity for those at risk.

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