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Timing of Substance Use Initiation: Assessing the Role of Trauma and Race

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Abstract

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by

Rebecca C. Petrie

MPH, Emory University, 2002

BS, University of Maine, 2000

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

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Abstract

The purpose of this study was to examine the strength of the association between race, trauma, and the age of initiation for substance use, specifically tobacco, marijuana, alcohol among high school students aged 13-18 in the United States. This research is critical because prior research has shown that trauma and race led to higher rates of substance use in adulthood. Still, limited research has shown how these factors affect the age of substance use initiation. The theoretical foundation for this study was the general strain theory since the theory posits that exposure to stresses or strain leads to delinquency, which in this case is substance use. Further, past research on adverse childhood experiences of abuse, neglect, and exposure to substances defined trauma for this study. The 6 research questions looked at the difference in the age of initiation for 3 substances (tobacco, alcohol, and marijuana) by race/ethnicity and trauma history, while controlling for age, grade level, gender, and sexual identity. The strength of the association between variables were assessed using risk analysis and ordinal logistic regression. The results showed that trauma consistently contributed to an earlier age of initiation of substance use across all 3 substances. Race contributed at very early ages of initiation (age of 10 or younger) for all substances, but only with marijuana across all adolescent ages of initiation. However, trauma and race both contributed to very early substance use initiation (age 10 or younger) across all 3 substances. These findings demonstrate that positive social change can be achieved by preventing trauma in youth; therefore, funding more interventions to children 8 years old and younger to help build protective factors against trauma will help prevent substance use.

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Dedication

This dissertation is dedicated to the memory of my grandparents, Harvard and Evelyn Clark and Otha and Nina Corey, who always supported me in my academic endeavors. Thank you for showing me the value of hard work, resiliency, and unconditional love. This dissertation is also dedicated to my cousin Nathan Clark, who left us all too soon and taught me some critical life lessons. I love you all.

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Chapter 1: Introduction to the Study

Introduction

The U.S. Department of Health and Human Services declared opioid overdose a public health emergency in 2017, calling it a national epidemic (United States Department of Health and Human Services, 2019). Despite the dramatically increased rates of opioid use in the past decade, tobacco, alcohol, and marijuana rates continue to exceed opioid use. Alcohol and tobacco use were found to be the most harmful substance to human health, costing more than a quarter-billion disability-adjusted life years (DALY), as compared to tens of millions of DALY for illicit drug use (Peacock et al., 2018). Adolescence (between the ages of 10-18) is a critical period in development and early age of initiation has been shown to have a lifelong impact (Patton & Temmerman, 2016; Substance Abuse and Mental Health Service Administration, 2014). Therefore, there was an increased focus on adolescence to determine factors that lead to substance use as well as a key prevention point for substance use prevention (Das, Salam, Arshad, Fickelstein, & Bhutta, 2016; Degenhardt, Stocking, Patton, Hall, & Lynskey, 2016).

A possible factor that may influence the use of substances in adolescence is trauma, whether that trauma be through exposure to violence, abuse, neglect, or societal inequities (Felitti et al., 1998). Adverse childhood experiences (ACEs) are associated with higher rates of substance abuse in adulthood (Campbell, Walker, & Egede, 2016; Giordano, Ohlsson, Kendler, Sundquist, & Sundquist, 2014). Researchers have also shown that being part of a minority racial or ethnic group and increase rates of substance

use (Andersen & Blosnich, 2013; Braveman, 2014; Centers for Disease Control and Prevention, 2018b; Chen, Martin, & Matthews, 2006; Reisner, Greytak, Parsons, & Ybarra, 2015; Slopen et al., 2016). The evidence suggests that trauma, though its many different forms, and race are connected to substance use.

In this study, I sought to identify the relationship between race, trauma, and age of substance use initiation. Race brings inherent trauma experiences with racism (personal, structural, and institutional), historical trauma, high rates of poverty and inequity (Mather & Jarosz, 2014; Mohatt et al., 2014). Prior researchers have demonstrated, from a retrospective perspective, that trauma in childhood leads to increased substance use and poorer health outcomes in adulthood (Braveman, 2014; Chatterjee et al., 2018; Felitti et al., 1998; Nelson, Van Ryzin, & Dishion, 2014; Richmond-Rakerd, Slutske, & Wood, 2017; Slopen et al., 2016). However, there is a gap in knowledge if exposure to trauma, measured during adolescence, leads youth to begin substance use at younger ages. This information could have positive social change because it highlights potential areas for program intervention or further study.

In this study, I reviewed the background, purpose, and problem to be examined through a review of existing research that seeks to understand the complex relationships between race, trauma, and substance use. The research questions and the foundational theory provided the framework in which to conduct the research. Critical aspects of the study design, including dataset selection, representativeness of the data, and study limitation set the stage for the research. Finally, a discussion of the results and

interpretation of the data analysis will lead to recommendations for the future. This study has the potential for meaningful social change because it could provide insight into what factors led youth to use substances at a young age.

Background

Adolescent substance use has been a critical issue in the United States for over 2 decades (Luther & D'Avanzo, 1999; Toumbourou et al., 2007; Dow & Kelly, 2013; Richmond-Rakerd, Slutske, & Wood, 2017). Researchers have studied various aspects of substance use behaviors, seeking to understand the what, when and why people start using substances (Chatterjee et al., 2018; Richmond-Rakerd et al., 2017; Stockings et al., 2016). Further, substance use in adolescence has been shown to impact the ability to cope with personal issues and social expectations, such as academic performance and peer interactions (Leonard et al., 2015). These maladjustments can then lead to an increase in substance use and poorer health in adulthood (Nelson et al., 2014; Substance Abuse and Mental Health Service Administration, 2014). This information demonstrates how important it is to prevent substance use in adolescence, since it is clear that decisions and experiences from childhood have a strong impact on one's adult life.

From a theoretical perspective, the exposure to adverse life experiences, specifically racism and trauma, put strain on a person, thus making them more susceptible to risky lifestyle behaviors (Froggio, 2007; Hollist, Hughes, & Schaible, 2009; Slocum, 2010). There are have several studies that show connections to several of the concepts, trying to piece together a path that can predict substance use (Slocum,

2010). From a trauma perspective, Felitti et al. (1998) pioneered the discovery of the ACEs concept and the relationship to several causes of premature death in adults (Felitti et al. 1998). This landmark study led to research in several different areas to assess the role of childhood experiences on adult substance use behaviors. Furthering this research, Chatterjee et al. (2018) found that personal qualities favoring positive behavior choices had a moderating effect on ACEs influence on early initiation of marijuana and alcohol (Chatterjee et al., 2018). Slopen et al. (2016) found an increased prevalence of childhood adverse experiences among minority racial groups, showing that minority groups experienced higher rates of ACEs (Slopen et al., 2016). Braveman (2014) focused on the definitions of health disparities/health inequities and determined that early exposure to injustices correlates to problems later in life (Braveman, 2014; Richmond-Rakerd et al., 2017).

The gap in knowledge is how trauma, whether it be from racism or adverse childhood experience, impacted when youth begin using alcohol, tobacco, or marijuana. Youth substance use continues to be an important problem in the United States, and there has only been modest success with prevention and treatment options (Dow & Kelly, 2013). Therefore, it is essential to gather additional information to deepen understanding on youth risk factors and how they related to alcohol, tobacco, and marijuana use (Kann et al., 2018). Armed with this new information, we as a community of public health practitioners can make systemic changes through policy and programming to affect positive social change.

Problem Statement

The research problem to be investigated in this study is the association between race, trauma, and age of initiation for substance use among adolescences in the United States. Substance use is a public health epidemic in the United States (Hargen, 2017). Public health interventions often seek to delay the age of initiation of substance use (National Association of State Alcohol and Drug Abuse Directors, Inc., 2018). One factor correlated with substance use behaviors in adolescences is trauma, as measured through ACEs (Chatterjee et al., 2018). Felitti et al. (1998) coined the concept of ACEs, defined as exposure to abuse, neglect, exposure to substance use, in 10 different categories of childhood traumas. This research demonstrated that those with three or more ACEs led to higher rates of disease in adulthood (Felitti et al., 1998). Recently, researchers confirmed this connection and highlighted that ACEs are associated with higher rates of substance abuse (Campbell et al., 2016; Giordano et al., 2014). In addition, there is a correlation between being part of a population that experiences persistent health inequities (e.g. being part of a minority racial or ethnic group) and increased rates of adverse events in childhood, substance use and trauma (Andersen & Blosnich, 2013; Braveman, 2014; Centers for Disease Control and Prevention, 2018b; Chen et al., 2006; Reisner et al., 2015; Slopen et al., 2016). There is a gap in knowledge regarding if being part of a racial minority or experiencing trauma lead to earlier substance use initiation (Chatterjee et al., 2018).

Purpose of the Study

The purpose of this study is to examine the strength of the association between race, trauma and the age of initiation for substance use, specifically tobacco, marijuana, alcohol, among high school students aged 13-18 in the United States. Trauma was defined as a scale variable using the ACEs threshold of abuse, neglect, and exposure to substances (see Felitti et al., 1998; Field, 2013).

Research Questions and Hypothesis

RQ1: Is there a statistically significant difference in age of initiation of tobacco use by race/ethnicity (after controlling for trauma exposure, age, gender, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0$1: There is no statistically significant difference in age of initiation of tobacco use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States

H_a1: There is a statistically significant difference in age of initiation of tobacco use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States

RQ2: Is there a statistically significant difference in age of initiation of tobacco use by trauma exposure (after controlling for race, ethnicity, age, gender, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0$2: There is no statistically significant difference in age of initiation of tobacco use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States

H_a2: There is a statistically significant difference in age of initiation of tobacco use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States

RQ3: Is there a statistically significant difference in age of initiation of alcohol use by race/ethnicity (after controlling for trauma exposure. age, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0$3: There is no statistically significant difference in age of initiation of alcohol use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States

H_a3: There is a statistically significant difference in age of initiation of alcohol use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States

RQ4: Is there a statistically significant difference in age of initiation of alcohol use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0$4: There is no statistically significant difference in age of initiation of alcohol use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States

H_a4: There is a statistically significant difference in age of initiation of alcohol use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States

RQ5: Is there a statistically significant difference in age of initiation of marijuana use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0$5: There is no statistically significant difference in age of initiation of marijuana use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States

H_a5: There is a statistically significant difference in age of initiation of marijuana use by race/ethnicity (after controlling for trauma exposure. age, grade level, sexual identity) among high school students aged 13-19 in the United States

RQ6: Is there a statistically significant difference in age of initiation of marijuana use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0$6: There is no statistically significant difference in age of initiation of marijuana use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States

H_a6: There is a statistically significant difference in age of initiation of marijuana use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States

Theoretical Framework for the Study

The general strain theory (GST) was the theoretical foundation for this study. Agnew (1992) updated the strain theory, which focused specifically on crime and delinquency, to a general strain theory that helps explain how negative social influences and pressures lead to poor life choices. General strain theory is defined by aspects of social learning theory, social-ecological theory, and the stress-diathesis model of mental illness to develop the framework (Aseltine, Gore, & Gordon, 2000). Strain theory was a popular framework in the 1960s but had declined since that time (Agnew, 1992). There has been debate regarding the validity of the theory in recent years. There is a wide breadth of research that shows that poor societal influences lead to criminality and substance use; however, there is a lack in information regarding how the role of strain specifically plays into these factors (Aseltine et al., 2000). Specifically looking at substance use prevention, strains (e.g. exposure to trauma, familial substance use, depression) are a critical factor in determining risk for youth substance use (Eisenberg, Toumbourou, Catalano, & Hemphill, 2014; Sudhinaraset, Wigglesworth, & Takeuchi, 2016). In this study, I used this theory as a framework to see if exposure to trauma and being of a racial minority (thus exposure to racism and other forms of generational or historical trauma) impacts the age of substance use initiation (Mohatt et al. 2014). Add summary and synthesis throughout the paragraph to balance out the use of information from the literature with your own analysis.

Nature of the Study

My intent with the research questions was to seek information about a protected class of people (i.e., minors); therefore the selection of the study design had to ensure appropriate measures were taken to protect the participants (United States Department of Health and Human Services, 2016b). The selection of a national quantitative survey (a secondary data source) ensured appropriate protections are in place. In this study, I used the Youth Risk Factor Surveillance System (YRBSS), which was a quantitative, cross-sectional study design (Williams, 2007). The Centers of Disease Control and Prevention developed the YRBSS in 1990 to assess specific groupings of youth health behaviors that were shown to increase rates of morbidity, mortality or other interpersonal or community problems in adulthood (Centers for Disease Control and Prevention, 2018c). These specific grouping include unintentional injury and violence, sexual behaviors, alcohol, tobacco and other drug use, nutrition, and physical activity. Since its inception, more than 4.4 million high school students completed 1,900 surveys, creating a robust source of youth behavioral health data (Centers for Disease Control and Prevention, 2018c).

I used the statistical method of ordinal logistical regression testing to assess the relationship between the independent and dependent variables, since the dependent variable was ordinal in nature. The dependent variable for this study was the age of initiation for alcohol, tobacco, and marijuana. For each substance, separate research questions assessed the influence of two independent variables, race, trauma (see definition section). Gender, sexual identity, grade level, and age were selected as

covariates, as they were the demographics variables available in the public access file. While this study did not seek to establish a causal relationship, it did assess the difference between the variables of interest, which may then lead to further studies to help establish causation (Bleske-Rechek, Morrison, & Heidtke, 2015).

Definitions

Age of Initiation: Age when the respondent first tried a substance (Richmond-Rakerd et al., 2017).

Demographics: Attributes to define the study population. In this study, the key demographics will be age, sex, and grade (Centers for Disease Control and Prevention, 2018a).

General Strain Theory: A theory based on strain theory that highlights the role of individual responses to adverse life experiences that lead to negative behavior choices (Aseltine et al., 2000).

Historical Trauma: Historical trauma is defined as "Complex and collective trauma experienced over time and across generations by a group of people who share an identity, affiliation, or circumstance" (Mohatt et al., 2014, pg. 2).

Racial Minority: Classified as being part of one of four major racial/ethnic group: African American, American Indian/Alaska Native, Asian/Pacific Islander, or Hispanic; Identifying as a race other than Caucasian/White (Pollard & O'Hare, 1999).

Trauma: For this study, trauma was defined as forced sexual intercourse, experienced sexual violence, experienced sexual dating violence, bullying at school,

electronic bullying, and physical dating violence (Centers for Disease Control and Prevention, 2018a).

Assumptions

In this study, I used data from the YRBSS from the Centers for Disease Control and Prevention (Kann et al., 2018). The assumption for this study was that the data is representative of the overall population of youth ages 13-19 residing in the United States.

Scope and Delimitations

The specific aspects of the study were race, trauma (based upon the adverse childhood experiences by Felitti et al. (1998)), and the age of initiation for alcohol, marijuana, and tobacco (see Felitti et al., 1998). Part of the data review and clean process assured that each research question had appropriate cell size and power. The data was either recoded or concatenated into new variables, in accordance with the research design specified in Chapter 3. The statistical test, ordinal logistic regression, was determined to be the best statistical tool to assess relationship between the dependent variable (age of initiation for alcohol, tobacco, and marijuana) and the independent variables (race, ethnicity, and trauma) while controlling for the covariates (i.e. age, gender, sexual identity, grade level). Using a national dataset, rather than a state or regional survey, allowed for a greater number of respondents and increased statistical power (see Dorey, 2011; Kann et al., 2018). However, there were some concerns with generalizability. The YRBSS results are a point in time sample of high school students who self-report the

information; not all students complete the survey and not all states participate in the survey (Centers for Disease Control and Prevention, 2018a).

Limitations

There were a few limitations, challenges, and barriers encountered during this study. One limitation was that the YRBSS does not assess all 10 aspects of adverse childhood experience, which is a limitation to the study results (Centers for Disease Control and Prevention, 2018a). The questions that assessed trauma in this study were not an exact match with the questions asked in the study by Felitti et al. (1998). Another limitation was that not all states conduct the survey or report the data, which affect the generalizability of the results (Centers for Disease Control and Prevention, 2018a). Finally, the data from the YRBSS was self-reported, which relied on the truthfulness of the respondents to share substance use behaviors, thus may be open to underreporting of such behaviors (Centers for Disease Control and Prevention, 2018a).

Significance

The 2016 surgeon general report on alcohol, drugs, and health called substance misuse an epidemic (United States Department of Health and Human Services, 2016b). Given the scope of the problem, it is essential to have efficient and effective interventions reduce the impact (Strang et al., 2012). The timing of the substance use intervention is a critical aspect to understand and to ensure timely and appropriate prevention activities for young people (Nelson et al., 2014; Richmond-Rakerd et al., 2017). Funding for prevention efforts often starts at age 12, but the Substance Abuse and Mental Health

Service Administration (2019) has recently lowered the age to 9 years for underage alcohol use. With this research, I was able to provide information on the age of substance use initiation, looking through a lens of childhood trauma and racial identity, that may show that substance use prevention needs to start at a younger age. Further, the results shed light on the role of trauma, specifically at the point when it occurs in childhood, rather than retrospective studies like the landmark ACEs study, which assessed childhood trauma in adulthood (Felitti et al., 1998). Understanding what factors led students to start using substance will allow public health practitioners to make better decisions on the selection, timing, and implementation of substance use prevention intervention (Centers for Disease Control and Prevention, 2018b; Strang et al., 2012). This understanding is critical as it has the potential for meaningful social change. It is estimated that over 4% of adolescences have a substance use problem, which leads to increased morbidity and mortality (Williams, Ayers, Baldwin, & Marsiglia, 2016). The provision of more effective public health strategies that prevent or delay that initiation of substance use will improve the outcomes for adolescence and allow them to lead healthier adult lives, which has the potential for meaningful social change.

Summary

This chapter provided the background and gap in knowledge as well as demonstrated why further investigation into the relationship between race, trauma, and age of substance use initiation is warranted. Further, this chapter provided information on the theoretical model and provided the framework that will serve as the foundation for the

study. Chapter 2 delves into the existing body of research to demonstrate the need for this kind of information as well as highlight the implications for social change. Youth substance use is an important issue that must be adequately addressed to lead to positive social change (Dow & Kelly, 2013).

Chapter 2: Literature Review

Introduction

The research problem investigated in this study was there a statistically significant difference in age of initiation of tobacco, alcohol, or marijuana use by race or trauma exposure (after controlling for age, grade level, sexual identity) among high school students aged 13-19 in the United States. The purpose of this study was to examine two possible factors (race/ethnicity and trauma) that may lead to substance use at younger ages. These factors are essential because current literature showed that the age of initiation of substance use is a critical factor in planning and implementing effective public health prevention interventions (National Association of State Alcohol and Drug Abuse Directors, Inc., 2018). Recently, researchers confirmed that trauma in childhood, often referred to as adverse childhood experiences, are associated with higher rates of substance abuse in adulthood (Campbell et al., 2016; Giordano et al., 2014). In addition, there is a connection between being part of a population that experiences persistent health inequities (i.e., being part of a minority racial or ethnic group) and increase rates of adverse events in childhood, substance use and trauma (Andersen & Blosnich, 2013; Braveman, 2014; Centers for Disease Control and Prevention, 2018b; Chen et al., 2006; Reisner et al., 2015; Slopen et al., 2016). In this chapter, I will delve deeper into the literature and provide a comprehensive background on the literature search criteria, the theoretical basis for the study, and an exhaustive review of the literature search results.

Literature Search Strategy

The topics of trauma, race, and substance use are broad topics with numerous publications. The strategy for this research study focused on factors that impact the age of initiation for alcohol, tobacco, and marijuana. The hypothesis is that experiencing trauma or being in a racial minority group will affect the age of initiation. The strategy for the literature search was to search on the terms *age of initiation* AND *alcohol* OR *tobacco* OR *marijuana* AND *general strain theory* AND *trauma* AND *race*. This search led to 374,690 search results, demonstrating the depth and breadth of this topic. However, when the search terms where changes to look for all of these factors, there were no search results. The strategy was then shifted to look at multiple factors, such as *age of initiation* AND *alcohol* AND *trauma*. Since trauma is such a vast topic, more focused searches included looking of *sexual violence*, *violence,* and *bullying*, all of which were part of the trauma definition for this study. I used the Walden University library databases such as CINAHL & Medline and Thoreau as well as Google Scholar. The years were not limited to allow the discovery of seminal literature as well as current peer-reviewed articles; however, there was a focus on selecting articles published since 2014.

Theoretical Foundation

The theoretical foundation selected for this study was GST. Merton (1938) developed a theory, referred to as anomie, that aimed to explain how societal structures put pressure on people to control biological impulses, and what happens when those structures fail. Merton hypothesized that social goals (i.e., the direction society as a

whole is heading) and institutional mean (i.e., the ability to meet a goal) worked together to keep a person's behavior in check (Merton, 1938). People generally have five different methods of responding to cultural goals and institutional means: conformity, innovation, ritualism, retreatism, or rebellion (Merton, 1938). Between the 1940s-1960s, several sociologists worked to refine and add to Merton's theory, but as society changed in the 1970s and 1980s, the strain theory lost popularity (Cloward, 1959; Cohen, 1965; Agnew, 1992). That is, until 1992, when Agnew (1992) began to adapt these model in a general strain theory.

General strain theory takes aspects of social learning theory, social-ecological theory, and the stress-diathesis model of mental illness to develop a cohesive framework that helps to explain why people make poor life choices (Agnew, 1992; Aseltine et al., 2000). Whereas strain theory models were based exclusively at the interpersonal level, a general strain theory starts to branch out into other social-ecological factors that can lead to negative feelings (Agnew, 1992). Agnew (1992) indentified three types of strains: (a) not able to attain goals; (b) threats what a person currently has; (c) exposure to negative people or situations. As the GST began to take hold, other researchers began assessing the effects of multiple strains on a person's behavior (Aseltine et al., 2000).

Over the past 20 years, the definition of strain has continued to evolve. Aseline, et al. (2000) assessed the role mental illness plays on strain and determine that the GST includes mental illness as a type of strain (Aseltine et al., 2000). Agnew (2001) found that when people viewed the strain as inequitable, unable to be controlled, of high impact, or

where criminality is rewarding, there was a higher likelihood of delinquency (Agnew, 2001). Agnew, Brezina, Wright, and Cullen (2002) further refined the theory by digging deeper into why adolescents experience higher criminality rate (Agnew et al., 2002). The author's findings were that youth with, generally, more impulsive and when they are feeling poorly about themselves, were more likely to engage in delinquent behaviors (Agnew et al., 2002). Froggio and Agnew (2007) introduced the concept of subjective (situations some people find objectionable) versus objective (situations most people find objectionable) strains. The refinements to the theory reflected changes in the definition of acceptable behaviors over time as well as the incorporation of the concept of justice to one's view of strain.

While the GST is based and widely used in assessing criminality and delinquency, researchers started to extend the model into understanding the factors leading to substance use (Poquiz & Fite, 2016). In 2000, there was a full breadth of research that shows that poor societal influences lead to criminality and substance use; however, there is a lack in information regarding how the role of strain plays into these factors (Aseltine et al., 2000). Specifically looking at substance use, strains (e.g., exposure to trauma, familial substance use, depression, etc.) are a critical factor in determining risk for youth substance use (Hollist et al., 2009; Eisenberg et al., 2014; Sudhinaraset et al., 2016). Hoffman (2016) conducted a study that provided evidence that cumulative strains and stresses, particularly in adolescent, leads to higher levels of substance use, but only in late adolescence (16 years and older). Jang, Ferguson, and Rhodes (2016) looked at the

emotional impact of delinquency and heavy drinking, hypothesizing that engaging in substance use as an adolescent is be a coping mechanism for strain, thus may be less likely to experience emotional issues as an adult. The authors showed that there is some emotional benefit to males; overall, those who engage in delinquency and substance use as a teen had higher rates of anxiety and mental illness as an adult (Jang et al., 2016). These researchers demonstrated how substance use fits as a form of delinquency, thus aligns with the GST.

Other researchers have used the GST in various research that demonstrates the utility of the theory when looking at the role of trauma and race, as a strain on adolescent, on substance use age of initiation. Stogner and Gibson (2011) used the GST to assess if health issues are a strain for substance use initiation and frequency. Cullen, Unnever, Hartman, Turner, and Agnew (2008) and Moon, Hwang, and McCluskey (2011) highlighted bullying and school-based stress to be a critical source of strain on youth. Kam, Castro, and Wang (2015) used the GST to demonstrate that perceived racial discrimination was related to depression and negative emotions (thus strain) and was associated with increased substance use. Poquiz and Fite (2016) linked community violence exposure with perceived substance use among adolescents. Steele (2016) demonstrated that race is another factor that can affect the way strains affect an individual; those of different races have different susceptibility to different types of strain, most like due to social inequality (Steele, 2016). All of these studies demonstrated

that exposure to strains lead to negative consequences. The body of evidence presented here shows the utility of using GST when assessing factors leading to substance use.

GST served as a framework for my research to see if exposure to trauma and being of a racial minority (thus exposure to racism and other forms of generational or historical trauma) impacts the age of substance use initiation (see Mohatt et al., 2014). GST was selected because trauma is a source of strain in childhood and adolescence, which may lead to earlier initiation of substance use. The trauma may impede youth from achieving their goals or create such a negative self-image and feelings due to this strain such that they seek something to help them cope (Agnew, 1992; Jang et al., 2016). This information could help further the body of knowledge with general strain theory, as it will assess trauma as a strain and its connections to substance use initiation, which is a current gap in knowledge.

Literature Review Related to Key Variables and Concepts

Researchers have clearly documented that adolescent substance use is a public health issue in the United States and throughout the world (Das et al., 2016; Degenhardt et al., 2016; Fagan et al., 2015; Nelson et al., 2014). In 2013, the Center for Disease Control and Prevention's Mental Health Surveillance Report stated that 4.7% of adolescents have a substance use disorder (Perou et al., 2013). According to the National Institute on Drug Abuse (NIDA), alcohol, tobacco (including vaping), and marijuana are the most common substance used by adolescences in the eighth, 10th, and 12th grades (NIDA, 2019). Most significantly, vaping rates have dramatically increased over the past

five years (NIDA, 2019). The 2017 YRBSS results indicate that among high school students in the United States, 28.9% have tried smoking, 42.2% have used a vapor product, 60.4% have consumed alcohol, and 35.6% have used marijuana (Kann et al., 2018). The YRBSS results bring into question the reasons behind the high usage numbers. I sought to examine the factors that lead to earlier ages of substance misuse, specifically for alcohol, tobacco, and marijuana. The research shows that stress or strain impacts substance misuse among adolescents (Leonard et al., 2015). According to Das et al. (2016), the bigger challenge lies in identifying which stresses or strains cause, and in what configuration leads, early substance use. Looking specifically at age of initiation and adolescent substance use, I examined the issue from a trauma perspective and a racial perspective to highlight the current body of knowledge.

Trauma, Stress, and Strain

By looking at substance use from a theoretical lens, social and cultural factors that cause increased stress or strain lead to substance use (Stogner & Gibson, 2011; Sudhinaraset et al, 2016). Social factors that have been well documented to cause stress on youth academic performance (e.g. grades, college admissions, etc.), problematic socialization among peers (e.g. bullying, etc.), neighborhoods social factors (e.g. increase violence exposure, etc.), and housing mobility (e.g. safety, security, etc.) (Fagan, Wright, & Pinchevsky, 2015; Leonard et al., 2015; Scalco, Trucco, Coffman, & Colder, 2015; Schmidt, Glymour, & Osypuk, 2017). When youth are exposed to high stress situations, their bodies begin to adapt, leading to a diminished physiological response to stress.

Substances provide an external means of mounting a response, thus may be a factor that leads youth to choose substances (Kliewer et al., 2016). It should also be noted that there is a strong link between the risk factors association with mental health and substance use (Stone, Becker, Huber, & Catalano, 2012). However, there is limited data regarding if the substance use leads to increased rates of mental illness or mental illness leads to substance use, as the two are often co-occurring and finding a clear causal pathway is often difficult (Conway et al., 2017; Thompson, Merrin, Ames, & Leadbeater, 2018).

Living in a high poverty area has been demonstrated to have increased rates of risky behaviors (e.g. bullying, delinquency, etc.) that leads to poor health outcomes including substance abuse and mental health issues (Chen, Miller, Brody, & Lei, 2015). However, Jensen, Chassin, & Gonzales (2017) found that the youth from advantaged neighborhood (i.e., privileged) who were seeking adventure or thrills (termed sensation-seeking) were more likely to engage in substance use whereas the effect of sensation-seeking was reduced for those living in disadvantaged or poor neighborhoods. These behaviors may include involvement in crime, interpersonal violence or bullying. Therefore, the common thread between both advantaged and disadvantaged youth in these two cases is that physiological stress response from substance use; either as a coping mechanism for negative stress or through thrill seeking (Jensen et al, 2017; Kliewer et al., 2016).

In addition to social and peer-based factors, familial relationships play a key role in youth substance use. Bacio, Estrada, Huang, Martinez, Sandinas, & Prado (2015)

found that among Hispanic students, parental social interactions played a key role in substance use initiation. Adolescences whose parents have lower educational attainment and lower income levels were positively associated with increased substance use. Cornelius, De Genna, Goldschmidt, Larkby, & Day (2016) supported the finding that home life and parental substance use (both prenatal and childhood exposures) are factors in adolescent alcohol use. Childhood neglect or the lack of positive parent-child relationship have an association with increased delinquency and substance use in adolescence (Cruz, Mechammil, King, Bamaca-Colbert, & Robins, 2018; Duprey, Oshri, & Caughy, 2017; Telzer, Gonzales, & Fuligni, 2014). Conversely, when there are positive parental relationships, youth experience better outcomes. For example, when a youth experience bullying, they also experience higher rates of substance use. However, this effect is mitigated if the youth has a positive parental relationships (Elledge, Smith, Kilpatrick, McClain, & Moore, 2019; Lambe & Craig, 2017; Quinn, Fitzpatrick, Bussey, Hides, & Chan, 2016). Strong adult figures are essential for youth and play an important role in preventing substance use.

Racial and Ethnic Trauma

Being a part of a racial or ethnic minority community brings inherent trauma experiences with racism (personal, structural and institutional), historical trauma, high rates of poverty and inequity, it is a key indicator when assessing the influence of trauma (Mather & Jarosz, 2014; Mohatt et al., 2014). The trauma from racial stress and devaluation of self that comes with being part of a minority racial group in the United

States leads to rage and increased substance use (Hardy & Qureshi, 2012; Comas-Diaz, Hall, & Neville, 2019; Fast & Collin-Vezina, 2019). For example, it is well documented that discrimination and racial stress caused by historical trauma from generations of genocide perpetrated on indigenous peoples in the United States and Canada has led to disproportionate health disparities and substance use (Fast & Collin-Vezina, 2019; Skewes & Blume, 2019).

Higher levels of anxiety, depression, and high-risk health behaviors have linked to the psychological strain that comes with the constant presence of microaggression, racism, and other forms of racial discrimination (Sanchez, Benbow, Hernandez-Martinez, Serrata, 2019). While it is understood that trauma leads to increased substance use and poorer health outcomes in adulthood, but there is a gap in knowledge if exposure to racial trauma specifically leads youth to begin substance use at younger ages (Braveman, 2014; Chatterjee et al., 2018; Felitti et al., 1998; Nelson et al., 2014; Richmond-Rakerd et al., 2017; Slopen et al., 2016). The body of knowledge present helps to provide background and context for this study, but also demonstrates that there is a gap in knowledge around the effect the types of trauma may have on the timing of substance use initiation.

Age of Initiation

Age of initiation has been a topic studied since the 1970s when data began to measure the temporal start of substance use (Yamaguchi & Kandel, 1984). From a historical perspective, age of initiation was looked at from a social development perspective, where societal exposures or engagements were critical factors in delaying

substance use (specifically alcohol and marijuana) (Kosterman, Hawkins, Guo, Catalano, & Abbott, 2000; Williams, Ayers, Baldwin, & Marsiglia, 2016). Being able to understand the factors that lead a child or adolescent to being misusing substances is a critical topic in substance use prevention programming, since it is much preferable to prevent substance use than try to help people quit using substances. The consequences for substance use at younger ages are an increased likelihood of adult addiction and premature death, thus information that prevents or delays substance use has the potential for meaningful social change (United States Department of Health and Human Services, 2016a; Jensen et al., 2017). While there is no one study that directly demonstrates causality between race, trauma, and age of initiation, the existing body of research does show that these factors are often connected, which complicates that causal path.

The Role of Race. Many studies tie race to substance use initiation and demonstrate disparities by racial and ethnic groups. Latinx youth have earlier age of substance use, particularly higher rates of abuse of multiple substances (Fite et al., 2015; Strunin et al., 2017). Mixed race Latinx youth, either indigenous or black backgrounds, were more likely to initiate substances at an earlier age (Sartor et al., 2018; Vasquez et al., 2019). For indigenous youth, researchers determine that there is a much younger age of initiation, even with other demographic factors (such as residence and schools attended) were the same (Stanley & Swaim, 2015). Specifically, indigenous youth at age nine were almost ten times more likely to use marijuana and twice as likely to use alcohol than their white counterparts (Stanley & Swaim, 2015). However, black youth have been

shown to be less likely to initiate alcohol than white students, but more likely to experience childhood trauma (Sartor et al., 2018). Yet, black students have high risks of initiating marijuana and are more likely to initiate marijuana before tobacco, especially if they have been traumatized (Green et al, 2016).

Among all racial groups, the connection with early age of initiation and tobacco use is well documented, with parental tobacco use being an important factor leading to early use (Sutfin et al., 2015). The average age of tobacco initiation is 12 years, with e-cigarette being at 14 years (Sharapova et al., 2018). The choice of tobacco products vary by race; white youth smoke cigarettes and smokeless tobacco at higher rates, whereas Latinx youth have higher rates of bidi/kretek and African American youth have higher rates of flavored tobacco products (Sutfin et al., 2015). However, e-cigarettes are a rapidly emerging product that has not have extensive study and may be changing initiation patterns for youth (Sharapova et al., 2018).

For marijuana use specifically, Chen, Yu, Lasopa, & Cottler (2017) found that use started to increase at age 12, with a mean use age of 17 years, but it was among multi-racial groups where use was notably higher. Race is also a predictor with using marijuana as the initiating substance. While alcohol or tobacco is generally the first substance use by youth, African American young women (mean age 21 years) were three times more likely to start using marijuana before alcohol and both African American men and women were more likes to use marijuana before tobacco products, making marijuana their initiating substance (Sartor et al., 2013; Green et al., 2016; Kennedy, Patel, Cheh,

Hsia, & Rolle, 2016). Overall, when looking across all of the substance, there is evidence that race plays a role in early substance use initiation, but that there are also many other confounding factors that complicate the exact nature of this role.

The Role of Trauma. Trauma is also associated with early initiation of substance misuse, but there is limited information regarding if having a trauma exposure leads to an earlier age of substance use initiation. The information that is available points to a link between trauma exposure and substance use. Looking at trauma as a strain on a person's psycho/social/physical wellbeing, exposure to high amounts of strain during childhood may have a negative influence on brain development (Moustafa et al., 2018). Kingston & Raghavan (2009) supported this finding by determining that substance use predicted higher rates of trauma-based experiences.

When looking specifically at experience during childhood, exposure to violence, abuse, or sexual assault during childhood increases the likelihood of daily tobacco use after the sixth grade and increased alcohol use among white female (Dube et al., 2006; Farris, Zvolensky, Beckham, Vujanovic, & Schmidt, 2014). Exposure to sexual and physical abuse led to increased rates of alcohol initiation among white females under the age of before age 14, but there was no association in black female (Werner et al., 2016). Women with very early age of sexual initiation (ages 11-12), which may have been due to forced contact, had higher rates of familial substance use and were more likely to have a substance use issue themselves (Tsuyuki et al., 2019). However, many researched conducted studies of adults and asked them to recall their study participants to recall

childhood experiences. Few studies have assessed trauma during childhood, which makes understanding the temporality of trauma exposures is essential.

Summary and Conclusions

Overall, the review of the literature highlighted that substance use age of initiation is a vast and nuanced issue. The age a person starts using substances is linked to their social environment, including peer and parental exposures or involvement (Bacio et al., 2015; Cornelius et al., 2016; Jensen et al., 2017). These social environments are often broken down by racial groups, and research has shown that there are increased rates of early substance use initiation among racial minority groups (Sartor et al., 2013; Stanley & Swaim, 2015; Chen et al, 2017; Vazquez et al., 2019). Further complicating the racial link to the early age of initiation is the fact that exposure to oppression thought everyday lived experience is traumatic (Hardy & Qureshi, 2012; Comas-Diaz, Hall, & Neville, 2019; Fast & Collin-Vezina, 2019). Trauma itself has shown to have a link to substance use, but the relationship to age of initiation remains unclear because the association between the age of initiation and trauma experience is closely tied, it is difficult to ascertain which lead to the other (Dube et al., 2006; Kingston & Raghavan, 2009; Werner et al., 2016).

Therefore, it is clear that there is a gap in knowledge regarding how much of an effect trauma that occurs in childhood (i.e., racial, sexual, or physical trauma) has on the age of initiation for alcohol, tobacco, or marijuana. The information ascertained in this study helped to address this gap in knowledge by presenting information from a national

study of youth risk behaviors that address how much of an effect a trauma history had on substance use initiation. In addition, the information elucidated in this study can help lead social change because it will help deepen our collective understanding of substance misuse. Ideally, the more data that is collected on this topic will help public health practitioners develop more effective public health intervention, that will prevent young people from starting to use substances. Chapter 3 will delve into the methodology for this study.

Chapter 3: Research Method

Introduction

The purpose of this study was to examine the association between the age of initiation for substance use, specifically tobacco, marijuana, alcohol between race/ethnicity and trauma exposure among high school students aged 13-18 in the United States. This chapter will review how this study was conducted, including the study design and rationale, methodology, and threats to validity.

Research Design and Rationale

For this research study, I used a quantitative, cross-sectional research design to observe possible factors that affect the age of initiation for substance use (see Field, 2013). Cross-sectional studies are helpful in determining the prevalence and can provide evidence that demonstration causation (which would require more rigorous studies) through observational methods (Field, 2013; Mann, 2003). Cross-sectional studies are a point in time form of observation, where a sample population is taken from the population of interest and questioned (either by interview or questionnaire) to assess exposures or risk factors of interest (Mann, 2003). The selected secondary data source was the YRBSS, which is a sample of high school youth in the United States who were given a questionnaire to assess their behaviors and exposures to a particular risk factor (see Brener et al., 2013). From this data source, it was possible to assess if there is an association in this particular population between the age of substance use initiation with trauma or race. This same survey could have been given to a different set of youth and

had a different result; thus, it is necessary to understand that while cross-sectional surveys only show the association and cannot definitively prove the relationship (see Mann, 2003). There are no known design or resources constraints due to this design choice, and this is consistent with other similar studies seeking to understand the nature of the relationship between variables.

The dependent variable for this study was the age of initiation for tobacco, alcohol, and marijuana and the independent variables were trauma (a scale variable created by adding the scores of multiple traumatic variables, based on the ACEs categories of abuse, trauma, and neglect), and racial or ethnic groups, while controlling for age, grade level, gender, and sexual identity.

Methodology

The Centers for Disease Control and Prevention has conducted the YRBSS to collect information on youth behaviors that may lead to preventable adult-onset morbidity and mortality since 1991 (Brener et al., 2013). In the 1980s, the Centers for Disease Control and Prevention identified the need to assess youth risk behavior as part of their efforts to address the HIV epidemic (Brener et al., 2013). Since its implementation in 1991, the YRBSS has served multiple functions, including but not limited to, helping to identify current youth behaviors, identifying current health trends among youth, determining upcoming health-related issues for adults, and evaluating current programs and policies (Brener et al., 2013). The YRBSS consists of several different surveys, such as the biannual national youth survey (referred to as the Youth

Risk Behavior Survey), special population surveys, and methodology studies (Brener et al., 2013). Through the years, the YRBS has gone through numerous revisions and now focuses on unintentional and intentional injuries, sexual behaviors, substance use, dietary behaviors and physical activity (Centers for Disease Control and Prevention, 2018a).

Population

The target population for the YRBS are all youth who attend a public, private, or religiously-affiliated high school in Grades 9-12 in the United States (Centers for Disease Control and Prevention, 2018a). In 2017, the responses were weighted to oversample for minority populations (i.e., Black and Hispanic students) to ensure a representative sample (Centers for Disease Control and Prevention, 2018a). Forty-six of the 50 states, three tribal governments, three territories, and 21 large urban school departments participated in the survey; 40 of the states had their data weighted, meaning they had over 60% response rate (Centers for Disease Control and Prevention, 2019a). The was a 75% school response rate (144 schools participated out of 192), and 81% of students responded to the survey (14,765 out of 18,324; Centers for Disease Control and Prevention, 2018a).

Sampling and Sampling Procedures

Brener, et al. (2013) fully described the sampling procedures for the YRBS. The YRBS used a three-stage cluster sampling design that includes (a) primary sampling units (PSU) from large counties or large county groups (i.e. several small counties grouped together), (b) selection of private and public schools from the PSU, and (c) the random

selection of classes within the selected school to participate in the study (Brener et al., 2013). This design facilitates the creation of a representative sample of students, nationwide, in Grades 9-12 (Brener et al., 2013). Surveys must have a response rate of over 60% to be weighted and added to the dataset as part of the jurisdiction; all schools with results less than 60% have the students added to the overall dataset (Brener et al., 2013). Also, the data is weighted for vital demographic factors (i.e. sex, race/ethnicity, and grade) to compensate for missing responses that will ensure a representative population.

For this study, I conducted a power analysis was completed using the G*Power analysis program created by Faul, Erdfelder, and Buchner (2009). G*Power conducts five different power analyses (a priori, compromise, criterion, post hoc, and sensitivity) to ensure that the data set has sufficient sample size and is robust enough to avoid Type I (accepting alternative hypothesis when the null is true) and Type II (accepting the null hypothesis when the alternative is true) errors (Faul et al., 2009; Field, 2013). Statistical significance was considered at the p=0.05 level. The statistical test I inputted into G*Power was an ANCOVA for fixed effects, main effects, and interactions in the F test family with a post hoc power analysis for the initiation sample size of 14,765 gave a noncentrality parameter λ of 922.8125, critical F of 1.83134 and power of 1.000.

Procedures for Data Collection

The YRBSS has been operating for more than 20 years, and the survey tool that is given to each student has continually evolved (citation). Starting in 1988, the survey

developers at the Centers for Disease Control and Prevention (CDC) looked at the leading causes of morbidity and mortality in the United States and developed a series of questions to gauge youth risk behaviors for those areas (Brener et al., 2013). The top areas of morbidly and mortality in the 1980s were motor vehicle accidents, injury (both intentional and unintentional), and teen pregnancy (Brener et al., 2013). This led to the development of six key areas of health/risk behaviors, which are injury/violence, sexual behaviors, tobacco use, alcohol and drug use, unhealthy dietary behaviors, and physical inactivity (Brener et al., 2013). These six areas stayed consistent over the next 20 years, though experts in the field are regularly consulted to help revise, add, or delete questions to reflect the needs of the time (Brener et al., 2013). The 2017 survey is publicly available from the CDC website (Centers for Disease Control and Prevention, 2018a).

Data Analysis Plan

The selected tool for data analysis was SPSS, version 25 for Mac. Once the data was successfully been loaded into SPSS, it was cleaned and analyzed. Age of initiation for each of the three substances of interest are on a Likert scale and were recoded, as seen in Table 1. The data was recoded to show the dosage of substance use by age; when calculating the means for age initiation, the higher the mean, the younger the age of initiation. For example, a 0 would be the least amount of smoking exposure, followed by not starting until the age of 17 as a 1, and continuing until reaching the highest level of exposure to smoking at age 8 or younger would be given the highest score at 6. This way, when looking at the mean for the variable, the higher the score, the younger the age of

initiation for the variable. The trauma scale is the compilation of question assessing physical and sexual violence and bullying to create a single continuous trauma variable. The variable will be created by taking the following questions and adding the responses together, see Table 1. As with the age of initiation variable, the trauma variable was organized to have the least amount of exposure to violence as a 0 and the most exposure as a 4, which will allow for the mean to show the severity of abuse (i.e. the higher the score, the more exposure to violence and trauma). The race/ethnicity variables are categorical and did not need to be transformed. Since the dependent variables for this analysis were both ordinal, an ordinal logistic regression was selected for the statistical testing. Table 2 describes the research plan for this study.

Table 1

New Variable Calculations for Data Analysis

YRBS Variable	Original Coding	Re-coding
	Age of Initiation Variables	
Initiation of cigarette smoking (Q31)	1 = Never tried cigarette smoking 2 = 8 years or younger 3 = 9 or 10 years 4 = 11 or 12 years 5 = 13 or 14 years 6 = 15 or 16 years 7 = 17 years old or older	0 = Never tried cigarette smoking 1 = 17 years or older 2 = 15 or 16 years 3 = 13 or 14 years 4 = 11 or 12 years 5 = 9 or 10 years 6 = 8 years or younger
Initiation of alcohol use (Q41)	1 = Never tried alcohol 2 = 8 years or younger 3 = 9 or 10 years 4 = 11 or 12 years 5 = 13 or 14 years 6 = 15 or 16 years 7 = 17 years old or older	0 = Never tried alcohol 1 = 17 years or older 2 = 15 or 16 years 3 = 13 or 14 years 4 = 11 or 12 years 5 = 9 or 10 years 6 = 8 years or younger
Initiation of marijuana use (Q47)	1 = Never tried marijuana 2 = 8 years or younger 3 = 9 or 10 years 4 = 11 or 12 years 5 = 13 or 14 years	0 = Never tried marijuana 1 = 17 years or older 2 = 15 or 16 years 3 = 13 or 14 years 4 = 11 or 12 years

	6 = 15 or 16 years	5 = 9 or 10 years
	7 = 17 years old or older	6 = 8 years or younger
	Race	
What is your race/ethnicity (raceeth)	1 = American Indian/Alaska Native 2 = Asian 3 = Black or African American 4 = Native Hawaiian/Other PI 5 = White 6 = Hispanic/Latino 7 = Multiple – Hispanic 8 = Multiple – non-Hispanic	0 = White 1 = American Indian/Alaska Native 2 = Asian 3 = Black or African American 4 = Native Hawaiian/Other PI 5 = Hispanic/Latino 6 = Multiple – Hispanic 7 = Multiple – non-Hispanic
	Trauma	
Threatened at school (Q16)	1 = 0 times 2 = 1 time 3 = 2 or 3 times 4 = 4 or 5 times 5 = 6 or 7 times 6 = 8 or 9 times 7 = 10 or 11 times 8 = 12 or more times	0 = 0 times 1 = 1 time 2 = 2 or 3 times 3 = 4 or 5 times 4 = 6 or 7 times 5 = 8 or 9 times 6 = 10 or 11 times 7 = 12 or more times
Physical fighting (Q17)	1 = 0 times 2 = 1 time 3 = 2 or 3 times	0 = 0 times 1 = 1 time 2 = 2 or 3 times

	4 = 4 or 5 times	3 = 4 or 5 times
	5 = 6 or 7 times	4 = 6 or 7 times
	6 = 8 or 9 times	5 = 8 or 9 times
	7 = 10 or 11 times	6 = 10 or 11 times
	8 = 12 or more times	7 = 12 or more times
Physical fighting at school (Q18)	1 = 0 times	0 = 0 times
	2 = 1 time	1 = 1 time
	3 = 2 or 3 times	2 = 2 or 3 times
	4 = 4 or 5 times	3 = 4 or 5 times
	5 = 6 or 7 times	4 = 6 or 7 times
	6 = 8 or 9 times	5 = 8 or 9 times
	7 = 10 or 11 times	6 = 10 or 11 times
	8 = 12 or more times	7 = 12 or more times
Ever been physically forced sexual intercourse (Q19)	1 = Yes	0 = No
	2 = No	1 = Yes
Sexual violence (Q20)	1 = 0 times	0 = 0 times
	2 = 1 time	1 = 1 time
	3 = 2 or 3 times	2 = 2 or 3 times
	4 = 4 or 5 times	3 = 4 or 5 times
	5 = 6 or more times	4 = 6 or more times
Sexual dating violence (Q21)	1 = Did not date	0 = 0 times or Did not date
	2 = 0 times	1 = 1 time
	3 = 1 time	2 = 2 or 3 times

	4 = 2 or 3 times 5 = 4 or 5 times 6 = 6 or more times	3 = 4 or 5 times 4 = 6 or more times
Physical dating violence (Q22)	1 = Did not date 2 = 0 times 3 = 1 time 4 = 2 or 3 times 5 = 4 or 5 times 6 = 6 or more times	0 = 0 times or Did not date 1 = 1 time 2 = 2 or 3 times 3 = 4 or 5 times 4 = 6 or more times
Bullying at school (Q23)	1 = Yes 2 = No	0 = No 1 = Yes
Electronic bullying (Q24)	1 = Yes 2 = No	0 = No 1 = Yes
	Covariates	
How old are you (Q1)	1 = 12 years old or younger 2 = 13 years old 3 = 14 years old 4 = 15 years old 5 = 16 years old 6 = 17 years old 7 = 18 years old or older	None
What is your sex (Q2)	1 = Female 2 = Male	None

In what grade are you (Q3)	1 = 9th grade 2 = 10th grade 3 = 11th grade 4 = 12th grade 5 = Ungraded or other grade	None
Sexual identity (Q67)	1 = Heterosexual 2 = Gay or lesbian 3 = Bisexual 4 = Not sure	None

(Centers for Disease Control and Prevention, 2018a).

Table 2

Data Analysis Plan by Research Question

Research question	Variables	Statistical Tests to be conducted
RQ 1: Is there a statistically significant difference in age of initiation of tobacco use by race/ethnicity (after controlling for age, gender, grade level, sexual identity) among High School students aged 13-19 in the United States	Dependent: Age of initiation for cigarette smoking (Q31) Independent: Race/Ethnicity (raceeth) Covariates: Age (Q1); Sex (Q2); Grade (Q3); Sexual identity (Q67); Trauma (created scale, see below for description)	• Frequency Tables • Crosstab with Risk Analysis • Ordinal logistic regression
RQ 2: Is there a statistically significant difference in age of initiation of tobacco use by trauma exposure (after controlling for age, gender, grade level, sexual identity) among High School students aged 13-19 in the United States	Dependent: Age of initiation for cigarette smoking (Q31) Independent: Trauma (Created scale) Covariates: Age (Q1); Sex (Q2); Grade (Q3); Sexual identity (Q67); Race/Ethnicity (raceeth)	• Frequency Tables • Crosstab with Risk Analysis • Ordinal logistic regression
RQ 3: Is there a statistically significant difference in age of	Dependent: Age of initiation for alcohol (Q41)	• Frequency Tables

initiation of alcohol use by race/ethnicity (after controlling for age, grade level, sexual identity) among High School students aged 13-19 in the United States	Independent: Race/Ethnicity (raceeth) Covariates: Age (Q1); Sex (Q2); Grade (Q3); Sexual identity (Q67); Trauma (Created scale)	• Crosstab with Risk Analysis • Ordinal logistic regression
RQ 4: Is there a statistically significant difference in age of initiation of alcohol use by trauma exposure (after controlling for age, grade level, sexual identity) among High School students aged 13-19 in the United States	Dependent: Age of initiation for alcohol (Q41) Independent: Trauma (Created scale, see below) Covariates: Age (Q1); Sex (Q2); Grade (Q3); Sexual identity (Q67); Race/Ethnicity (raceeth)	• Frequency Tables • Crosstab with Risk Analysis • Ordinal logistic regression
RQ 5: Is there a statistically significant difference in age of initiation of marijuana use by race/ethnicity (after controlling for age, grade level, sexual identity) among High School students aged 13-19 in the United States	Dependent: Age of initiation for marijuana (Q47) Independent: Race/Ethnicity (raceeth) Covariates: Age (Q1); Sex (Q2); Grade (Q3); Sexual identity (Q67); Trauma (Created scale)	• Frequency Tables • Crosstab with Risk Analysis • Ordinal logistic regression

RQ 6: Is there a statistically significant difference in age of initiation of marijuana use by trauma exposure (after controlling for age, grade level, sexual identity) among High School students aged 13-19 in the United States	Dependent: Age of initiation for marijuana (Q47) Independent: Trauma (Created scale, see below) Covariates: Age (Q1); Sex (Q2); Grade (Q3); Sexual identity (Q67); Race/Ethnicity (raceeth)	• Frequency Tables • Crosstab with Risk Analysis • Ordinal logistic regression

For the trauma scale variable, Questions 17-24 were added together to get a total trauma score. The higher the score, the more trauma exposure for an individual. I looked at the logistical regression model to determine how the race and trauma explain the difference in the age of substance use initiation. This analysis was done for race as compared to the independent variable (age of initiation for each substance) while controlling for the covariates. Once all the tests were completed, the results were compared to see if the null hypothesis is accepted or rejected.

Threats to Validity

One of the advantages of using a secondary data source like the YRBS is that there has been considerable testing done to ensure that the questions are reliable and valid. Threats to internal validity included the limited number of demographic variables and the fact that as a cross-sectional study, temporality is not able to be measured. This fact means that there may be other factors besides the variables that can lead to the relationship between the variable, thus low internal validity (Carlson & Morrison, 2009).

Reliability testing has demonstrated that approximately 75% of the questions have substantial or high validity (Brener et al., 2013). However, validity testing has shown that self-reporting does lead to underestimates of risk behaviors (Brener et al., 2013). This issue could lead to an external threat to validity, since underestimates may lead to incorrectly accepting the null hypothesis (Carlson & Morrison, 2009). Further, since this is a cross-sectional study, there is a potential that the people selected for the study were not representative of all of the youth in the United States, especially since some states did not participate (Brener et al., 2013). These issues are addressed by ensuring a large sample size, which will help increase the statistical power of the study (Faul et al., 2009). Finally, errors in the statistical testing procedures, such as a statistical assumption violation, could introduce statistical conclusion validity issues (Field, 2013).

Ethical Procedures

The Centers for Disease Control and Prevention has a strict set of ethical guidelines, codes, and statutes that accompany any of their surveys or surveillance systems (Centers for Disease Control and Prevention, 2016). The Youth Risk Behavior Surveillance System (YRBSS) and the Youth Risk Behavior Survey (YRBS) have both been placed in the public domain; thus there is no agreements or documents needed to gain access to the information (Centers for Disease Control and Prevention, 2018c). However, to ensure the confidentiality of the participants, each child participating in the survey must have parental permission through a signed consent form (Centers for Disease Control and Prevention, 2018a). Further, the public access dataset restricts access to

demographics, such as census tract, zip code, state, or parental demographic (Centers for Disease Control and Prevention, 2018a). Data for this study was downloaded on a password-protected computer and kept in a secure file folder.

Summary

In summary, by using secondary data from a national survey, it was possible to assess the difference in age of substance use initiation from difference racial backgrounds or trauma. Limited demographic variables controlled for the effect they may have on the outcome and used ordinal logistic regression to assess if there is a statistically significant difference between the dependent and independent variables, which are both ordinal and continuous. The results of the study are provided in chapter 4.

Chapter 4: Results

Introduction

The purpose of this study was to examine the strength of the association between race, trauma, and the age of initiation for substance use, specifically tobacco, marijuana, alcohol, among high school students aged 13-18 in the United States. In this study, I used the YRBSS, which was a quantitative, cross-sectional study design (see Williams, 2007). The YRBSS is a sample of high school youth in the United States who were given a questionnaire to assess their behaviors and exposures to a particular risk factor (Brener et al., 2013). Data is collected every other year and for this study, I used the most recent data available from the Centers for Disease Control and Prevention website, which at the time of data analysis was 2017.

The following six research questions and their corresponding hypotheses were utilized to determine the strength and significance of the association:

RQ1: Is there a statistically significant difference in age of initiation of tobacco use by race/ethnicity (after controlling for trauma exposure, age, gender, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0$1: There is no statistically significant difference in age of initiation of tobacco use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States

H_a1: There is a statistically significant difference in age of initiation of tobacco use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States

RQ2: Is there a statistically significant difference in age of initiation of tobacco use by trauma exposure (after controlling for race, ethnicity, age, gender, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0 2$: There is no statistically significant difference in age of initiation of tobacco use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States

$H_a 2$: There is a statistically significant difference in age of initiation of tobacco use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States

RQ3: Is there a statistically significant difference in age of initiation of alcohol use by race/ethnicity (after controlling for trauma exposure. age, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0 3$: There is no statistically significant difference in age of initiation of alcohol use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States

$H_a 3$: There is a statistically significant difference in age of initiation of alcohol use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States

RQ4: Is there a statistically significant difference in age of initiation of alcohol use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0$4: There is no statistically significant difference in age of initiation of alcohol use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States

H_a4: There is a statistically significant difference in age of initiation of alcohol use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States

RQ5: Is there a statistically significant difference in age of initiation of marijuana use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0$5: There is no statistically significant difference in age of initiation of marijuana use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States

H_a5: There is a statistically significant difference in age of initiation of marijuana use by race/ethnicity (after controlling for trauma exposure. age, grade level, sexual identity) among high school students aged 13-19 in the United States

RQ6: Is there a statistically significant difference in age of initiation of marijuana use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States:

$H_0$6: There is no statistically significant difference in age of initiation of marijuana use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States

H_a6: There is a statistically significant difference in age of initiation of marijuana use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States,

Over the course of the next several pages, I present the data collection and results of the study as well as provide a summary of these results. This chapter contains information on the data collection process, provides summary study population demographics, and presents the results by research question component, which is the substance of interest, divided by description of the overall model, results by race and then by trauma exposure. I also discuss the hypothesis testing used to determine the association between race, trauma, and the age of initiation for tobacco, alcohol and marijuana.

Data Collection

Institutional research board (IRB) approval (No. 01-08-20-0101858) was received in December 2019. Once approved, data for the 2017 YRBSS was accessed via the Centers for Disease Control and Prevention public website (Centers for Disease Control and Prevention, 2019b). The data was uploaded into SPSS version 25 and reviewed for key variables of interest. All variables that were not pertinent to this study were removed from the study dataset. The variables of interest were recoded, and summary descriptive

statistics were completed in accordance with the data analysis plan laid out in in Table 1 from Chapter 3.

The variables of interest, with the exception of the created trauma variable, were ordinal in nature, using either a Likert scale or yes/no response (Centers for Disease Control and Prevention, 2019b). As a result, it was determined that ordinal logistic regression would be the best analytical test to assess the nature of the relationship between the dependent and independent variables. The data that was available through the provided documentation was not coded the same as the actual data in the dataset. Originally, an analysis of covariance (ANCOVA) was to be used for the analysis, but since the dependent variable was ordinal and not continuous, this led to the decision to use the ordinal logistic regression. Ordinal logistic regression fit with the model well, as it allows for ordinal, continuous, or categorical independent variables, all of which was present for this study.

Baseline demographic frequency for all variables were run, to provide a baseline for variable creation. The overall data set included 14,765 total respondents. Demographics for the study were compared to the overall population of the United States, to ensure a representative same, as described in Table 3.

Table 3

Demographics of the 2017 YRBSS compared to United States Census Population Estimates

	YRBSS		US Census*	
Variable	*N*	%	*N*	%
Age				
10 – 14-year old's	2,003	13.6%	21,392,992	6.5%
15 – 19-year old's	12,681	86.4%	21,445,493	6.6%
Gender				
Female	7,526	51.4%	21,973,665	52%
Male	7,112	48.6%	20,284,750	48%

*2018 Population Estimate from American Community Survey (American Community Survey, 2020)

While the data by age is difficult to compare for representative needs, given that this data was specifically for high school students versus the U.S. population, the data by gender show that the data is very representative of the overall same population. For this variable, it provides evidence that the data has good external validity. Table 4 depicts the descriptive summary statistics for the dependent variables, age of initiation for tobacco, alcohol, and marijuana.

Table 4

Age of Initiation Summary Statistics

	Variable	Frequency	Percentage
Cigarette Smoking	0 = Never tried cigarette smoking	8,593	72.1%
	1 = 17 years or older	258	2.2%
	2 = 15 or 16 years	972	8.2%
	3 = 13 or 14 years	1,015	8.5%
	4 = 11 or 12 years	513	4.3%
	5 = 9 or 10 years	270	2.3%
	6 = 8 years or younger	293	2.5%
	TOTAL	11,914	100.0%
	Missing Values	2,851	19.3%
Alcohol	0 = Never tried cigarette smoking	5,995	44.1%
	1 = 17 years or older	482	3.5%
	2 = 15 or 16 years	2,607	19.2%
	3 = 13 or 14 years	2,352	17.3%
	4 = 11 or 12 years	951	7.0%
	5 = 9 or 10 years	545	4.0%
	6 = 8 years or younger	674	5.0%
	TOTAL	13,606	100.0%
	Missing Values	1,159	7.8%
Marijuana	0 = Never tried cigarette smoking	9,185	64.1%
	1 = 17 years or older	362	2.5%
	2 = 15 or 16 years	1,958	13.7%
	3 = 13 or 14 years	1,850	12.9%
	4 = 11 or 12 years	592	4.1%
	5 = 9 or 10 years	209	1.5%
	6 = 8 years or younger	182	1.3%
	TOTAL	14,338	100.0%
	Missing Values	427	2.9%

For the two independent variables, race/ethnicity and particularly trauma, additional work was necessary to prepare for analysis. Race/ethnicity was grouped together using the YRBSS created variable *raceeth* (Centers for Disease Control and Prevention, 2019b). The trauma variable was a grouping of nine different variables. Table 5 outlines the frequency for the independent variables.

Table 5

Race/Ethnicity and Trauma Summary Statistics

Variable			Frequency	Percentage
Race/Ethnicity		Am Indian/Alaska Native	137	0.9%
		Asian	648	4.5%
		Black or African American	2,796	19.4%
		Native Hawaiian/Other PI	116	0.8%
		White	6,261	43.4%
		Hispanic / Latino	1,543	10.7%
		Multiple - Hispanic	2,104	14.6%
		Multiple - Non-Hispanic	823	5.7%
		Total	14,428	100.0%
		Missing	337	2.3%
Trauma	Threatened at school	0 = 0 times	13,768	93.6%
		1 = 1 time	429	2.9%
		2 = 2 or 3 times	217	1.5%
		3 = 4 or 5 times	84	0.6%
		4 = 6 or 7 times	44	0.3%
		5 = 8 or 9 times	26	0.2%

	6 = 10 or 11 times	13	0.1%
	7 = 12 or more times	121	0.8%
	TOTAL	14,702	100.0%
	Missing	63	0.4%
Physical fighting	0 = 0 times	9,239	76.6%
	1 = 1 time	1,241	10.3%
	2 = 2 or 3 times	947	7.9%
	3 = 4 or 5 times	247	2.0%
	4 = 6 or 7 times	113	0.9%
	5 = 8 or 9 times	64	0.5%
	6 = 10 or 11 times	34	0.3%
	7 = 12 or more times	172	1.4%
	TOTAL	12,057	100.0%
	Missing	2,708	18.3%
Physical fighting in school	0 = 0 times	13,177	91.0%
	1 = 1 time	810	5.6%
	2 = 2 or 3 times	304	2.1%
	3 = 4 or 5 times	66	0.5%
	4 = 6 or 7 times	27	0.2%
	5 = 8 or 9 times	8	0.1%
	6 = 10 or 11 times	7	0.0%
	7 = 12 or more times	79	0.5%
	TOTAL	14,478	100.0%
	Missing	287	1.9%
Physically forced sexual intercourse	0 = No	13,336	92.4%
	1 = Yes	1,104	7.6%

	TOTAL	14,440	100.0%
	Missing	325	2.2%
Sexual violence	0 = 0 times	12,724	90.0%
	1 = 1 time	670	4.7%
	2 = 2 or 3 times	465	3.3%
	3 = 4 or 5 times	93	0.7%
	4 = 6 or more times	193	1.4%
	TOTAL	14,145	100.0%
	Missing	620	4.2%
Sexual dating violence	0 = 0 times or Did not date	13,144	95.4%
	1 = 1 time	313	2.3%
	2 = 2 or 3 times	165	1.2%
	3 = 4 or 5 times	41	0.3%
	4 = 6 or more times	109	0.8%
	TOTAL	13,772	100.0%
	Missing	993	6.7%
Physical dating violence	0 = 0 times or Did not date	13,241	94.0%
	1 = 1 time	345	2.4%
	2 = 2 or 3 times	255	1.8%
	3 = 4 or 5 times	91	0.6%
	4 = 6 or more times	153	1.1%
	TOTAL	14,085	100.0%
	Missing	680	4.6%
Bullying at school	0 = No	11,941	81.8%
	1 = Yes	2,665	18.2%
	TOTAL	14,606	100.0%

	Missing	159	1.1%
Electronic bullying	0 = No	12,482	85.5%
	1 = Yes	2,113	14.5%
	TOTAL	14,595	100.0%
	Missing	170	1.2%

The trauma variables were recoded, as detailed in Table 1, to allow for the creation of the trauma scale variable. The variables were recoded so that the less amount of exposure to the trauma received a lower score. For example, those who never experienced physical fighting were given a 0 and those who experienced it 12 or more times was given a 7. Then, each of the indicated trauma variables were added together to give an overall score for trauma; the higher the score, the more exposure to trauma the respondent experienced.

The covariates, age, grade, gender, and sexual identity were selected because they are the available demographics in the publicly available dataset and helped assure that the relationship that was observed was indeed between the dependent and independent variables. The dataset was sufficiently large and sampled appropriately by the Centers for Disease Control and Prevention to ensure a representative sample with sufficient statistical power (Centers for Disease Control and Prevention, 2018a).

Results

The overall population in the YRBSS contained a total of 14,765 participants. Table 6 described the descriptive statistics for the overall survey population and Table 7 detailed the descriptive statistics for those who responded to the dependent variables (i.e. the age of initiation for tobacco, alcohol, and marijuana).

Table 6

Descriptive Statistics for Study Population

Variable	*N*	%
Demographic Variables (Covariates)		
Age		
12 years old or younger	59	0.4%
13 years old	22	0.1%
14 years old	1,922	13.1%
15 years old	3,586	24.4%
16 years old	3,688	25.1%
17 years old	3,611	24.6%
18 years old or older	1,796	12.2%
Gender		
Female	7,526	51.4%
Male	7,112	48.6%
Grade Level		
9th grade	3,921	26.8%
10th grade	3,715	25.4%
11th grade	3,602	24.6%
12th grade	3,383	23.1%
Ungraded or other grade	30	0.2%
Sexual Identity		
Heterosexual (straight)	12,012	85.1%
Gay or lesbian	357	2.5%
Bisexual	1,137	8.1%
Not sure	602	4.3%

Table 7

Summary Statistics for Dependent Variables

Dependent Variables		
Initiation of Cigarette Smoking		
Never tried cigarette smoking	8,593	72.1%
8 years old or younger	293	2.5%
9 or 10 years old	270	2.3%
11 or 12 years old	513	4.3%
13 or 14 years old	1015	8.5%
15 or 16 years old	972	8.2%
17 years old or older	258	2.2%
Initiation of Alcohol Use		
Never drank alcohol	5,995	44.1%
8 years old or younger	674	5.0%
9 or 10 years old	545	4.0%
11 or 12 years old	951	7.0%
13 or 14 years old	2,352	17.3%
15 or 16 years old	2,607	19.2%
17 years old or older	482	3.5%
Initiation of Marijuana Use		
Never tried marijuana	9,185	64.1%
8 years old or younger	182	1.3%
9 or 10 years old	209	1.5%
11 or 12 years old	592	4.1%
13 or 14 years old	1,850	12.9%
15 or 16 years old	1,958	13.7%
17 years old or older	362	2.5%

Tobacco (Cigarette Smoking)

The results of the analysis are broken into three main components. First, are the results of the overall model, see Table 8. Second, is the result of the analysis for those with very young ages of initiation (10 years of age or less), see Table 9. Lastly, the results are discussed by each research question, RQ1 - race and RQ2 - trauma. The predictor variables were tested a priori to verify there was no violation of the assumption of no multicollinearity.

Overall Model. The model included the dependent variable (age of cigarette smoking initiation), race (by each specific racial category, as well as comparing white and all other races), trauma (created trauma variable), and covariates (age, gender, grade, sexual orientation). An ordinal logistic regression was the selected test for this model, therefore, the race/ethnicity variables needed be to broken up into dichotomous variables, as the predictor variables and covariates must be either dichotomous or continuous (Lund Research, 2018). Each race variables were created into variables that delineated the race of interest versus all other races (i.e. Asian/Not Asian). The model controlled for the effects each covariate has on the overall predictor variable effect and was tested a priori to verify there was no violation of the assumption of no multicollinearity. The results demonstrated that the overall model was statistically significant (p=.000), see Table 8.

Table 8

Race/Ethnicity, Trauma, and Cigarette Smoking Age of Initiation Statistics

	Variable	Estimate	Standard Error	Wald	Sig	95% Confidence Interval	
						Lower	Upper
Race	White (reference)	.208	0.099	4.404	.036	.014	.402
	Other Races	-.364	.046	63.67	.000	-.453	-.275
	American Indian/ Alaska Native	.335	.246	1.850	.174	-.148	.818
	Asian	-.822	.172	22.81	.000	-1.159	-.485
	Black or African American	-.378	.111	11.55	.001	-.596	-.160
	Native Hawaiian/ Other PI	-.122	.275	0.195	.658	-.661	.481
Ethnicity	Hispanic; all races	-.002	.103	.000	.986	-.204	.200
Trauma		0.187	.008	574.20	.000	.172	.203

To assess the effect for very young age of initiation (i.e. age of 10 or younger), binomial variables were created for age on initiation (10 year and younger vs 11 or older), race/ethnicity (white versus other races), and trauma (trauma score of 10 or higher vs trauma score of 9 or lower). The demographics of each group and statistical results are described in Table 9.

Table 9

Early Age of Cigarette Smoking Statistics

		Age of Initiation		Odds	95% CI	
		11 or Older	10 or Younger	Ratio	Lower	Upper
Race	White	1,399	213	1.678	1.391	2.024
	Other Races	1,319	337			
Trauma	9 or less	1411	276	4.448	3.129	6.325
	10 or more	77	67			

RQ1- Race. RQ1 stated is there a statistically significant difference in age of initiation of tobacco use by race/ethnicity (after controlling for trauma exposure, age, gender, grade level, sexual identity) among high school students aged 13-19 in the United States. The results showed that people who were white has an ordered log-odds (Estimate) = 0.208, *SE* = .0099, *Wald* = 4.404, $p < .035$, which is statistically significant. The estimated odds ratio favored a positive relationship of nearly 1.23 for everyone unit increase of age of initiation for cigarette smoking. This result shows that being white is a predictor for cigarette smoking. People from other races than white did not have an overall positive association with the age of tobacco use initiation, rather had an inverse, statistically significant relationship. However, with the exception of Asian (log-odds estimate = -0.822, *SE* =.172, *Wald*=22.810, $p<.000$) and African American/Black (log-odds estimate = -0.378, *SE* =.111, *Wald*=11.549, $p<.001$) both of which show a

statistically significant inverse relationship to age of cigarette smoking use, other individual races did not have a statistically significant association. Overall, the results show that a person from other races are 1.4 times less likely to start smoking cigarettes at younger ages.

When looking at very young ages of initiation, the results, as seen in Table 7, showed that the odds ratio for the model that age of initiation less than 10 years compared to race was 1.678 (95% CI: 1.391, 2.024). This result showed that being part of a racial group other than white had a 1.678 increased likelihood of smoking before the age of 10. Therefore, while being white has a statistically significant relationship to smoking overall, being part of a race other than white has a statistically significant relationship to very early smoking initiation.

RQ2 -Trauma. RQ 2 states is there a statistically significant difference in age of initiation of tobacco use by trauma (after controlling for race/ethnicity, age, gender, grade level, sexual identity) among high school students aged 13-19 in the United States. The results in Table 8 showed an ordered log-odds (Estimate) = 0.187, *SE* = .008, *Wald* = 574.196, $p < .001$. The estimated odds ratio favored a positive relationship of nearly 1.2 for every one unit increase of age of initiation for cigarette smoking.

When looking at very young ages of initiation the result, as seen in Table 9, showed that the odds ratio for age of initiation less than 10 years for those with higher trauma scores were 4.448 (95% CI: 3.129, 6.325). This result showed that trauma is a significant factor for smoking at a younger age, meaning that those with a high trauma

background had a 4.5 times increased likelihood of smoking at a younger age. This is considerably higher likelihood than the effect of trauma overall, but both have a positive association to cigarette smoking initiation.

Alcohol

Similarly to the prior section, the results of the analysis are broken into three main pieces. First, are the results of the overall model, see Table 10. Second, is the result of the analysis for those with very young ages of initiation (10 years of age or less), see Table 11. Lastly, the results are discussed by each research question, RQ3 - race and RQ4 - trauma. The predictor variables were tested a priori to verify there was no violation of the assumption of no multicollinearity.

Overall Model. The model included the dependent variable (age of alcohol use initiation), race (by each specific racial category, as well as comparing white and all other races), trauma (created trauma variable), and covariates (age, gender, grade, sexual orientation). An ordinal logistic regression was the selected test for this model, therefore, the race/ethnicity variables needed be to broken up into dichotomous variables, as the predictor variables and covariates must be either dichotomous or continuous (Lund Research, 2018). Each race variables were created into variables that delineated the race of interest versus all other races. The model controlled for the effects each covariate has on the overall predictor variable effect and was tested a priori to verify there was no violation of the assumption of no multicollinearity. The results demonstrated that the overall model was statistically significant (p=.000), see Table 10.

Table 10

Race/Ethnicity, Trauma, and Alcohol Use Age of Initiation Statistics

	Variable	Estimate	Standard Error	Wald	Sig	95% Confidence Interval	
						Lower	Upper
Race	White (reference)	.029	0.083	0.122	.727	-.133	.191
	Other Races	-.111	.038	8.572	.003	-.186	-.037
	American Indian/ Alaska Native	-.214	.227	0.886	.347	-.659	.231
	Asian	-.645	.123	27.312	.000	-.887	-.403
	Black or African American	-.341	.091	13.916	.000	-.520	-.162
	Native Hawaiian/Other PI	-.091	.232	0.154	.695	-.545	.363
Ethnicity	Hispanic; all races	.130	.086	2.310	.129	-.038	.299
Trauma		.203	.008	677.757	.000	.188	.218

To assess the effect for very young age of initiation (i.e. age of 10 or younger), binomial variables were created for age on initiation (10 year and younger vs 11 or older), race/ethnicity (white versus other races), and trauma (trauma score of 10 or higher vs trauma score of 9 or lower). The demographics of each group and statistical results are described in Table 11.

Table 11

Early Age of Alcohol Initiation Statistics

		Age of Initiation		Odds	95% CI	
		11 or Older	10 or Younger	Ratio	Lower	Upper
Race	White	3,047	459	1.490	1.312	1.691
	Other Races	3,248	729			
Trauma	9 or less	2,430	484	3.676	2.720	4.967
	10 or more	112	82			

RQ3 - Race. RQ3 states is there a statistically significant difference in age of initiation of alcohol use by race/ethnicity (after controlling for trauma exposure, age, gender, grade level, sexual identity) among high school students aged 13-19 in the United States, was conducted. The results showed that people from other races had an inverse, statistically significant relationship, while those who identified as white did not have a statistically significant relationship. From an individual race category, only Asian (log-odds estimate = -0.645, *SE* =.123, *Wald*=27.312, *p*<.000) and African American/Black (log-odds estimate = -0.341, *SE* =.091, *Wald*=13.916, *p*<.000) both show a statistically significant inverse relationship to age of alcohol use, meaning they were 1.9 and 1.4 times less likely to start using alcohol at younger ages, respectively. Overall, identifying as a race other than white lead to being 1.1 times less likely to start using alcohol at younger ages

When looking at very young ages of initiation, the result, as described in Table 11, showed that the odds ratio for age of initiation less than 10 years for those who were a person of color were 1.49 (95% CI: 1.312, 1.691). This result showed that race was a statistically significant (at the .001 level) predictive factor for alcohol use at a younger age, while race was not a predictive factor for alcohol use across all ages of initiation.

RQ4 - Trauma. RQ4 states is there a statistically significant difference in age of initiation of alcohol use by trauma (after controlling for race/ethnicity, age, gender, grade level, sexual identity) among high school students aged 13-19 in the United States, was conducted. The results showed an ordered log-odds (Estimate) = 0.203, *SE* = .008, *Wald* = 677.757, $p < .001$. The estimated odds ratio favored a positive relationship of nearly 1.2 for every one unit increase of age of initiation for alcohol use.

When looking at very young ages of initiation the result, as showed in Table 9, showed that the odds ratio for age of initiation less than 10 years for those with higher trauma scores were 3.676 (95% CI: 2.720, 4.967). This result showed that trauma is a significant factor for smoking at a younger age, meaning that those with a high trauma background had a 3.7 times increased likelihood of smoking at a younger age. This is considerably higher likelihood than the effect of trauma overall, but both have a positive association to alcohol use.

Marijuana

First, are the results of the overall model, see Table 12. Second, is the result of the analysis for those with very young ages of initiation (10 years of age or less), see Table

13. Lastly, the results are discussed by each research question, RQ5 - race and RQ6 - trauma. The predictor variables were tested a priori to verify there was no violation of the assumption of no multicollinearity.

Overall Model. The model included the dependent variable (age of marijuana use initiation), race (by each specific racial category, as well as comparing white and all other races), trauma (created trauma variable), and covariates (age, gender, grade, sexual orientation). An ordinal logistic regression was the selected test for this model, therefore, the race/ethnicity variables needed be to broken up into dichotomous variables, as the predictor variables and covariates must be either dichotomous or continuous (Lund Research, 2018). Each race variables were created into variables that delineated the race of interest versus all other races. The model controlled for the effects each covariate has on the overall predictor variable effect and was tested a priori to verify there was no violation of the assumption of no multicollinearity. The results demonstrated that the overall model was statistically significant (p=.000), see Table 12.

Table 12

Race/Ethnicity, Trauma, and Marijuana Use Age of Initiation Statistics

	Variable	Estimate	Standard Error	Wald	Sig	95% Confidence Intervals	
						Lower	Upper
Race	White	-.209	0.090	5.350	.021	-.385	-.032
	Other Races	.261	.042	38.43	.000	.179	.344
	American Indian/ Alaska Native	-.385	.252	2.339	.126	-.878	.108
	Asian	-1.327	.167	63.17	.000	-1.654	-1.000
	Black or African American	.120	.097	1.514	.219	-.071	.310
	Native Hawaiian/ Other PI	.054	.242	.050	.822	-.420	.529
Ethnicity	Hispanic; all races	.193	.092	4.375	.036	.012	.375
Trauma		.220	.008	829.91	.000	.205	.234

To assess the effect for very young age of initiation (i.e. age of 10 or younger), binomial variables were created for age on initiation (10 year and younger vs 11 or older), race/ethnicity (white versus other races), and trauma (trauma score of 10 or higher vs trauma score of 9 or lower). The demographics of each group and statistical results are described in Table 13.

Table 13

Early Age of Marijuana Initiation Statistics

		Age of Initiation		Odds	95% CI	
		11 or Older	10 or Younger	Ratio	Lower	Upper
Race	White	1,944	107	1.729	1.371	2.182
	Other Races	2,742	261			
Trauma	9 or less	1,991	138	6.149	4.258	8.881
	10 or more	122	52			

RQ5 - Race. RQ5 states is there a statistically significant difference in age of initiation of marijuana use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States. The results showed that people from other races than white had an overall positively associated, statistically significant relationship with the age of marijuana use initiation. The log-odds estimate = .261, *SE* =.042, *Wald*=38.431, *p*<.000 show that people from other races are 1.3 times more likely to use marijuana at younger ages. Having Hispanic ethnicity (estimate = .193, *SE* =.092, *Wald*=4.375, *p*<.03) was also statistically significantly related to early marijuana use at the 0.05 level.

From an individual racial category perspective, only Asians (log-odds estimate = -1.327, *SE* =.167, *Wald*=5.350, *p*<.000) show a statistically significant relationship, but it was an inverse relationship to age of marijuana use, meaning they were 3.8 times less likely to start using marijuana at younger ages. Also, people who are white has a statistically significant relationship (Estimate = -0.209, *SE* = .0090, *Wald* = 5.350, *p* <

.021), meaning those who are white were 1.23 times less likely to use marijuana. Therefore, while race/ethnicity overall is statistically significant, the results highlight the importance of looking at individual racial categories as well as race overall, since the relationships were different.

When looking at very young ages of initiation, the result, as described in Table 13, showed that the odds ratio for age of initiation less than 10 years for those who were a race other than white were 1.729 (95% CI: 1.371, 2.182). This result showed that race was a statistically significant (at the .01 level) predictive factor for marijuana use at a younger age, while race was not a positive predictive factor for marijuana use across all ages of initiation.

RQ6 - Trauma. RQ6 states is there a statistically significant difference in age of initiation of marijuana use by trauma (after controlling for race/ethnicity, age, gender, grade level, sexual identity) among high school students aged 13-19 in the United States, was conducted. The results showed an ordered log-odds (Estimate) = 0.220, SE = .008, $Wald$ = 829.912, $p < .000$. The estimated odds ratio favored a positive relationship of nearly 1.24 for every one unit increase of age of initiation for marijuana use.

When looking at the age of initiation among the very young (i.e., age of initiation less than 10 years), the result showed that trauma is a significant factor for smoking at a younger age, meaning that those with a high trauma background had 6.2 times greater likelihood of using marijuana at a younger age. This is considerably higher likelihood

than the effect of trauma overall, but both have a positive association to marijuana initiation.

Key Findings

Overall, the results showed that both race and trauma had a statistically significant effect across all three substances, as seen in Table 14 and visualized in Figure 1.

Table 14

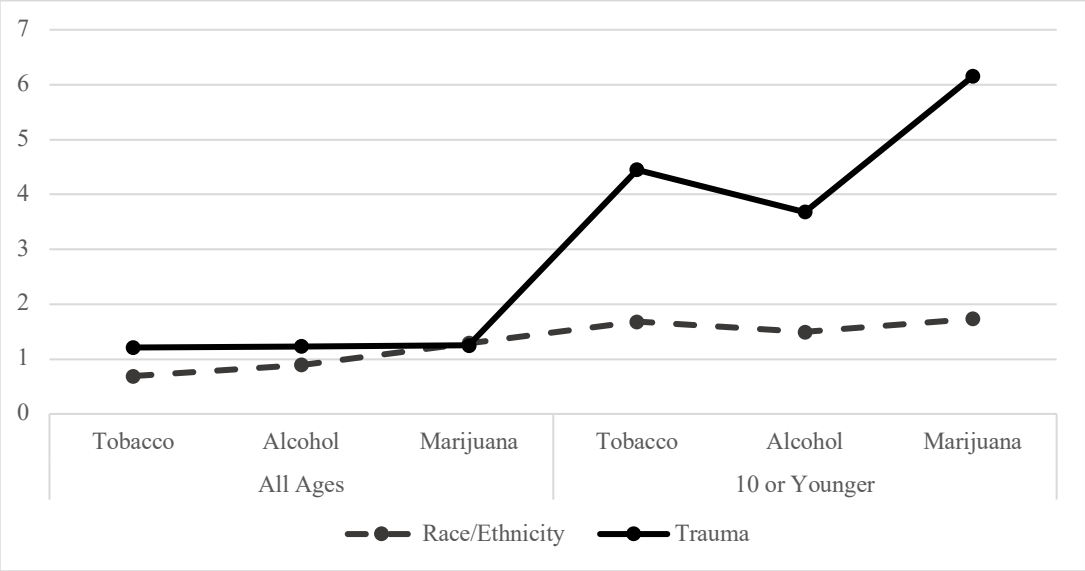
Odds ratios of for age of initiation, by predictor variable

Predictor Variable	Dependent Variable	All Ages				10 or Younger			
		OR	95% CI		Sig	OR	95% CI		Sig
Trauma	Tobacco	1.21	1.19	1.23	.00	4.45	3.13	6.33	.00
	Alcohol	1.23	1.20	1.24	.00	3.68	2.72	4.97	.00
	Marijuana	1.25	1.23	1.27	.00	6.15	4.26	8.88	.00
Race/Ethnicity*	Tobacco	0.69	0.64	0.76	.00	1.68	1.39	2.02	.00
	Alcohol	0.89	0.83	0.96	.00	1.49	1.31	1.69	.00
	Marijuana	1.29	1.20	1.41	.00	1.73	1.37	2.18	.00

*Other than white, including all races and Hispanic ethnicity

Figure 1

Odds Ratios Comparison between Race/Ethnicity and Trauma



Race/ethnicity (i.e. being part of a racial group other than white) had a statistically significant inverse relationship for cigarette smoking and alcohol use, meaning that they were less likely to start using these substances at earlier ages. This relationship was reversed when looking at age of substance use initiation at the age of 10 or younger. When looking at this relationship, race became a positively associated, statistically significant predictor of early substance use for all three substances. However, it is notable that when visualized in Figure 1, trauma has a notable role in the early age of initiation in all substance.

Based on these findings, Table 15 outlines the findings for each research question, grouped by the independent variable and the decision to reject the null hypothesis for each question.

Table 15

Research Question Results

Research Question	Null Hypothesis	
	Accept	Reject
RQ 1: Is there a statistically significant difference in age of initiation of tobacco use by race/ethnicity (after controlling for trauma exposure, age, gender, grade level, sexual identity) among high school students aged 13-19 in the United States		X
RQ 2: Is there a statistically significant difference in age of initiation of tobacco use by trauma exposure (after controlling for race, ethnicity, age, gender, grade level, sexual identity) among high school students aged 13-19 in the United States		X
RQ 3: Is there a statistically significant difference in age of initiation of alcohol use by race/ethnicity (after controlling for trauma exposure. age, grade level, sexual identity) among high school students aged 13-19 in the United States		X
RQ 4: Is there a statistically significant difference in age of initiation of alcohol use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States:		X
RQ 5: Is there a statistically significant difference in age of initiation of marijuana use by race/ethnicity (after controlling for trauma exposure, age, grade level, sexual identity) among high school students aged 13-19 in the United States		X
RQ 6: Is there a statistically significant difference in age of initiation of marijuana use by trauma exposure (after controlling for race, ethnicity, age, grade level, sexual identity) among high school students aged 13-19 in the United States		X

The null hypothesis was rejected for all six research questions, demonstrating that both race and trauma have an impact on the age of substance use initiation.

Summary

The results showed that both race and trauma have a role in influencing the age of substance use initiation. Race played a stronger role for very early age of initiation but was not consistently statistically significant across all ages. For research questions 1, 3 and 5, which focused on the relationship of race, the null hypothesis was rejected because of the relationship race has with very young age of initiation. If the analysis only looked at the age of initiation for the overall study population, the null hypothesis for RQ1 and RQ3 would have been accepted. However, race played a statistically significant role in age of initiation under the age of 11 across all substances, therefore the null hypothesis was rejected across the board. Trauma, on the other hand, was consistently a statistically significant predictor of substance use across all ages but was particularly strong predictor for very early age of initiation. Research questions 2, 4, and 6 have a rejected null hypothesis regardless of study population. The nature of the relationship between the dependent and independent variables yielded some interesting findings, which will be fully explored though the interpretation of the findings, limitations of the study, recommendations, implications, and conclusion of the analysis will be discussed in Chapter 5.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this study was to examine the strength of the association between race, trauma and the age of initiation for substance use, specifically tobacco, marijuana, alcohol, among high school students aged 13-18 in the United States. Since this research was being conducted on a protected class of people (i.e. minors), the nature of the study was a quantitative cross-sectional national survey (the YRBSS) that has sufficient sample size to ensure participant confidentially and statistical power (see Williams, 2007). Prior research has shown that experiencing trauma and being part of a racial minority group lead to increase rates of health disparities, but in this study, I sought to understand the relationship between these two factors and the age of substance use initiation (see Andersen & Blosnich, 2013; Braveman, 2014; Centers for Disease Control and Prevention, 2018b; Chen et al., 2006; Reisner et al., 2015; Slopen et al., 2016).

I found that there was a statistically significant relationship between race, trauma and the age of initiation across all substance. However, race was not a clear positive predictor of earlier substance use initiation. Instead, for cigarette smoking and alcohol, it was a statistically significant inverse relationship, meaning that white respondents had earlier age of initiation for these two substances. Hispanic students also had a statistically significant inverse relationship with cigarette smoking and alcohol, but a statistically significant positive relationship with marijuana. Trauma across all three substances was a

statistically significant positive relationship, meaning the higher one's trauma exposure, the more likely they were to use substances at a younger age.

Further analysis looked at the relationship between trauma and race for those who began using substances at the age of 10 or younger. Early age of initiation had a much stronger positive association across all substance for both race and trauma. This means that those who begin using substances at the age of 10 or younger are more likely to be part of a racial minority and are much more likely to have experienced trauma, which aligns with the general strain theoretical framework. The strength of the relationship between race, trauma and age of initiation is much stronger, indicating that these two factors are significant predictors of early age of initiation.

Interpretation of the Findings

The critical aspect of this study was to determine if race and trauma play a key role in the early age of initiation. From Chapter 2, several researchers showed that earlier substance use lead to increased likelihood of adult substance use, addiction issues, morbidity and mortality (United States Department of Health and Human Services, 2016a; Jensen et al., 2017). Further, with this study, I aimed to help address the gap in knowledge regarding the relationship between race, trauma, and age of initiation, but this is often challenging as these factors are often connected and thus getting a clear causal path is challenging.

From a racial perspective, there have been several researchers who conducted studies that linked earlier substance use to those belonging to different racial groups.

Among Hispanic youth, prior research showed that there was a increased likelihood of early age of initiation for substance (Fite et al., 2015; Strunin et al., 2017; Vazquez et al., 2019). The results from this study mostly confirms this finding, particularly that Hispanic youth were more likely to use alcohol and marijuana at younger ages, but not for cigarette smoking. Current literature showed that Native American youth had higher rates of substance use and earlier age of initiation (Stanley & Swaim, 2015). This finding was not confirmed by this study. Native Americans did not have a statistically significant across any of the substances. There may not have been enough respondents, as the total sample size for American Indian/Alaska Native (AIAN) was 0.9% of the overall survey respondents. The total AIAN population at the last census was 1.7% of the total U.S. population , which is almost twice the proportion represented in the survey (United States Census, 2012). One area of note is that race was not a positive predictor for cigarette smoking across all ages but was for early age of initiation. Researchers are showing that e-cigarettes are changing youth tobacco behaviors, which may have influenced this finding (Sharapova et al., 2018). More youth may be vaping and obtaining tobacco through other means than cigarette smoking, which would affect the outcome of this study.

In this study, I looked at race in aggregate, which prior studies from researchers indicated that there was a connection with early age of initiation, particularly with marijuana use. (Chen et al., 2017; Sutfin et al., 2015). Race has a statistically significant relationship when looking at very early age of initiation (age of 10 or younger) for all

substance, but there was only a positive statistically significant relationship with marijuana across all ages of initiation. This supports the finding that race is a factor in very early age of initiation, but not as critical in those who start at older ages.

From a trauma perspective, exposure to violence, abuse, sexual assault, and other forms of trauma during childhood increases the likelihood of substance use (Farri et al., 2014; Werner et al., 2016). This finding was confirmed, as across all three substances trauma had a statistically significant impact on the age of initiation. What was most notable from this study was that trauma played a major role in the initiation of substance before the age of 10. There is some evidence in current literature that trauma led to early substance use, but the size of the effect observed in this study is notable (see Dube et al., 2006; Kingston & Raghavan, 2009). This study found that youth experiencing trauma were 4.5 times as likely to use tobacco, 3.7 times as likely to use alcohol, and 6.15 times as likely to start using marijuana before the age of 10. This finding aligns with the theoretical framework for this study, as the presence of stress and strain clearly influence delinquency or in this case, substance use (see Agnew, 1992).

Limitations of the Study

There were several limitations to this study. First, while the selected survey contained sufficient data for a representative sample size and sufficient statistical power, the cell size for the selected variable accounted for a small proportion of the overall dataset. For example, out of 14,765 respondents, only 52 scored more than 10 on the trauma scale and began using substance at a young age. This number of respondents still

had enough statistical power for analysis (as it was tested with G*Power) but represented only 0.35% of the entire sample. Next, since this dataset was nationally available, several key demographic features that may have influenced the outcome were not available. These demographics include parental income (i.e. student socioeconomic status) and geographical feature (i.e. zip code, urban or rural area, etc.). As mentioned previously in Chapter 1, not all states were included in the sample, which could also affect the generalizability of the data. Next, the data analysis focused on race, ethnicity, and trauma. The trauma score was an additive measure and were the not the same questions as the 10 adverse childhood experiences (Felitti et al., 1998; Centers for Disease Control and Prevention, 2018a). Having trauma questions that were the same as those asked to assess adverse childhood experience would have allowed for greater comparability of the results to other similar studies. Finally, the data from the YRBSS is self-reported, which relies on the truthfulness of the respondents to share substance use behaviors, thus may be open to underreporting of such behaviors (Centers for Disease Control and Prevention, 2018a). Further study is needed to be able to confirm the findings of this study.

Recommendations

Based on the findings of this study, it is recommended that more research be conducting on how trauma impacts that age of initiation for youth. The results from this study showed that the higher the trauma exposure, the more likely youth were to use substance at younger ages. There is a need for additional research that seeks to understand what types of trauma, when during childhood does the trauma occur, and at

what number of traumatic events led to earlier substance use initiation. Current evidence leads me to believe that this association is likely, but there is more research needed to delve into the details of this association.

Implications

This study, particularly the finding of the strength of the association between trauma and very early age of substance use initiation, had significant social change implications. Most substance use prevention strategies begin at the age of 12, but this research clearly points out that by age 12, many youths who need support have already started using substance. There is an opportunity for positive social change, as this research showed a key demographic that is currently being missed for substance use education. It is necessary to reach youth at much younger ages to have meaningful substance use prevention efforts. This may mean having more early childhood education program where youth who have trauma exposures can have access to age-appropriate interventions. Further, this means that public health practitioners need to broaden the understanding of what substance use prevention interventions look like. It is clear that building a youth's protective factors helps to prevent or delay substance use initiation (Lipari, Williams, Copello, & Pemberton, 2015). These efforts need to be done at a much younger age that is currently being funded (Substance Abuse and Mental Health Service Administration, 2019). It is incumbent upon all public health practitioners, once the knowledge of the role trauma has on young children, to lead the positive social change and actively work to do something to address it.

Conclusion

In conclusion, the result of this study found that race and trauma both play a significant role in the age of initiation of substance use. While race does not always play a strong role in early age of initiation, but it does play a role in very early age of initiation. Further, trauma across all substance and age categories plays a statistically significant role. By conducting this study, I provided a bit more information to help elucidate the causal pathway between race, trauma, and the age of initiation. The next step is to determine the best course of action to begin to address the impact of trauma in childhood. It is clear that there needs to be a strong emphasis on reaching children at younger ages and if possible, preventing traumatic experiences. This isn't something that is going to be a quick or easy fix, but it is a social and moral imperative that public health interventions address trauma at a much earlier age, to help prevent young children from using substance.

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