EXAMINING ONSET AND RISK FACTORS FOR ALCOHOL USE IN AFRICAN AMERICAN AND CAUCASIAN MIDDLE SCHOOL STUDENTS: A SURVIVAL ANALYSIS

By

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A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Human Development and Family Studies - Doctor of Philosophy

2015

ABSTRACT

EXAMINING ONSET AND RISK FACTORS FOR ALCOHOL USE IN AFRICAN AMERICAN AND CAUCASIAN MIDDLE SCHOOL STUDENTS: A SURVIVAL ANALYSIS

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The early onset of alcohol use in adolescence is a marker of sustained problem use in adolescence, as well as elevated risk for later alcohol use disorders (AUD) in adulthood. However, it is not yet clear which set of multi-causal factors actually predicts early onset drinking. Preventing the consequences of first drink onset, in part, is dependent on what factors predict onset and for whom. The current study sought to discern and expand the knowledge of causal factors for early onset drinking among early to middle adolescents and to identify which predictors seem most important at each age/grade level.

A total of 663 students, beginning in the sixth grade, were administered the Coordinated Community Student Survey over a three-year period. Bronfenbrenner's bioecological model was used as a conceptual framework for understanding the proximal and distal interactions of parent, peer, school, community, depression, and anxiety, and their linkages to alcohol use onset. A survival analysis was used to determine age at onset of first drink and to assess specific predictors of first drink. Though the methodology of the survival analysis has not been widely used in previous social science research, its usefulness in addressing important and pressing questions is becoming apparent.

Using a discrete-time survival analysis for each predictor variable, this study found that lack of parental emotional support, involvement, supervision, teacher support, and depression predict first drink onset. When the discrete-time full model was run, teacher support was found to be the

most significant in predicting first drink onset. As expected, first drink onset occurred at age 11 years. A significant developmental finding of the hazard and survival functions was that the transition from eighth grade to ninth grade, is a risky time for middle school students with respect to first drink onset. The results of the current study provide an enhanced understanding of the antecedents of alcohol onset as potentially important moderators of the etiologic pathway. Moreover, by validating predictors of first drink onset, this study contributes to the critical development of targeted interventions that have the potential to delay first drink onset.

This work is dedicated, with love.
To my husband, Jonathan Harper.
And to my mom, Rene Arthur.

ACKNOWLEDMENTS

First and foremost, I would like to acknowledge and thank God for giving me the strength and determination to complete my Ph.D. You have blessed me beyond measure with your grace and love, a supportive family, wonderful friends, and the personal gifts that have enabled me to experience success in my academic career. May this dissertation and all that I do bring glory to your name.

I consider it an honor to have worked with such an amazing doctoral guidance committee. I want to thank my dissertation chair, Dr. Hiram Fitzgerald, for the professional mentoring that you provided, and which helped to shape my identity as a scholar. Thank you for your encouragement and the ways you have challenged me in my development as an academician. Truly, without your support, I wouldn't be where I am today. I would also like to thank my committee members, Dr. Marsha Carolan, Dr. Francisco Villarruel, Dr. Deborah Johnson, and Dr. Barnes-Najor. Dr. Carolan, you have positively influenced my development as a scholar from the very beginning. In many ways I am grateful for all of the support you have given me. Dr. Villarruel, thank you for your willingness to be my co-chair in a less than ideal situation and when it was a significant time restraint for you. Dr. Johnson, I have looked up to you and Dr. Carolan as two very strong and successful female scholars. Dr. Barnes-Najor, I want to specifically thank you for your unwavering support in helping me understand the process and presentation of research. Your kindness and patience were abundant. I want to thank each of you for providing me with not only feedback that strengthened my dissertation, but also with inspiration.

This dissertation would not have been possible without the consultation I received from Dr. KyungSook Lee. I appreciate the support and kindness you gave me from the time we sat down

to talk about my research until the final defense. I know that you invested time and energy in this project when you did not have any to spare.

I would not be here today if it was not for the love and support of my husband, Jon Harper, and my mom, Rene Arthur. Jon, I cannot even begin to express my gratitude for everything that you have done for me during my time in graduate school, while I was working on my dissertation, and especially in the move to do, ultimately, what I love. Through all the ups and downs you have loved me unconditionally and have stayed by my side as a calm and steady force. You are an amazing partner in life and I love you very much. Mom, it is truly a gift from God and a tremendous privilege to be your daughter. You have showed me love and support in every phone call, whether it be in panic or in delight. You were as invested as I, at every step of the way.

I am blessed to be supported by other family members as well. Thanks to my brother, Scott and my sister Kathy, for making me laugh when I wanted to cry, and for keeping it light when I was burdened and overwhelmed. I continue to cherish my relationship with each of you. I also want to acknowledge my husband's family for all your love and support. I am thankful for all the ways you have welcomed me into your family as your daughter and sister.

I am indebted to my friends who have walked this journey with me. Michelle, your unending prayers, support, and love has been such a blessing to me. Sarah, I love you like a sister. Heather, our talks have meant more than you know. Lori, Arva, and Joanne, you have been my bible study buddies since the very beginning of my program and your prayers were coveted. Mindy, we have lived parallel lives. We have been through so much together that no one else will ever experience or understand. I thank God for each and every one of you.

I also want to thank Michigan State University for being my academic home for the past five years. I will never forget my time here. Thanks especially to the Department of Human

Development and Family Studies, the College of Social Science, and the Graduate School for the financial support you provided for my dissertation and throughout my graduate program.

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Chapter 1: Introduction

Onset of Alcohol Use

Research has long documented that substance use at a young age, particularly alcohol use, has lasting implications for development. Although prevention programs have contributed to a 22-year decline in the prevalence of adolescent drinking, nearly 30 percent of adolescents continue to abuse alcohol (Chen, Yi, & Faden, 2015). In the United States, the National Survey on Drug Use and Health estimated that there are currently 42 million alcohol users between the ages of 10 and 19 (SAMHSA, 2013). Thus, while the prevalence of adolescent drinking has declined, the overall population growth in the United States reflects an increase in the absolute number of adolescents who consume alcohol, which results in negative consequences for the adolescents, their families, and their communities.

Evidence has shown that alcohol use before the age of 15 is a strong predictor of later substance dependence, which in turn, is linked to a variety of maladaptive outcomes in adulthood. These outcomes include unemployment, poor academic success, difficulties in reaching full social competence, increased likelihood of psychiatric disorders, and violent crime (Brook, Brook, Zhang, Cohen, & Whiteman, 2002). In addition to being confronted with exposure to and consumption of alcohol, adolescents are concurrently engaged in developing personal, social, and academic competencies that are critical to becoming successful adults. The influence of early risk and protective factors on normative developmental tasks of adolescence can be direct or indirect, but in either case, significant evidence indicates that such risk factors can accrue and cascade, driving adolescents onto negative developmental pathways (Dodge, Malone, Lansford, Miller, & Pettit, 2009; Matsen, 2006). With respect to alcohol use, Chassin, Pillow, Curran, Molina, and Barrera (1993) found that childhood risk factors can have unique

effects on adult substance use disorders, but that adolescent risk for alcohol use disorders is not immutable if significant interventions occur.

The age at first drink is not causally associated with alcoholism, but rather manifests a wide range of previously occurring indicators of disinhibited behavior and psychopathology. Risky characteristics and risky environments from infancy onward funnel the individual onto a pathway of risk aggregation and cumulative disadvantage. This often leads to a greater likelihood for early onset of alcohol and other drug use, delinquency, and depression during adolescence as well as substance abuse and other psychopathology throughout the adult years (Fitzgerald, Puttler, Refior & Zucker, 2007; Fitzgerald, Wong & Zucker, 2013; Mayzer, Fitzgerald, & Zucker, 2009).

Evidence corroborating this earlier risk theory has led some investigators to assert that delaying the age at which young people first drink alcohol may reduce the later incidence of alcohol abuse and alcoholism. The delayed onset assertion is predicated on literature demonstrating that heightened risk for alcohol problems and later alcohol use disorder (AUD) are associated with having had an early first drinking experience (Mayzer et al., 2009). Most research indicates the risk of AUD appears to increase from age 12 to 21 years (Guo, Hill, Hawkins, Catalano, & Abbott, 2002) with onset of first drink averaging around 12 years of age (SAMHSA, 2012). While there is consensus that early onset of alcohol use frequently leads to heightened risk for later alcohol use problems, there is little agreement on the factors that predict early onset use of alcohol. Therefore, it is worth exploring and validating the predictive factors related to early onset alcohol use, because identifying predictors of first drink may simulate intervention design delaying onset.

Rationale for the Study

Many developmental connections have been observed in the risk factors that predict the likelihood of problem alcohol use in adolescents. What is not clear in the literature are which set of multi-causal factors contribute to early onset drinking itself. Therefore, efforts to understand and address underage drinking can benefit from a developmental perspective as a means for preventing and treating the causes and consequences of behavioral problems predictive of early onset alcohol use. Many influences and interactions involving any complex gene-environment interplay that shapes the course of human development affects the development and consequences of underage alcohol use (Matsen, 2009).

The study of alcoholism etiology reinforces the ecological or systems perspective; one that takes into account the individual, familial, and ecological contexts within which individuals and families reside (Fitzgerald, Zucker & Yang, 1995). Examining individual influences and the interaction between different contexts such as those involving family, peers, and community can provide a comprehensive understanding of the dynamics that contribute to adolescent alcohol use (Shekhtmeyster, Sharkey, & You, 2011; Ennet, Bauman, Faris, Hipp, & DuRant, 2008; Elkington, Bauermeister, & Zimmerman, 2011; Moon, Patton, & Rao, 2010). For example, Bry, McKeon, and Pandina (1982) examined six etiological variables (i.e., grades, affiliation with a religion, age at first drink, psychological distress, self-esteem, and perception of parental love) in 24 combinations. Adolescents who exhibited at least four risk factors proved to be four and a half times more likely to report substance use.

Developmental risk research initially focused on identifying specific causal factors known or suspected to increase the probability of adverse child outcomes. However, the causal outcome approach failed to produce significant preventive interventions because it did not reflect the

systemic context of emergent psychopathology. Thus, the widespread use of multiple risk factor metrics in research today reflects the robust finding that multiple relative to single risk exposures are more predictive of long-term developmental consequences (Rutter, 1979, 1981; Sameroff, 2006; Sameroff, Seifer, & McDonough, 2004). Sameroff et al. (1987) argue that the number of risk factors present is a better predictor of developmental outcomes than the particular type of risk that is involved. For these reasons, the current study drew on predictors from individual, family, peer, neighborhood, and school contexts to investigate the onset of alcohol use in adolescents.

Predictor Variables

A number of support factors have been found to predict the initiation of alcohol use, such as those that arise in family or peer contexts. Family factors including low parental supervision and monitoring have been well-documented as predictor variables in onset and ongoing alcohol use in adolescents (Fitzgerald et al., 2007; Moon et al., 2010). Adolescence is a time when peer influences emerge as significant challenges or complements to family influences on child behavior. Peer factors such as a lack of reciprocal peer closeness and/or the lack of friendships at school are documented predictors of adolescent drinking. Research has demonstrated that potential moderating effects are often at play. Weak familial bonds, as indicated by measures of support and supervision, have been shown to predict associations with substance using peers and subsequent adolescent alcohol use (Simons-Morton & Chen, 2005). Ennett et al. (2008) found that family factors can amplify negative peer modeling both through family stress and through family alcohol use. Conversely, Brook et al. (2002) found that positive family environments, as indicated by both closeness and supervision, mitigate negative peer effects.

Outside of the immediate family, the school setting has been identified as the most consistent institution in the lives of children and adolescents. Studies indicate that a lack of success in peer relationships during elementary school, resulting from poor social skills and peer rejection, is a strong marker of a variety of deviant outcomes among adolescents including the use of alcohol and other drugs (Dodge et al., 2009). Research has found middle school aged students who report troubled relationships with school personnel are also more likely to use tobacco, alcohol, and marijuana (Ennett et al., 2008; Dorius, Bahr, Hoffman, & Lovelady, 2004). Conversely, factors such as teacher support, commitment to school, and student interest in school activities are protective factors that make adolescent alcohol use less likely (Moon et al., 2010).

In addition to school influences, children and adolescents who are exposed to violent neighborhood events are more likely to experience negative effects on their mental health and psychological development (Wallen & Rubin, 1997). Moreover, such effects are evident as early as the preschool years (Fitzgerald, McKelvey, Schiffman, & Montanez, 2006). Neighborhood effects have been linked to a number of negative outcomes among youth. Nebbit, Lombe, Yu, Vaughn, and Stokes (2012) found that adolescents who witnessed and/or were victimized by community violence were more likely to report alcohol use.

Neighborhood safety as a predictor variable may also explain racial differences in adolescent onset of alcohol use. It is well established that crime and violence tend to be concentrated in disadvantaged urban areas. Stark socioeconomic inequalities across neighborhoods and associated patterns of racial segregation can deprive communities of resources essential to the development of children and adolescents (Jencks & Mayer, 1990). Kurlychek, Krohn, Dong, Hall, and Lizotte (2012) propose a new construct, collective efficacy, as an important consideration when examining adolescent risk. Collective efficacy develops when residents have

a sense of belonging and willingness to take action to combat crime in their community. Their findings suggest that high levels of collective efficacy were negatively associated with youth problem behavior in the neighborhood (Kurlycheck et al., 2012). That is, when there was a high degree of collective efficacy within the neighborhood community, youth were less likely to act out. In sum, the literature clearly indicates that factors which predict early onset of first drink are most likely to be found among a composite set of variables derived from family, peer, school, and neighborhood contexts.

Because alcoholism is a psychiatric diagnosis, traditional research on alcohol use has focused on its relationship with mental health problems. Research indicates that anxiety and depression are strong comorbid correlates of alcohol use disorders. In addition, evidence supports an additive risk model; the greater the number of depressive symptoms present, the higher the probability of alcohol use in adults and adolescents (Kelder et al., 2001).

While the relationship between anxiety, depression, and substance use have been widely investigated, the results vary across such dimensions as race and ethnicity. There are many possible explanations for these variations. For example, African American adolescents growing up in the United States face significant challenges that are more taxing, on average, than those faced by Caucasian adolescents. Vega and Gill (1998) found that the average number of self-reported risk factors differs significantly, with African American youth reporting the greatest number and Caucasian youth the smallest. African American youth also face levels of discrimination that exceed those reported by adolescents from any other minority group, and this stress likely takes a toll on their developmental outcomes (Gibbons, Gerrard, Cleveland, Wills, & Brody, 2012). Mandara, Richards, Gaylord-Harden, and Ragsdale (2009) found that the effects of discrimination on depressive and anxiety symptoms increased when African American youth

transitioned from seventh to eighth grade, and that depressive symptoms were more prevalent than anxiety. It seems reasonable therefore, that individual-level affective problems such as depression and anxiety may also contribute to the onset of first drink in African American youth.

The secondary data set that was examined in the current study provided a significant number of African American youth to adequately assess relevant predictive factors for both African American and Caucasian adolescents. There were inadequate sample numbers however, to address questions of early onset among Latino-Americans, Native Americans, or any other racial/ethnic group.

Racial variation. Very young children reared in alcoholic families are surrounded by many risk factors for developmental or behavioral problems, most of which derive from one or more of the following domains: child characteristics, parental characteristics, family characteristics, parent-child relationships, and the quality of the home and neighborhood environments (Fitzgerald et al., 1995; Fitzgerald & Eiden, 2007). Additionally, research focused on adolescent alcohol use has identified multiple risk pathways including unique pathways among African American and Caucasian adolescents (Dodge et al., 2009). Research suggests that Caucasian youth are more likely to use alcohol earlier and show continuity of alcohol use in the year after drinking onset than are African American youth. Moreover, the onset and current alcohol use rates are higher for Caucasian adolescents than they are for African American adolescents at every grade level surveyed in the Monitoring the Future (MTF) national sample (Johnston et al., 2011).

Little is known however, about racial variations in factors predicting early onset of drinking, or of differences in year-to-year continuity of alcohol use during adolescence (Chung, Kim, Hipwell, & Stepp, 2013). African American adolescents growing up in the United States face

significant challenges that are more taxing, on average, than those faced by Caucasian American adolescents (Gibbons et al., 2004). The lower alcohol use rate among African American youth is therefore perplexing given the overwhelming research suggesting that African American youth are exposed to more risk factors than are Caucasian youth.

Nevertheless, 20 years ago, Newcomb's comprehensive review (1995) pointed to the sparse and inconsistent findings on intragroup and intergroup variability in risk factors for drug use among African American and Caucasian youth. Gil, Vega, and Turner (2002) added that studies on racial differences in alcohol use involve an inadequate range of risk factors, fail to account for the differential importance of risk factors at different developmental stages, and include a limited number of longitudinal studies on ethnically diverse samples. The current study addressed two of these criticisms; inadequate risk factors and a focus on cross-sectional approaches as it examined early onset of alcohol use in a sample of sixth, seventh, and eighth grade African American and Caucasian students over a three-year period. Single and multiple predictor variables were assessed apropos of their predictive relationship to drinking onset within and between racial groups of emerging adolescents.

Gender differences. Disquieting rates of alcohol use among young adolescent girls call for original research on gender-specific risk factors for alcohol use (Fitzgerald, Zucker, Puttler, Caplan, & Mun, 2000; Schinke, Fang, & Cole, 2008). Historically, most national surveys have reported boys initiating and continuing alcohol use more than girls, but current surveys indicate prevalence rates for girls are approaching those of boys. The National Survey on Drug Use and Health (SAMHSA, 2012) found that eighth grade girls actually were more likely than boys to be current alcohol users (10.3% versus 7.6%). The Monitoring the Future (MTF) survey (Johnston et al., 2011) and the Youth Risk Behavior Survey (Centers for Disease Control and Prevention,

2010) both show alcohol use rates do not differ significantly between eighth grade females and males. As students enter the twelfth grade however, the results of these three national surveys show males using alcohol more often than females. Whether or not these self-report surveys provide accurate early evidence of actual gender-neutral alcohol use that then trail off in emergent adulthood is unknown. What is clear is that among emergent adolescents, girls are reporting rates of alcohol use equal to that of boys, but boys catch up and report more alcohol use in later adolescence.

Studies other than those using self-report measures do find that girls are more likely than boys to smoke, drink, and/or use drugs when they are overly concerned with peer approval during puberty and are vulnerable to depression—a risk factor for substance use and abuse (Silberg, Rutter, D'Onofrio, & Eaves, 2008). Low parental monitoring and concern and an unstructured home environment are also strongly correlated with substance use among girls. That is, a parent's failure to monitor their daughter's activities can put her at risk (Li, Feigelman, & Stanton, 2000). For boys, earlier onset of alcohol use is correlated with less parental encouragement of independence and individuality at 4 years old, and with less individuation and self-confidence at age 9 years (Baumrind, 1985). Conversely, strong family bonds are associated with lower rates of substance use for all youths. The current study examined gender differences in onset of alcohol use to track differential rates of onset age during the transition from childhood to adolescence.

Statement of the Problem

Early onset of drinking is an established factor for later risk behaviors related to alcohol use. However, it is not yet clear which set of multi-causal factors actually predict early onset drinking. Preventing the consequences of early onset drinking is, in part, dependent on what

factors predict onset and for whom. Not all children exposed to parental alcoholism or various forms of parental conflict or psychopathology wind up engaging in early onset or drinking at all.

Validating predictors of first drink onset is critical to the eventual development of targeted interventions that have the potential to delay onset. This study therefore aimed to discern and expand the knowledge of causal factors of early onset drinking among early to middle adolescence. This study also sought to identify which predictors seem most important at each age/grade level and which contribute to individual differences in first drink and potential risk for alcohol abuse. Finally, this study examined gender differences in onset of alcohol use to track differential rates of onset age during the transition from childhood to adolescence.

Research Questions

The goal of the current study was to identify the risk variables that predict adolescent alcohol use onset among a sample population of sixth, seventh, and eighth grade students who were tracked over a three-year period. The following research questions and correlating hypotheses were examined:

1. At what age does onset of first drink occur in this sample?
2. Do boys begin drinking earlier than girls?
3. Does onset of first drink occur earlier in Caucasian adolescents or African American adolescents?
4. Considering race and gender, who is more at risk for earlier onset of drinking?
5. What risk variables predict onset of first drink in a population based sample of middle school age children?

A survival analysis was used to determine when individuals drop out of the "no onset" category. It was anticipated that this analysis would contribute to a deeper understanding of

factors related to first drink onset. In addition, sample characteristics and power analysis provided opportunities to assess occurrences of first drink onset for males and females, and for African American and Caucasian youths. Because early onset of alcohol and other drug use in adolescence is a marker of sustained problem use in adolescence, as well as elevated risk for later alcohol use disorders (AUD) in adulthood, the results of the current study may provide an enhanced understanding of the antecedents of alcohol use onset as potentially important moderators of the etiologic pathway (Mayzer et al., 2009).

Chapter 2: Literature Review

Many influences and interactions involving complex gene-environment interplay shape the course of human development (Matsen, 2006). Risk factors can be understood as having a cumulative effect on child development (Sameroff, Seifer, Baracos, Zax, & Greenspan, 1987), such that as the number of risks increase, the effects on the child become more pronounced. Moreover, the number of risk factors present have been found to be a better predictor of developmental outcomes than the kind of risk factors involved (Sameroff et al., 1987). It is worth noting however, that studies of toxic risk suggest rearing environments with low family resources, poor neighborhoods and schools, and exposure to parental strife and psychopathology account for significant variance in the predictors of poor developmental outcomes (Shonkoff & Phillips, 2000).

From a systemic perspective, risk factors interact in combination in ways that produce effects that the same risk factors alone do not produce. The critical risk factors often measured in the adolescent literature on alcohol use include but are not limited to those associated with parents, peer and school support; neighborhood, and emotional health (Chilenski & Greenberg, 2009; Dodge et al., 2009; Elkington et al., 2011; Moon et al., 2010; Nebbit et al., 2012; Shekhtmeyster et al., 2011). Thus, from a systems or ecological perspective, full models of causal processes are needed to examine predictors affecting alcohol use onset.

Theoretical Context

Systems models, such as the bioecological framework suggested by Bronfenbrenner (1979, 1989), share three key assumptions. First, in open systems, individuals and their environments are continually interacting and exerting mutual influence, and as a result, are constantly changing. Second, individuals are active participants in their development, not merely acted

upon by the environment. That is, they are also exerting influence on the environment. Third, transactions between individuals and their environments are reciprocal with change occurring within and across levels, and are influenced by variables that are both proximal and distal to the individual.

Bronfenbrenner's earlier theorizing emphasized four systemic levels starting with those most proximal to the individual and progressing to those that are increasingly distal. He later reframed his theory on human development as a bioecological model to include a greater emphasis on the role that person variables play in structuring person-environment transactions (Bronfenbrenner & Morris, 1998), and increasingly, with an emphasis on proximal processes as the key factors in development (Bronfenbrenner, 1994, 1995, 1999; Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 1998). It was also from this time onward that he discussed the Process-Person-Context-Time (PPCT) approach that has become the essence of the bioecological model; specifically, particular forms of interaction between person and environment.

The power of such processes influences development as a function of the characteristics of the developing person, in the immediate and more remote environmental contexts and time periods, in which proximal processes take place (Cairns & Cairns, 1994). The bioecological model addresses two closely related but fundamentally different developmental processes, each taking place over time. The first process defines the phenomenon under investigation; continuity and change in the biopsychological characteristics of human beings (Bronfenbrenner & Morris, 2006) The second focuses on the development of the scientific tools, theoretical models, and corresponding research designs required for assessing continuity and change (Bronfenbrenner & Morris, 2006).

Three types of biopsychological person characteristics are distinguished as the most influential in shaping development through their capacity to affect the direction and power of proximal processes (Cairns & Cairns, 1994). First, dispositions can set proximal processes in motion within a particular developmental domain and sustain their operation. For example, depression can create a context that enhances the expectation that alcohol may provide relief from depressive symptoms. Second, bioecological resources of ability, experience, knowledge, and skill are required for effective functioning of proximal processes. For example, being reared in a conflict-ridden family may prevent positive social competence from developing sufficiently enough to ward off negative proximal influences from peers and others engaging in drinking. Finally, demand characteristics invite or discourage reactions from the social environment that either foster or disrupt the operation of proximal processes. For example, normative transitional changes during adolescence to stronger peer influences can become intertwined with peer demands to engage in drinking and other antisocial behaviors.

The microsystem of the adolescent consists of familiar and often intimate social networks of interpersonal relationships involving direct face-to-face interactions, referred to as proximal processes (Muuss, 1996). The biggest change in Bronfenbrenner's revised bioecological model compared with his first version, is that the micro level now includes proximal processes and person factors as they are situated within context. That is, person characteristics such as dispositions, temperament, and knowledge and skill required for the effective functioning of proximal processes are considered in the revised bioecological model. Person characteristics that invite or discourage reactions from the social environment can foster or disrupt the operation of proximal processes. In addition to the support from interpersonal relationships with family,

peers, and teachers as factors that contribute to the delay of alcohol use onset, is the impact that anxiety and/or depression may have.

The mesosystem refers to the connections between contexts. Some common examples are the connection between family experiences and school experiences, school experiences and church experiences, and family experiences and peer experiences. For example, children whose parents have rejected them may have difficulty developing positive relations with their friends or peers, or they may be drawn to peers who have similar family experiences that provide set points for engaging in negative social behaviors. Therefore, the mesosystem comprises the linkages and processes taking place between family, peers, and institutional settings (Bronfenbrenner, 2005). Examining individual factors in combination with the interaction between different contexts that exist in relation to family, peers, and community can provide a more complete understanding of the factors that contribute to adolescent alcohol use and alcohol use onset (Shekhtmeyster et al., 2011; Ennet et al., 2008; Elkington et al., 2011; Moon et al., 2010).

The exosystem is the larger community system within which the adolescent lives. Although the adolescent does not directly participate in exosystem decision making, the decisions do have a direct and indirect influence in his/her life. The three most significant developmental exosystem influences emanate from the relationship between one or both of the parents and the workplace, the parents' circle of friends, and the effect of neighborhood/community resources on family functions (Muuss, 1996).

It is necessary to consider community effects on adolescent alcohol use by examining how individual perceptions of the community context have influenced individual outcomes (Chilenski & Greenberg, 2009). As indicated earlier, neighborhood disorder, including violence, has been linked to increased substance use by adolescents (Nebbit et al., 2012). Understanding factors

that predict early onset drinking, and its potential to structure pathways of addictive behavior with lasting detrimental effects on individuals, families, and society, requires research that explores variables drawn from multiple levels (Fitzgerald, Zucker, & Yang, 1995) as delineated by systemic models such as the bioecological approach developed by Bronfenbrenner and his colleagues.

Risk factors can be understood as having a cumulative effect on child development (Sameroff, Seifer, Baracos, Zax, & Greenspan, 1987), such that as the number of risks increase, the effects on children become more pronounced. Some researchers have also proposed that various risk factors interact with each other, and may have effects in combination that they would not have in isolation. This study examined risk factors from multiple intersecting social contexts, in which adolescents' lives are embedded. Bronfenbrenner's human ecological model was used to provide a conceptual framework for understanding the proximal and distal interactions of family, peer, school, community, depression and anxiety, and their linkages to alcohol use onset. Thus, these predictor variables were examined in this study (see Appendix B).

Adolescent Alcohol Use: Predictors of Early Onset Drinking

There is strong evidence to support the conclusion that early onset drinking in the United States occurs at least by age 12 years (Masten, Faden, Zucker, & Spear, 2009). Various national surveys confirm that alcohol is the drug of choice among American adolescents of all ages compared to tobacco and marijuana (Matsen et al., 2009). An extant review of literature on onset of alcohol use shows that the that younger individuals are when they first begin drinking, the greater their level of problems associated with alcohol misuse (Hawkins et al., 1997). Evidence for this conclusion derives from two major sources, national databases that survey adolescents at least annually to gain information across a broad range of behaviors, and cross-

sectional and longitudinal studies specifically designed to ascertain factors that predict early onset drinking and the long-term consequences of early onset of alcohol use.

Early onset evidence from national surveys. Extensive use of national databases to measure the onset of adolescent substance use is convenient, particularly when considering multiple factors. The National Institute on Alcohol Abuse and Alcoholism conducted a surveillance report that compiled data on adolescent substance use from three nationally representative surveys (SAMHSA, 2012). The National Survey on Drug Use and Health (NSDUH) is a survey involving household interviews with approximately 70,000 randomly selected individuals ages 12 years and older. The other two surveys are school-based; the Monitoring the Future (MTF), which surveys students in eighth, tenth, and twelfth grades, and the Youth Risk Behavior Survey (YRBS), which surveys students in ninth through twelfth grade.

Results for NSDUH, YRBS, and MTF have been combined to provide an overview of 22 years (1991-2013) of adolescent self-report descriptions with respect to a wide variety of behaviors including those that involving drinking (Chen et al., 2015). The median age of initiation of drinking alcohol has increased from 13.65 years (in a 1991 to 1993 sample) to 14.47 years (in a 2011 to 2013 sample; NSDUH). In addition, there has been a gradual decline in the proportion of youth reporting initiation of drinking at age 12 years or younger (NSDUH, YRBS). All three surveys clearly show a decline in drinking during the past 30 days (prior to taking survey) in every age group from 12 to 20 years.

Despite the declines in overall alcohol use among adolescents over the 22-year period, the data show that 30 percent of youth continue to drink. In 2013, NSDUH reported there were 4.6 million persons ages 12 years or older who had used alcohol for the first time within the past 12

months; this averages to approximately 12,500 initiates per day. In 2013, YRBS reported 18.2 percent of youths drank alcohol before the age of 13 years.

In 2014, MTF reported the proportions of eighth, tenth, and twelfth graders who reported drinking an alcoholic beverage in the 30-day period prior to the survey as 9 percent, 24 percent, and 37 percent, respectively. Likewise, the 2013 YRBS reported that 34.9 percent of youth in ninth through twelfth grades combined, used alcohol in the previous 30 days. Also in 2013, NDHUS rates of current alcohol use were reported as 2.1 percent among 12 and 13-year-olds, 9.5 percent for 14 and 15-year-olds, and 22.7 percent for 16 and 17-year-olds. For lifetime alcohol use rates, the NSDUH reported 30.8 percent of 12 to17-year-olds, the MTF reported 40 percent for eighth, tenth, and twelfth graders, and the YRBS reported 66.7 percent for youth in ninth through twelfth grades combined. While the median age of onset has clearly changed, the relationship between onset of drinking and risk for subsequent alcohol use disorders nonetheless persists.

Early onset evidence from cross-sectional and longitudinal studies. Although national databases often have larger sample sizes, which improves estimates of alcohol use, they do not provide evidence of factors that predict use or non-use of alcohol. Conversely, cross-sectional and longitudinal studies offer opportunities to gain an understanding of predictive factors linked to adolescent alcohol use. Many of the predictive factors of later alcohol misuse are also likely predictors of an earlier age of initiation of alcohol use.

From a developmental perspective, alcohol abuse is conceptualized as a lifespan problem with roots reaching into infancy and the preschool years (Fitzgerald, Davies, & Zucker, 1994; Fitzgerald & Eiden, 2007). Therefore, findings of longitudinal studies of alcohol etiology during infancy and early childhood suggest it is no longer adequate to view adolescent drinking onset as

the baseline for understanding the etiological risk for problem drinking (Fitzgerald et al., 2013). In addition, because early onset of alcohol and other drug use in adolescence is a marker of sustained problem use in adolescence, as well as an elevated risk for later alcohol use disorders (AUD) in adulthood, it is important to understand the antecedents of these behaviors as potentially important mediators of the etiologic pathway (Mayzer et al., 2009).

The most consistent antecedent risk factors for starting to drink during adolescence derive from personal, parental, and peer domains (Donovan, 2004). Mayzer et al. (2009) compared early drinkers to those who had not yet tried alcohol by age 12 to 14 years and found that the direct effect of preschool delinquent behavior on adolescent delinquent behavior was significant for early drinkers only. This direct path represented the influence of early predisposition on adolescent outcomes, and demonstrated the etiologic contribution of precursory risk to later delinquent behavior among this subset of children whose families were selected because of familial alcoholism (Mayzer et al., 2009). Children arrive at the transitions and challenges of adolescence with the personality, human, and social capital that they have accumulated during childhood, as well as with their record of achievements and failures meeting the various developmental tasks of childhood. Thus, it is not surprising that many of the influential factors associated with early drinking emerge and are shaped during the first decade of life (Zucker, Donovan, Masten, Mattson, & Moss, 2008).

In the Seattle Social Development Study (Hawkins et al., 1997), earlier age of alcohol initiation was predicted by the following predictors at ages 10 or 11 years: Caucasian ethnicity, greater parental drinking, less bonding to school, and having more friends who drink. In another study examining a community-based, high-risk sample of families, parental alcoholism and the mother's ratings of child sleep problems, trouble sleeping, and being overtired at ages 3 to 5-

years-old predicted onset of alcohol use by ages 12 to 14 years (Wong, Brower, Fitzgerald & Zucker, 2004). Parental alcoholism also predicted onset of drunkenness by ages 12 to14 years in the same study. Additionally, Dodge et al., (2009) found that conduct problems that are predictable from early parenting behaviors account for and describe how poor early parenting leads to a child's development of peer relation problems and adolescent substance use.

The Michigan Longitudinal Study (MLS) has followed a sample of 3 to5-year-old children of alcoholics (COA) and their families for 27 years (Fitzgerald et al., 2013). The Buffalo Longitudinal Study (BLS) has followed a sample of alcoholic and non-alcoholic families beginning when the children were 12-months-old through kindergarten and into early childhood (Eiden & Leonard, 2002). The MLS and BLS studies were designed to identify developmental pathways for alcohol use disorders and co-occurring psychopathology. Both studies were based on the assumption that adolescent and adult problems with alcohol abuse can be traced back to experiences in infancy and early childhood. Investigators concluded that parent-child relationships, family relationships, resources, and community contexts, best captured the dynamics of developmental processes (Fitzgerald & Eiden, 2007).

Findings from the MLS and BLS support the proposition that there are multiple pathways within which children develop healthy or maladaptive behaviors. Past research has consistently shown that children of alcoholics (COAs) are more likely than non-COAs to develop psychopathology and substance-related problems (Sher, 1991; Fitzgerald & Eiden, 2007; Fitzgerald et al., 1995). As indicated, research shows that the effect of family history of alcoholism on adolescent alcohol involvement appears to be mediated by many other variables (Chassin, Pillow, Curran, Molina, & Barrera, 1993; Sher & Gotham, 1999; Dodge et al., 2009). Zucker et al., (2008) also found significant antecedent predictors of children's substance use

initiation, which included lower pro-social family processes (e.g., monitoring, rules, parent-child attachment), deviant peer affiliation, peer drug use, parental tolerance of substance use, parental drug abuse, child over-activity, child social skills deficits, and single-parent families.

Children of alcoholics in particular are more likely to show internalizing symptoms, aggression, and substance abuse than their peers are (Chassin, Rogosch, Barrera, 1991; Sher 1991). Many COAs are exposed to risk factors early in life that predispose them to becoming canalized onto pathways leading to high risk for psychological and substance use disorders (Fitzgerald & Zucker, 2005). Among children who face the highest risk, these pathways are infused with regulatory problems, relationship problems, and environmental stress, all of which are components of the early etiology for alcohol use disorders.

By adolescence, children with slower rates of increase in behavioral control over time were more likely to drink, to report having been drunk, to experience alcohol-related problems, and to have used illicit drugs other than alcohol by age 14 years (Zucker et al., 2007). A biological family history of alcoholism is associated with increased alcohol involvement and risk of alcoholism in adolescents and young adults (Sher, 1991). However, because it is not inevitable that familial alcoholism leads one to pathological alcohol involvement, family history (as a distal variable) must be transduced more by proximal variables than distal ones (Sher & Gotham, 1999). Based on the current literature, it was hypothesized that the onset of first drink would occur at age 11 years. Longitudinal and cross-section studies both identified an age range between 10 and 13 years old for first drink. This is an important developmental implication when examining causal factors in first drink onset.

Alcohol use by gender in national surveys. In 2014, the MTF reported gender differences in 30-day alcohol use differ by grade. Among eighth graders, the differences were very small,

with girls consistently reporting slightly higher rates than males since 2002. Among tenth graders, boys generally—though not always—provided higher rates than girls; boys were consistently slightly higher in use than girls between 2009 and 2013, but girls were slightly higher in 2014. Among twelfth graders, boys have consistently reported distinctly higher 30-day alcohol use rates than girls although the gap is narrowing.

In 2013, the NSDUH reported 57.1 percent of boys, ages 12 years or older were current drinkers, which was higher than the rate for girls (47.5%). Among youth ages 12 to 17 years, however, the percentage of girls who were current drinkers (11.2%) was similar to the rate for boys (11.9%). The rates for boys and girls were lower than those reported in 2012 (12.6% and 13.2%, respectively). As noted previously, national surveys provide descriptive information about use, but do not provide information about predictive factors related to onset and use.

Alcohol use by gender in cross-sectional and longitudinal studies. Consistent with findings from national surveys, cross-sectional and longitudinal studies found boys to have an earlier onset age, and to use alcohol more often than girls. What is interesting however, are the early contextual influences that differ for each gender. Baumrind (1985) reported that earlier ages of onset of alcohol use for girls correlated with less parental responsiveness and less encouragement of the child's individuality at age 4 years, and with less parental monitoring and lower socioeconomic status at age 9 years. For boys, earlier onset of alcohol use correlated with less parental encouragement of independence and individuality at age 4 years, and with less individuation and self-confidence at age 9 years (Baumrind, 1985). In their review of alcohol use in women and girls, Fitzgerald, Zucker, Puttler, Caplan, and Mun (2000) concluded that maternal alcoholism may be more harmful to the social and personality development of daughters, than is paternal alcoholism.

In the Seattle Social Development project, the strongest predictors of problem drinking at 16-years-old were an earlier age of initiation of drinking and being male (Hawkins et al., 1997). Lifetime symptoms of externalizing disorders (i.e., conduct disorder and oppositional defiant disorder) were significantly higher in sons than in daughters of parents whose first drink came before age 15 years (McGue, Legrand, & Elkins, 2001). Chassin, Pitts, DeLucia, and Todd (1999) found that paternal alcohol problems emerged as more detrimental than maternal alcohol problems for girl and boy adolescents alike and young adult alcohol problems as well. In another study of high-risk boys from Pittsburgh, age of onset of alcohol use (use of at least one standard drink per episode) through age 15 years was predicted by antisocial behavior diagnosed utilizing the DSM III-R (Clark, Parker, & Lynch, 1999).

In summary, based on the current literature it was hypothesized that boys would take their first drink before girls. Although some research has shown that girls are drinking earlier than they have in the past, predominately, boys are still drinking alcohol earlier.

Alcohol use by race in national surveys. In the MTF and YRBS, reports of current alcohol use in each grade were higher than NSDUH reports for Caucasians and African Americans. Among twelfth graders, for example, higher reports of current alcohol use were observed in the MTF than in the NSDUH for Caucasians (50.9% versus 44.4%), African Americans (29.1% versus 24.6%). The NSDUH reported that African Americans in the ninth through twelfth grades were less likely than their Caucasian counterparts to be current alcohol users. The YRBS data showed similar patterns for Caucasians and African Americans corresponding with NSDUH reports at each grade level. In addition, the YRBS found that the prevalence of current alcohol use among African Americans increased from 28.6 percent in the ninth grade to 41.8 percent in the twelfth grade. Corresponding reports for Caucasians showed increased alcohol use from 37.0

percent in the ninth grade to 57.1 percent in the twelfth grade. All three databases reported that the onset of alcohol use was earlier for Caucasians and that they used alcohol more often than African Americans. It should be noted however, that in adult literature on alcoholism, the health consequences of alcohol use disorders are more severe for African Americans than for Caucasians (e.g., Kerr, Karriker-Jaffe, & Yu, 2013).

Alcohol use by race in cross-sectional and longitudinal studies. The weight of the evidence currently supports differences between Caucasian and African American adolescents with respect to age of onset and predictors influencing decisions to drink. Research has indicated that African American youth are less likely to drink in the year after initiation of drinking, whereas Caucasian youth are more likely to show continuity of alcohol use in the year after onset (Malone, Northrup, Masyn, Lamis, & Lamont, 2012). The research also indicated that African American girls showed intermittent substance use in early adolescence (ages 13 to 14 years), which is in accord with research indicating lower persistence of alcohol use among African American youth. The lower prevalence of alcohol use, and intermittent rather than continuous, pattern of substance use at early ages is contrary to expectation (Chung et al., 2013).

Some research shows that alcohol use in African American youth is associated with greater risk than Caucasian youth for certain alcohol and drug-related conditions including personal injury and death, domestic violence, and comorbid psychiatric disorders (Joseph & Pearson, 2002; Low, Sinclair, & Shortt, 2012; Vega, Zimmerman, Warheit, Aposporiu, & Gil, 1993). Gil et al., (2002) found that despite greater overall exposure to risk factors in early adolescence than Caucasian youth, first use of alcohol was later for African Americans. However, the risk factors had very powerful effects on the African American adolescents in the study. Findings suggested

that negative affect, poor self-concept, and school-related factors had potent long-range effects that lead to alcohol use among African Americans, but not Caucasians (Gil et al., 2002).

D'Amico, Miles, Shih, Tucker, and Zhou (2010) found rates of substance use did not differ between non-Hispanic African Americans and European Americans in their rates of lifetime or past-month alcohol use after adjusting for sex, grade, and family structure. In addition, Chen and Jacobson (2012) concluded that African American adolescents had significantly higher initial levels of heavy drinking than Caucasians in their longitudinal study. These inconsistencies indicate further probing is required. One factor that is consistent among all races is age of initiation of alcohol use. Children with alcohol-using peers at ages 10 to11 years are more likely to initiate alcohol use early and to misuse alcohol later in adolescence (Hawkins et al., 1997). The current studies considered both the patterns of alcohol trajectories and the contributing factors for African American and Caucasian adolescents to better understand racial differences. Based on the current literature, Caucasian students take their first drink of alcohol earlier than their African American counterparts.

Outcome differences in national surveys. Due to differences in sample populations (i.e., only school-enrolled youth versus both enrolled and non-enrolled youth) comparisons among the NSDUH, MTF, and YRBS need to be made with caution. The NSDUH and MTF showed similar trends in the prevalence of substance use among twelfth graders from 2002 to 2008, although some year-to-year variations were observed between the surveys. However, the NSDUH, MTF, and YRBS differed most notably in the magnitude of their respective prevalence estimates (SAMHSA, 2012). The NSDUH estimates tended to be lower than the estimates from the two school-based surveys, and YRBS estimates for tenth and twelfth graders tended to be greater than estimates from MTF.

The NSDUH, MTF, and YRBS are used to collect information about substance use among adolescents, but with different intents. For example, the NSDUH includes detailed questions to measure substance use disorders (i.e., substance dependence or abuse), receipt of substance abuse treatment services, mental health conditions (e.g., major depressive episode), and receipt of treatment or counseling for mental health problems (SAMHSA, 2012). The MTF, in addition to substance use questions like those asked in the NSDUH, includes questions about risk behaviors for human immunodeficiency virus (HIV) infection. The MTF also includes a longitudinal component that follows samples of high school seniors into young adulthood and further into adulthood, which allows for tracking of changes in substance use patterns among the same persons as they encounter various life experiences, such as college, employment, and marriage. Finally, by focusing on six priority health risk behavior categories—including tobacco, alcohol, and other drug use—that are important contributors to the leading causes of death, disability, and social problems in the United States, the YRBS provides data on adolescent substance use in the broader context of adolescent health, including relationships between substance use and other health behaviors or conditions.

For many variables however, these surveys yield different self-reports for the same behaviors they are attempting to measure (SAMHSA, 2012). It is important to consider the background information about characteristics of these surveys to begin suggesting reasons for differences in estimates of substance use among adolescents. Specifically, adolescent substance users may be more prone to underreport their use in household settings out of concern that a parent may discover that they have used certain substances. Brener, Billy, and Grady (2003) explained that the potential for reduced privacy in household settings has been offered as an explanation for lower substance use estimates in household surveys such as NSDUH than in school-based

surveys such as MTF and YRBS. Despite MTF and YRBS estimates tending to be higher than NSDUH estimates however, these two surveys are designed to be representative of the school-based population. For this reason, they do not include high school dropouts who are therefore more likely to be under-represented in such surveys. MTF also does not include students who were absent on the day that the survey was administered. YRBS conducts make-up questionnaire administrations for students who were absent on the day that the survey was administered at their school, but is less likely to include data from chronic absentees.

Nevertheless, surveys such as the MTF and YRBS are not designed to make estimates for the adolescent population overall (SAMHSA, 2012). In a prior review of adolescent substance use estimates from these same surveys, Harrison (2001) concluded that all three surveys were well-designed and well-executed, and that one survey's design and results were not necessarily better or more valid than another's—although Harrison also noted that larger sample sizes would improve the precision of estimates.

Outcome differences in cross-sectional and longitudinal studies. Cross-sectional and longitudinal studies face similar limitations that result in outcome differences. Cross-sectional studies may not provide definitive information about cause and effect relationships because they offer a single snapshot of a specific data point at a given point in time, and therefore do not consider what happens before or after that particular point. And while longitudinal studies conduct several observations of the same subjects over a period of time and are able to detect developmental changes in the characteristics of the target population, there are issues related to repeated measurements, and often subject attrition is an issue. Moreover, both research approaches are vulnerable to the many threats to validity such as subject selection, missing data, instrumentation, and regression to the mean (Shadish, Cook, & Campbell, 2002).

Ecological Variables

Over the past few decades, the term "risk" has appeared frequently in the literature on substance use as well as in the legislation of various states and at the federal level. Research examining the factors leading to adolescent alcohol use is as varying as it is extensive. It is important to understand first, what a risk factor suggests. Risk, for the purpose of most research in this field, is defined as a set of presumed cause and effect dynamics that place an individual child or adolescent in danger of future negative outcomes (McWhirter, McWhirter, McWhirter, & McWhirter, 2007). Because human beings are by definition living systems, risk factors are cumulative and interactive, and they are probabilistic, not deterministic. Therefore, not all persons with a high number of risk factors necessarily develops problems, while some people with few risk factors can develop problems. For alcohol use disorders, COAs are five to eight times more likely to develop alcohol use disorders than are non-COAs, but 70 percent of COA do not become alcohol use disordered.

Although the present study examined late elementary and middle school students, as evidenced earlier, the etiology of alcoholism can start long before then and the first drink may be an expression of predictors that develop from as early as infancy (Fitzgerald et al., 1994). A large body of literature has found that age at initiation of drinking is associated with future drinking patterns and other risk factors, and that prolonging onset reduces these risks. Evidence for this contention comes from both the MLS and BLS studies mentioned previously. The current study was predicated on the assumptions that examining individual factors and the interaction between different contexts such as family, peers, and community could provide a more complete understanding of the variables that contribute to adolescent alcohol use (Shekhtmeyster et al., 2011; Ennet et al., 2008; Elkington et al., 2011; Moon et al., 2010).

The proximal and distal influences of support, safety, and emotional factors are the primary mechanisms of development that include personal characteristics and selected person-environment contexts that operate over time. The framework used in the current study included the key elements critical to utilizing the bioecological model when examining predictors of alcohol use onset in adolescence. This study examined changes in these proximal and distal factors in students over time from the sixth through tenth grades.

Family influences on early onset drinking. There is substantial research indicating that family-based factors predict adolescent substance abuse. These findings are consistent with decades of basic developmental theory and research suggesting that the quality of the parent-child relationship influences children's behavior or misbehavior (Brooks, Coie, & Dodge, 1998). Children of alcoholics in particular are more likely to show internalizing symptoms, aggression, and substance abuse than their peers (Chassin, Rogosch, Barrera, 1991; Sher 1991). Fitzgerald et al. (1993) found that alcoholic and comparison families did not differ over a wide range of demographic variables but did differ on measures of psychopathology, suggesting that alcoholics as well as other types of psychopathologic comorbidity play a significant role in family functioning and child-rearing as early as the preschool years.

As indicated, research shows that the effect of family history of alcoholism on adolescent alcohol involvement appears to be mediated by several other variables (Chassin, Pillow, Curran, Molina, & Barrera, 1993; Sher & Gotham, 1999; Dodge et al., 2009). Significant antecedent predictors of children's substance use initiation include lower prosocial family processes (e.g., monitoring, rules, parent-child attachment), deviant peer affiliation, peer drug use, parental tolerance of substance use, parental drug abuse, child over-activity, child social skills deficits, and single-parent families (Zucker, Donovan, Masten, Mattson, & Moss, 2008). Maughan,

Christiansen, Jenson, Olympia, & Clark (2005) concluded that children with disruptive behaviors tend to come from family contexts characterized by considerable stress, changes in family structure, and inconsistent and highly punitive disciplinary practices. In contrast, early parental involvement, monitoring, and expectations over time protected against adolescent drinking (Simmons-Morton & Chen, 2005). Guo et al. (2001) also found that lax rules and poor parental monitoring predict greater alcohol use, whereas authoritative parenting of adolescents predicts less alcohol use and fewer alcohol problems. Finally, Patock-Peckham and Morgan-Lopez (2006) demonstrated that family influences continue to predict drinking behavior from adolescence into emerging adulthood.

As established, family risk factors strongly associated with increasing alcohol use in youth included parental substance use, family conflict, and parenting practices. Longitudinal evidence indicates that the negative impact of physically abusive parenting practices on behavior may be more pronounced in African American children than in Caucasian children (Lansford et al. 2002). However, studies examining the association between less severe forms of physical discipline and conduct problems in the two racial groups have produced mixed findings (Lansford, Deater-Deckard, Dodge, Bates, & Pettit, 2004; Pardini, Fite, & Burke, 2008). Thus, there is some preliminary evidence, particularly in regard to physical discipline, to suggest differential sensitivity to risk factors between African American and Caucasian youths. African American youth who reside in households with conflicting family relationships and evidence of parental substance use are more likely to use alcohol (Elkington et al., 2011).

Ennett et al. (2008) found indicators of family closeness (i.e., parental support, parental supervision, and parent-adolescent closeness) were negatively associated with alcohol misuse, whereas family stress and family alcohol use were positively associated with adolescent alcohol

misuse for both African American and Caucasian adolescents. To the contrary, Wang et al. (2005) did not find a significant relationship between family supervision and alcohol use in their study on minority youth.

There is substantial research indicating parent-based factors are correlated with adolescent alcohol use. These findings are consistent with decades of basic developmental theory and research suggesting that the quality of the parent-child relationship has a great deal of influence on the child's behavior. The family is the principal microsystem context in which development takes place. The closeness of this proximal relationship should be a critical factor when examining causal factors of adolescent alcohol use onset.

Peer influences on early onset drinking. Another variable influencing alcohol use that is supported by a large body of research is the influence of peers (Dorius et al., 2004; Gil et al., 2002; Elkington et al., 2011; Brook et al., 2002 Ryan, Abdelrahman, French, & Rodriguez, 1999). Research indicates that a lack of success in peer relationships in elementary school, such as poor social skills and peer rejection, is a strong marker of a variety of adolescent deviant outcomes including the use of alcohol and other drugs (Dodge et al., 2009). The association with deviant peer networks is directly linked to substance use in youth via peer selection and socialization (Suldo, Mihalas, Powell, & French, 2008; Brook et al., 2002).

On the one hand, the peer group takes on an increasing socializing role during adolescence, locking youth into a trajectory of substance use that may have started with earlier family interactions (Dodge et al., 2009). Alternatively, family can be a protective factor by actively enhancing positive development in the peer socialization process. Brook et al. (2006) and Dorius et al. (2004) found that a positive family environment, as indicated by both closeness and supervision, can mitigate negative peer effects.

Some research has suggested racial differences in the importance of perceived peer use as a predictor of adolescent alcohol use (Curran, Stice, & Chassin, 1997). For example, perception of a friend's alcohol use was a risk factor for an adolescent's drinking behavior, but the association was stronger among Caucasian youth, relative to African American youth (Unger et. al., 2001). Dodge et al. (2009) found that peer factors play a stronger role for Caucasian adolescents and family factors play a stronger role for African American adolescents. In addition, research has suggested that Caucasian adolescents are more likely to receive drug offers from friends and at friend's homes, whereas African Americans are more likely to receive offers from dating partners, parents, and in the park (Moon et al., 2010; Gil et al., 2002).

Research has clearly identified that lack of peer support is a risk factor for alcohol use. What needs to be considered is if this linkage is proximal or more distal in relationship to parental factors. It has been argued that parent attachment was more strongly related to well-being in adolescence than peer attachment (Sentse, Lindenberg, Omvlee, Ormel, & Veenstra, 2009). Therefore, the influence mediation effects have on predictive power of peer support in first drink onset should be examined.

Teacher influences on early onset drinking. School factors that repeatedly emerge in the literature show that caring relationships and meaningful participation are factors that promote positive outcomes and reduce negative ones (Shekhtneyster et al., 2011; McCarty, Rhew, Murowchick, McCauley, & Vandfer Stoep, 2012). Outside of the immediate family, the school setting has been identified as the most consistent institution in the lives of children (Moon et al., 2010). Research also has found that middle school aged students who report troubled relationships with teachers are more likely to use tobacco, alcohol, and/or marijuana (Ennett et al., 2008; Dorius et al., 2004). Of the few studies investigating the role of teachers in trajectories

of adolescent alcohol use, results have suggested that the supportiveness and expectations of teachers are related to infrequent use of alcohol (Suldo et al., 2008; Moon et al., 2010).

Interestingly, Dorius et al. (2004) found that if middle school students were dissatisfied with school and felt teachers did not care and were not fair, then they were more likely to initiate regular use of alcohol. Wang, et al. (2005) found social skills and teacher support for minority youth were significant predictors of school connectedness, that in turn, significantly predicted substance use. Mayberry, Espelage, and Koenig (2009) found that adolescents' views of their teachers and school were not only associated with the amount of alcohol use they reported, but also the contextual systems that might protect those adolescents from strong influences of negative peer pressure and negative parenting attitudes and behaviors. The lack of teacher support has been identified as a risk factor for alcohol use in youth.

Bronfenbrenner (1989) posited that the most proximal and significant sphere or setting is the individual's microsystem, which includes the person's family, peers, school, and neighborhood. Suldo et al., (2008) found that the more students perceived their teachers as supportive, the less likely they were to use substances in the future. Importantly, teachers still made a difference even when the powerful influences of peer groups and parenting behaviors were considered. Thus, however more distal teacher support is from parent-child relationships, it should be considered as an additional predictive factor in the onset of alcohol use.

Neighborhood influences on early onset drinking. Many researchers concur that to fully examine the issues related to youth experience with neighborhood violence, an ecological framework is required (Cicchetti & Lynch, 1993; Dawes & Donald, 2000), which places the developing child within the dynamic distal context of their families, communities, and societies at large. Neighborhoods have become the "contexts" of choice in epidemiology in part because

studies linking census data to person-level data on health outcomes and covariates continue to be of use.

For example, studies using census data may be specifically useful if they examine aspects that have been infrequently used in the past such as the relation of neighborhood socioeconomic context to potential mediators of neighborhood effects (Dietz, 2001). Researchers have found that neighborhoods with more unemployment, larger numbers of residents living below the poverty line, and heightened residential mobility are often plagued with high rates of crime and violence (Kurlychek et al., 2012; Diez, 2001; Leventhal & Brooks-Gunn, 2003). Such neighborhoods often have limited means to informally control crime, subcultural values that frequently condone violence, residents who are less likely to trust one another, and residents who have a lesser sense of cohesiveness (Kurlychek, 2012). Moreover, high risk neighborhoods also are linked to alcohol use regardless of family mobility from one low-income neighborhood to another (Buu et al., 2007; Buu et al., 2009).

Increasingly, children living in fear of neighborhood violence are being exposed to violent events in their neighborhoods and communities, and observing violent events can have negative effects on children's mental health and psychological development (Wallen & Rubin, 1997). Nebbit et al. (2012) found adolescents who witnessed community violence and who were victimized by community violence were more likely to report alcohol use. Muller, Goebel-Fabbri, Diamond, and Dinklage (2000) also found that social support can buffer a child from the effects of family violence but it does not buffer adolescents from the effects of community violence regardless of whether or not they were a victim or a witness. Fitzgerald et al. (2006) found that exposure to neighborhood violence exacerbated paternal use of physical punishment

with preschool-age children, even among fathers who scored low on measures of antisocial behavior.

Adolescents living in low-income neighborhoods are associated with adverse mental health, criminal, and delinquent behavior outcomes. (Leventhal & Brooks-Gunn, 2003). African American adolescents are more likely than Caucasian adolescents to live in neighborhoods that are dangerous due to high crime rates, substance availability, poverty, and scarce resources (Gibbons et al., 2012). Zimmerman and Messner (2013) determined that, compared to Caucasians, the risk exposure to violence was significantly higher among African Americans. Moreover, African Americans were also more likely than Caucasians to witness acts of violence. Scholars have long linked exposure to community violence to drug initiation, use, and dependence (Wallen & Rubin, 1997; DuRant et al., 2000; Muller et al., 2000). More specifically, DuRant et al. (2000) studied African American youth living in public housing, and found that exposure to violence was related to frequency of cigarette, alcohol, and other substance use. The implication is that stronger support from family, peers, and school can mediate or moderate the path to alcohol use onset when an adolescent is living in a perceived or actual unsafe neighborhood. As a result of the well-established link between perceived unsafe neighborhood and substance use, it was predicted that lack of neighborhood safety would foreshadow first drink onset.

There is a need to consider community effects on adolescent alcohol use by examining how individual perceptions of the community context have influenced individual outcomes (Chilenski & Greenberg, 2009). As indicated earlier, neighborhood disorder including violence has been linked to increased substance use in adolescents (Nebbit, Lombe, Yu, Vaughn, & Stokes, 2012).

The context of neighborhood safety, albeit a more distal predictive factor than parent, peer, and teacher support, should be considered in examining causal factors in first drink onset.

Personal characteristics and early onset drinking: Depression and anxiety. Two of the most commonly investigated mental health disorders in relation to alcohol use are depression and anxiety. Depression and anxiety are person characteristics that can be influential in shaping the course of development through their capacity to affect the direction and power of proximal processes. Personal characteristics such as emotional health factors can play a role in amplifying tendencies for earlier alcohol use. Traditional research on alcohol use has focused on its relationship with mental health disorders. Outcomes of this research have demonstrated that high numbers of individuals who have alcohol use disorders also have some sort of comorbid mental health disorder. For example, 60 percent of adolescent substance abusers also have some type of mental health disorder (Armstrong & Costello, 2002).

Depression is the most commonly studied mental health disorder when investigating the comorbidity between adolescent alcohol use and other mental health disorders (Goodwin, Fergusson, & Horwood, 2004). Depression is more likely to be comorbid with alcohol use in girls than in boys, whereas the opposite is true for antisocial behavior. Nevertheless, there is clear evidence that internalizing problems are also evident in male COA from elementary age to mid-adolescence (Zucker, Wong, Puttler, & Fitzgerald, 2003).

Strong correlations exist between symptoms of depression and the use of alcohol, with depressed adolescents twice as likely to drink alcohol as those who are not (Kandel, 1997; Armstrong & Costello, 2002; Boys et al, 2003; Kelder et al., 2001). This pattern also persists with middle school students; the more depressive symptoms that are present, the higher the probability of alcohol use (Kelder et al., 2001). The relationship between alcohol use and mental

health is particularly important to investigate in adolescents due to the prevalence of depressive symptoms in this population, with prevalence rates for depressed mood ranging from 10 to 40 percent (Kelder et al., 2001; Goodman et al., 2004). As noted, depression in adolescence is more common in girls, and this gender disparity becomes more apparent during the teen years when girls have close to twice the rate of depression compared to boys (McGinness, Dyer, & Wade, 2012).

Although the relationship between anxiety and substance use is commonly investigated, the results of these studies are mixed. According to Armstrong and Costello's (2002) review of literature, studies that investigated this relationship have shown the smallest and most inconsistent differences between substance users with anxiety and those without. The results of their review found no relationship between the presence of anxiety and the use of marijuana. Additionally, those who had anxiety were only 1.3 times more likely than those without anxiety to drink alcohol. More recent research however, reported finding a strong significant relationship (Grant et al., 2004; Valentine, Mount, & Deacon, 2004). Although the literature has found a relationship between substance use and mental health, researchers are calling for further studies to investigate these relationships while taking into account other confounding variables that may contribute to comorbidity (Goodwin et al., 2004; Armstrong & Costello, 2002). The female preponderance emerges early in life, with retrospective data indicating that at age 6 years, females are already twice as likely to have experienced an anxiety disorder than males are (Lewinsohn, Gotlib, Lewinsohn, Seeley, & Allen, 1998). Emotional health and the age at which symptoms of depression and anxiety are manifested, are important developmental considerations when examining causal factors for first drink onset.

An important consideration that must be addressed is racial differences in the prevalence and impact of person characteristics such as depression and anxiety. African American adolescents growing up in the United States face significant challenges that are more taxing, on average, than those faced by Caucasian adolescents. They face levels of discrimination that exceed those reported by adolescents from any other minority group and this stress takes a toll on their developmental outcomes (Gibbons et al., 2012). Mandara et al. (2009) found that the effects of discrimination on depressive and anxiety symptoms were reported when transitioning from seventh to eighth grades and that depressive symptoms were more prevalent than anxiety. Moreover, Gibbons et al. (2004) found a relationship between perceived discrimination and increases in risky behavior such as alcohol use.

Bronfenbrenner acknowledged the relevance of biological and genetic aspects of the person (Bronfenbrenner, 2001/2005; Bronfenbrenner & Ceci, 1994). He devoted more attention, however, to the personal characteristics that individuals bring with them into any social situation (Bronfenbrenner, 1993, 1995; Bronfenbrenner & Morris, 1998). It is relevant to consider person characteristics, as they too influence proximal processes when examining contexts shaping developmental outcomes. To understand how person characteristics influence those proximal processes, a richer design would examine the ways in which person characteristics of the study participants influenced the ways in which they acted and interacted.

Multiple Risk Factors

Logically, racial groups may be exposed differentially to risk factors, and the number or pattern of factors required to significantly increase risk may differ by group as well. Research has consistently shown that children experiencing multiple risk factors were much more likely to experience a psychological disorder(s) (Rutter, 1979). This led Rutter and other developmental

researchers (Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987) to propose that multiple risk factor exposures in children interfere with healthy child development. As such, Rutter (1987) concluded that no single factor was sufficient to explain developmental outcomes, and that risk factors must be studied using multiple risk factor frameworks.

Multiple risk factor exposures can overlap (e.g., harsh and unresponsive parenting) or be independent (e.g., housing quality and temperament), but in each case prediction is enhanced by combining multiple risks in the model (Coffelt, Forehand, Olsen, Jones, Gaffney, & Zens, 2006; Forehand, Biggar, & Kotchick, 1998; Rutter, 1979). Sameroff et al. (1987) suggested that cumulative risks are not substantially detrimental for children until four or more risk factors have accumulated. Thus, to add to the existing literature, future studies utilizing a multiple risk factor model, which is now widely accepted, must be used to increase understanding of adolescent alcohol use onset.

Research Hypotheses

The bioecological perspective was conceptualized in this study, as it frames proximal and distal multi-level influences on development and anchors development within a systemic model. The factors hypothesized to predict first drink onset are also supported by Zucker's (1979) developmental probabilistic model that predicts more proximal factors should have primacy and then increasing distal factors enter in. In addition, the bioecological model explained that depression and anxiety are person characteristics that can be influential in shaping the course of development through their capacity to affect the direction and power of proximal processes and are therefore necessary to consider when examining predictors of first drink onset. The present study sought to identify predictors of early alcohol use onset. The hypotheses were as follows:

1. Early onset of first drink of alcohol will occur at age 11.

2. First drink will occur earlier for boys than girls.
3. Onset of first drink will occur earlier in Caucasian adolescents than African American adolescents.
4. Early first drink onset will occur earlier for Caucasian boys than Caucasian girls and African American boys and girls.
5. Multiple factors will predict early onset of alcohol use. The most proximal factors will have primacy and then distal factors will enter in. Parent factors (emotional support, involvement and supervision) will have more predictive power, than peer support, teacher support, and neighborhood safety. Depression and anxiety will be significant for the youngest students reporting first drink onset along with parent factors.

Significance

Early onset of drinking is an established sign for later risk behaviors related to alcohol use. Preventing the consequences of early onset drinking is, in part, dependent on what factors predict onset and for whom. This study distinguished causal factors for early onset drinking among early to middle adolescence. In addition, this study made it possible to determine which predictors seem most important at each age/grade level, which has developmental implications. Finally, findings may provide practical implications for development of evidence-based targeted interventions that have the potential to delay onset of alcohol use.

Chapter 3: Methods

Design of the Original Coordinated Community Assessment Study

The Research on Applied Developmental Science (ROADS) lab, under the leadership of Dr. Jessica Barnes and Dr. Jason Almerigi, began an ongoing research project in 2002 with the Genesee Intermediate School District (GISD). This project collaborated with 21 school districts and was comprised of over 100 urban, suburban, and rural schools. The research team from ROADS and the GISD convened to create a survey instrument named the Coordinated Community Student Survey (C^2S^2). The C^2S^2 was designed in collaboration with multiple community partners including members from Michigan State University, Genesee Intermediate School District, United Way of Genesee County, and all 21 school districts in Genesee County. The intention in using this participatory research approach was to give individual schools and communities a direct voice in the assessment of their youth (Barnes, Almengi, Hsu, 2009).

The C^2S^2 was a longitudinal study designed to conduct a community needs assessment and evaluate student outcomes based on school program participation in youth development programs. The guiding questions underlying C^2S^2 were: 1) What are student needs and strengths, and do these needs and strengths differ across communities?; 2) What are the critical times to begin prevention activities across different domains of student outcomes?; 3) What are the differences in needs and strengths for boys and girls?; 4) How do home, school, and neighborhood environments influence student outcomes, and how do these influences change over time?; and 5) How does participation in school-based support services influence student outcomes? The primary assessment instrument used in the study, (the C^2S^2) was a survey designed to assess student outcomes related to health, safety, and nutrition programs and services

provided by schools to students in fourth through twelfth grades throughout Genesee County (Barnes, Almengi, Hsu, 2009).

The C^2S^2 survey was administered in the spring of 2006, 2007, 2008, 2009, and 2010. A total of 32,210 students completed the survey at least one time during this 5-year period. Of this total, 12,450 students completed the survey in 2006, 10,145 students completed the survey in 2007, 11,597 students completed the survey in 2008, 12,175 students completed the survey in 2009, and 8,107 students completed the survey in 2010. Given the multiple programs and services that the C^2S^2 survey was designed to assess, the survey was deemed comprehensive. It included questions about student behaviors, beliefs, and perceptions across 32 domains, ranging from participation in after-school activities to feelings of anxiety to perceptions of neighborhood safety.

Procedure for data collection. Students completed the Coordinated Community Student Survey (C^2S^2), a 45-minute self-report questionnaire comprised of 208 items and designed to assess their attitudes, beliefs, and behaviors about physical, social, and mental health as well as school, home, and neighborhood environments. The survey questions were developed using reliable and valid, multi-item scales that were selected by the faculty and community members who comprised the Coordinated Community Collaborative from public and peer-reviewed sources that had known psychometric properties (see Appendix A for a summary of the C^2S^2 subscales and their alpha reliability indices). Approval was secured from the Institutional Review Board of Michigan State University and consent forms were distributed to the parents of all students in participating schools via student backpacks and home mailings. Approximately 40 percent of all parents provided consent for students to participate in the study. Signed parental consent forms and student assent forms were collected prior to data collection.

University research staff administered the surveys at each participating school during school hours. Personal identifying data were obtained for the purpose of connecting survey data across the years to build a longitudinal database. Each student was assigned a unique number in the database so that they could be tracked over time. The final database consisted only of unique identifiers to ensure anonymity of participants.

The design, format, and question sets of the C^2S^2 were based on state and national-level youth surveys (e.g., Michigan 21st Century Statewide Evaluation, California Health Kids Survey, the Centers for Disease Control and Prevention's YRBS survey, and the SEARCH Institute's 40 Developmental Assets for Adolescents instrument (Barnes, Almengi, Hsu, 2009). This allowed for the yearly results to be comparable to the state and national standards. The Coordinated Community Student Survey was also designed to track students over time to assess individual-level change. This offered two advantages. The first was the ability to track high risk populations who moved across districts. The second advantage was that it provided stronger evidence for establishing causal links between school services and students outcomes (Barnes, Almengi, Hsu, 2009). The study involved one cohort (three waves) of sixth, seventh, and eighth grade students in a Midwest area comprised of over 100 urban, suburban, and rural schools.

Sample

The sample consisted of all 663 students in grades sixth through eighth during the first year of the study (2006) and who also completed the survey in 2007 and 2008 (see Table 1).

Table 1.

Cross-Sequential Design of the Study by Grade and Wave

Student Grade	Wave 1 2006 (n)	Wave 2 2007 (n)	Wave 3 2008 (n)
6th	333		
7th	187	333	
8th	143	187	333
9th		143	187
10th			143
Total N	663	663	663

Note. Students at each beginning grade level were assessed at each of the next two grades.

The mean number of students per school was 16.70 (*SD* = 22.28, range: 1–156). Data from the full study indicate that of the 32,210 students who completed the survey, three or more consecutive waves of data were obtained for 4,048 students (12.6%). A total sample of 663 students is the result of a sample selection with less than .02 percent missing data. Approximately 86 percent of students were Caucasian (14 percent African American), and 58 percent were female. A critical issue in race and ethnicity data collection is how many categories of race and ethnicity to include. One of the unresolved questions in the collection of race and ethnicity data is how to collect information on Latino ethnicity. Therefore, a separate category was available on the survey. In Table 2, the sex and racial demographics are illustrated.

Table 2.

Sample Demographics for Sex and Race

Caucasian		African American		Total		Sample Total
Boys	Girls	Boys	Girls	Boys	Girls	
235	334	41	53	276	387	663

Of the 21 school districts in the sample, approximately 67 percent of the African American students came from the Flint Community Schools (see Table 3).

Table 3.

Race by School Districts

	Schools	Race		Total
		African American	Caucasian	
District	Flint Community Schools	62	7	69
	Grand Blanc Community Schools	3	37	40
	Mt. Morris Consolidated Schools	6	38	44
	Goodrich Area Schools	0	52	52
	Bendle Public Schools	1	47	48
	Genesee School District	0	12	12
	Carman-Ainsworth Community Schools	12	29	41
	Fenton Area Public Schools	0	7	7
	Kearsley Community Schools	0	13	13
	Flushing Community Schools	0	74	74
	Atherton Community School District	0	14	14
	Davison Community Schools	0	93	93
	Clio Area Schools	0	11	11
	Lake Fenton Community Schools	0	20	20
	Westwood Heights Schools	4	0	4
	Bentley Community School District	1	22	23
	Beecher Community School District	3	0	3
	Linden Community School District	1	23	24
	Montrose Community School District	0	2	2
	LakeVille Community School District	0	18	18
	Perry Public Schools	0	51	51
Total		93	570	663

The instrument used in the study did not inquire about family income. Family income is an important consideration in research, as family economic hardship is consistently associated in negative developmental outcomes in children (National Center for Children in Poverty, 2011) with large disparities in families by race. The percentage of adolescents in low-income families surpasses that of adults. In addition, children ages 12 to 17 years are more than twice as likely as

adults aged 65 years and older to live in poor families. More than 60 percent of African American, Latino, and American Indian children live in low-income families, compared to about 30 percent of Caucasian and Asian children (National Center for Children in Poverty, 2011).

The free and reduced price lunch (FRPL) program is a federal initiative that provides free or discounted lunches to children from low-income families. Families must demonstrate eligibility to participate, and schools receive cash subsidies from the U.S. Department of Agriculture to pay for the food (The Annie E. Casey Foundation, 2012). The program's enrollment data serve as one of the best sources on low-income students. As such, the data is also used to determine funding for various federal and state programs targeted to students from low-income families. Students from families with incomes below 185 percent of the poverty level are eligible for free or reduced prices in the National School Lunch Program. Students from families reporting income between 130 percent and 185 percent of the federal poverty line are eligible for reduced priced meals, while children from families with incomes below 130 percent of poverty are eligible for a fully subsidized or free meal (The Annie E. Casey Foundation, 2012). This study included 21 schools districts in Genesee county that reported over 50 percent of their students as enrolled in the FRPL program in 2006 and 2007, and 57 percent in 2008 (Michigan Department of Education, 2015).

Sampling Procedures

The sample for the current study was selected from the original C^2S^2 data set using a one-step procedure to select all of the school-age children in the original data set.

Inclusion criteria. Selection criteria were based on all sixth through eighth grade children.

Exclusion criteria. Only children who did not have parental consent or those with parental consent who refused to sign an assent form were excluded from the original study.

Instrument

Demographic information. The demographic questionnaire consisted of four questions including name, birth date, gender, and race.

Scale descriptions. Data from four broad domains and eight constructs were utilized for this study. Factor analysis was conducted and internal validity was significant (see Table 4). Data were obtained for all three domains (i.e., support, safety, emotional health) in all three waves of the study as follows:

Support Networks (parent, peers, school)

Domain: Parent support:

1. *Parent emotional support* (4 items)
2. *Parental involvement* (6 items)
3. *Parental supervision* (2 items)

Domain: Peer support:

4. *Peer social support* (5 items)

Domain: Teacher support*:*

5. *Teachers at school* (4 items)

Domain: Neighborhood safety:

6. *Neighborhood safety* (4 items)

Domain: Emotional health:

7. *Depression* (10 items)
8. *Anxiety* (9 items)

Domain: Alcohol use:

9. Alcohol: Use of alcohol (1 item)

Parent support was comprised of parent emotional support, involvement, and supervision. Students self-reported their experiences of parent emotional support, involvement, and supervision on a total of 13 items scored on a Likert scale that included the following choices: "Strongly Disagree," "Disagree," "Agree," "Strongly Agree," "Never," "Not much," "Sometimes," or "A lot." A higher score for parent support indicated greater levels of support from parents in the child's life. Some items required reverse coding.

Support networks include support from parents, support from peers, and support from school teachers, and were measured in all three waves of the study. All scale scores loaded strongly onto the single factor with evidence of correlational relationships between the factor scores and factors.

Peer support was comprised of peer social support. Students self-reported their experiences of peer social support on five items scored on a Likert scale that included the following choices: "Strongly Disagree," "Disagree," "Agree," or "Strongly Agree. A higher score for peer support indicated a greater level of support from their peers. A standardized factor score was computed for peer support using a least square regression approach. All scale scores loaded strongly onto the single factor with evidence of correlational relationships between the factor scores and factors.

Teacher support was comprised of social support from teachers at school. Students self-reported their experiences of school support on four items scored on a Likert scale that included the following choices: "Strongly Disagree," "Disagree," "Agree," or "Strongly Agree." A higher score for school support indicated greater levels of support from teachers and staff at school in the child's life.

The *safety factor* included neighborhood and was measured in all three waves of the study. The scale scores loaded strongly onto the single factor with evidence of correlational relationships between the factor scores and factor. Students self-reported their experiences of neighborhood safety on four items scored on a Likert scale that included the following choices: "Strongly Disagree," "Disagree," "Agree," or "Strongly Agree." A high score for neighborhood safety indicated greater levels of a lack of safety.

Emotional health included affective state of depression and anxiety and was measured in all three waves of the study. Students self-reported their experiences of depression on 10 items scored on a Likert scale that included the following choices: "Not at all like me," "Not much like me," "Kind of like me," or "A lot like me." The depression scale score was reverse coded to represent a lack of depression symptoms.

Students self-reported their experiences of anxiety on nine items scored on a Likert scale that included the following choices: "Not at all like me," "Not much like me," "Kind of like me," or "A lot like me." A standardized factor score was computed for affective state using a least square regression approach with Varimax rotation. Both scale scores loaded strongly onto the single factor with evidence of correlational relationships between the factor scores and factors. A high score in affective state indicated a positive emotional state. Table 4 summarizes information on scales, including internal reliability scores.

Table 4.

Internal Reliability for Predictor Factors

Factors	Constructs	Number of Items	Response Scale	@
Parent Support	Emotional Support	4	4-point scale	.89
	Involvement	6	4-point scale	.81
	Supervision	2	4-point scale	.85
Peer Support	Peer Social Support	5	4-point scale	.92
Teacher Support	Teacher Support	4	4-point scale	.84
Neighborhood Safety	Neighborhood Safety	4	4-point scale	.87
Emotional Health	Depression	10	4-point scale	.92
	Anxiety	9	4-point scale	.91
Alcohol Use	30-day alcohol use	1	4-point scale	N/A

Table 5 describes the characteristics of the study's sample population. Factor analysis was used to correlate the predictor variables. Information gained about the interdependencies between variables reduced the set of items used for each variable. As a result, the internal reliability scores for the predictor variables differed from the original C^2S^2 data set.

Table 5.

Descriptive Statistics

Predictors	Race	N	Mean	SE	95% CI
Parental Emotional Support	African American	93	3.34	0.06	(3.21, 3.48)
	Caucasian	565	3.45	0.02	(3.39, 3.50)
Parental Involvement	African American	93	2.95	0.06	(2.81, 3.08)
	Caucasian	565	2.86	0.03	(2.80, 2.92)
Parental Supervision	African American	91	2.35	0.11	(2.12, 2.59)
	Caucasian	567	2.25	0.04	(2.16, 2.33)
Peer Support	African American	92	3.04	0.08	(2.87, 3.21)
	Caucasian	569	3.40	0.02	(3.35, 3.45)
Teacher Support	African American	92	2.84	0.07	(2.69, 2.99)
	Caucasian	569	3.03	0.03	(2.97, 3.10)
Neighborhood Safety	African American	93	2.41	0.10	(2.21, 2.62)
	Caucasian	565	2.10	0.04	(2.02, 2.18)
Depression	African American	92	2.23	0.08	(2.07, 2.39)
	Caucasian	566	2.13	0.03	(2.07, 2.20)
Anxiety	African American	93	2.54	0.08	(2.37, 2.71)
	Caucasian	565	2.43	0.03	(2.36, 2.50)

Note. The number of non-African American ethnic groups was too small to be considered in the study. There were no significant differences in mean predictors based on race.

Data Analysis

Discrete time survival analysis. Survival analysis is generally defined as a set of methods for analyzing data where the outcome variable is the time until the occurrence of an event of interest (Cox, 1972). Historically, survival analysis has not been used extensively in the social sciences including the field of family research. However, its usefulness in addressing important and pressing research questions on developmental processes and the environment is becoming more apparent. In addition, recent examples of its use in addressing questions that pertain to the family include investigations of the effects of family and other factors on adolescent alcohol use

initiation (Guo, et al., 2002), and the study of the intergenerational transmission of neuropsychological executive functioning in COA (Jesteret al., 2009).

Though its application within the social sciences has been relatively recent, survival analysis has been used for decades in the field of medicine. In such applications, analyses literally focused on how long individuals "survived" before experiencing a life-ending event, and thus the language of "survival" and accompanying "hazard" ratios became associated with negative experiences (Collett, 2003; Elandt-Johnson & Johnson, 1999; Kalbfleisch & Ross, 2002; Lawless, 2003).

More generally, survival analysis involves the modeling of time to the "target event" data—in this context, death or failure is considered an "event" in the survival analysis literature. The survival analysis of data in the current study had three primary characteristics: 1) the dependent variable or response was the waiting time until the occurrence of the first use of alcohol; 2) observations were censored in the sense that for some respondents, the use of alcohol had not occurred at the time the data were analyzed; and 3) there were predictors or explanatory variables (i.e., parent, peer, and school support, neighborhood safety, race, and emotional health) whose effect on the waiting time was examined.

Conditions for survival analysis. When considering survival analysis, researchers must determine the specific "target event" to be examined. For the purposes of this study, the "target event" was the first report of alcohol use by both African American and Caucasian middle school students. One of the most important factors of survival analysis is that it provides a method for dealing with respondents who have experienced the event (alcohol use) and those who have not experienced the event (used alcohol) during the data collection period. Respondents with an unknown event time are referred to as "censored" cases. They do not experience the target event

during the period under study but they may or may not experience the event at a later point in time (Keiley & Martin, 2005). Survival analysis allows the researcher to manage censored respondents in a useful manner by providing information not only about event occurrence but also about event non-occurrence. Therefore, this method may provide a more complete understanding of characteristics of the respondents who are least likely to have experienced the target event during the period of data collection (Collett, 2003).

To conduct a survival analysis, the time period during which the event can occur must be determined. The respondents is this study consisted of all 663 students who were in the sixth through tenth grades. The decision to start the study with sixth grade students was made to first investigate the developmental influences on alcohol use in early adolescence, and second, to capture the "at risk" population for the target event of alcohol use. This was a discrete time survival analysis, as the event occurrence was measured in discrete units (grades 6, 7, 8, 9, 10).

A life table is constructed in the survival analysis method and summarizes the distribution of the event occurrence in the sample. The first column indicates the discrete time periods and associated metric. The second column indicates the risk set; respondents who are eligible to experience the event of alcohol use during each time period (grade). The third column indicates those respondents who reported alcohol use during each grade. The forth column includes respondents who were censored (did not report alcohol use during the points of data collection).

Discrete Time Survival Analysis or Continuous Time Survival Analysis

Hazard function. From the life table, three more statistical summaries are analyzed. The hazard function, the survival function, and the median life time (Keiley & Martin, 2005). The discrete time hazard function, denoted as h(t), is the conditional probability that a person will experience the target event under investigation during the time period, denoted as *j*, given that

the respondent has not reported the use of alcohol in the previous time period (grade). The hazard function represents the proportion of each time period's risk set who experienced the event during that time period (Collett, 2003). The greater the hazard, the greater the risk of substance use occurrence during that time period or vice versa.

Survival function. The discrete-time survival function, S(t), indicates the probability that a randomly selected person will "survive" during period *j* (Keiley & Martin, 2005). For this study, the survival function indicated the probability that the respondent would not use alcohol during that time period.

Median life time. The median life time is the time period by which half of the sample has experienced the event and half have not (Collett, 2003). The median life time is the average time to the target event. For target events that may be rare, median life time often cannot be estimated (Keiley & Martin, 2005). However, for this study, subgroups within a sample, such as race or gender, can provide useful information.

Logistic Regression

The results derived from survival analyses include point estimates and confidence intervals of the relative risk associated with the predictive factors and corresponding p-values. By restricting analysis of a dataset to these measures, an investigator may miss important information on the extent to which predictive factors determine the outcomes. Such questions can be suitably addressed by measures of the variation of a dependent variable explained by predictive factors (Korn & Simon, 1991). As a result, a logistic regression was used. It is a statistical measure of how close the data are to the fitted regression line. It is also known as the coefficient of determination, or the coefficient of multiple determination for multiple regression.

This study presented a significant opportunity to apply potentially relevant findings at specific contexts of development that have the possibility to increase families' capacities for resilience and minimize risks for alcohol use. From a developmental perspective, incorporating methodologies that take into account the intersections of alcohol use, race, and gender, as well as the larger environmental systems in adolescents' lives, can be a good opportunity to provide prevention programs that are strength-based with a resilience focus. In order to achieve this, a developmental model must be used to conceptualize research questions and methodologies (Ungar, 2005).

Chapter 4: Analysis

Discrete Time Survival Analysis

A discrete time survival analysis was used (Singer & Willett, 2003) to test the effects of variables believed to predict the age of onset of drinking alcohol in early adolescence beginning at sixth grade. The approach was used to determine age of onset of first drink and to assess specific predictors of first drink. Research on the occurrence and timing of events often uses regression analysis and analysis of variance. Unfortunately, not only are these normally versatile methods ill-suited for modeling event occurrence, they may also conceal more than they reveal (Singer & Willett, 2003). Traditional methods use means and standard deviations to describe the data, whereas survival models describe whether events occur, when they occur, and why they occur. Discrete-time survival models (Kalbfleisch & Ross, 2002; Lawless, 2003; Willett & Singer 2003) using person-year data sets and nested logistic regression models were therefore used to evaluate lifetime associations between the outcome measures and predictors. The methodological features have a well-defined event whose occurrence is being explored, a clearly identified beginning point, and a substantively meaningful metric for clocking time (Singer & Willet, 2003).

In a survival analysis, an important subgroup are the respondents who did not experience the event during the data collection period. A mean length of time to an event or any other statistic cannot be estimated when the fact of occurrence (i.e., whether an event occurred) and the time when it occurred are unknown. Censoring occurs whenever a researcher does not know an individual's event time. There are two main reasons for censoring: 1) some individuals have never experienced the target event, and 2) other individuals experience the event but not during the period of data collection (Singer & Willet, 2003).

The Cox model (1972) provides an estimate of the treatment effect on survival after adjustment for other explanatory variables. In addition, it allows for estimation of the hazard (or risk) of death for an individual, given their prognostic variables. In this model, time to censoring and survival times are independent. In other words, censoring is independent of unusually high or low risk for occurrence of event, which implies that survival times for censored and uncensored individuals is the same and removal of censored individuals from the analysis would yield an unbiased estimate of survival time or time to event (Cox, 1972).

The most important quantities in survival analysis are the survival and hazard functions. The survival function, at a specific time, provides the probability that a participant will "survive" until at least a designated time. The hazard function time gives the probability of "death" or event at a particular time, given that the participant has survived up to that time. In the context of the current study, death represented the first drink of alcohol. The hazard function is the basis for the regression analysis of survival data through the use of the Cox proportional hazards model (Cox, 1972). This model assumes that the hazard function for a participant is the product of a simple subject-specific factor and a complicated factor, the baseline hazard function that is common to all participants. The virtue of the Cox model is that the baseline hazard function drops out of the analysis, thus avoiding the need to make strong assumptions on its form. In terms of interpretation of the effects of covariates, Cox proportional hazards regression is similar to logistic regression. In logistic regression, the betas are log odds ratios in Cox proportional hazards regression, and the betas are log relative risks. The Cox-proportional method has the additional advantage of being able to establish influence of covariates such as demographic factors, nature of diseases, and treatment received on hazard/survival rate (Cox, 1972).

Survival functions were estimated for eight time-varying, predictor variables: 1) parental emotional support, 2) parental involvement, 3) parental supervision, 4) peer support, 5) teacher support, 6) neighborhood safety, 7) student depression, and 8) student anxiety. Proportional hazards models were used to examine these eight variables with alcohol onset as the dependent variable. A second set of proportional hazards models examined the relation between each predictor variable, and alcohol onset and race. Finally, proportional hazard models were used to examine the relationship between predictor variables, alcohol onset, race, and sex.

Because the data in this study were collected at a particular time period, the discrete-time survival analysis was used (Singer & Willett, 2003). Essentially, a series of discrete-time logit regression models were estimated to predict the age of first drink. Logit (log-odds) is expressed as a linear function of the independent variables (covariates) as: log(P(t)/(l - P(t)) = B0(t) + B.X, + B,X2(t), where P(t) refers to the hazard, B0(t) refers to the intercepts (one for each of the time intervals), X refers to the time-invariant covariate, and X2 refers to the time-variant covariate. For a time-invariant covariates, sex and race each take on a single value (1 = male, 0 = female), and race two values (AA = 0, white = 1). In contrast, a time-variant covariate (e.g., parental involvement) can take on a different value in each time period. Cox regression (or proportional hazards regression) allows for analyzing the effect of several risk factors on survival. The probability of the endpoint (death or any other event of interest, e.g. onset of alcohol use) is called the hazard. The hazard is modeled as: $H(t) = H_0(t) \times \exp(b_1X_1 + b_2X_2 + b_3X_3 + \cdots + b_kX_k)$, where $X_1 \cdots X_k$ are a collection of predictor variables and $H_0(t)$ is the baseline hazard at time, *t*, representing the hazard for a person with the value "0" for all the predictor variables.

Discrete-time hazard models were fitted to data using logistic regression software in R (R Development Core Team, 2015). The dichotomous outcome status was regressed on all of the

time dummy variables and selected independent variables. Similar to multiple regression, the construction of the hazard model required coefficient estimation and corresponding statistical tests to indicate the effect of a particular independent variable, while controlling for the effects of all other independent variables in the hazard model. In the current study, maximum likelihood estimates of model parameters and the obtained standard errors and Goodness of Fit statistic were used to test the hypotheses. As previously noted, the hazard model required the proportionality assumption to hold. Willett and Singer (2003) posited that researchers should assume that non-proportionality exists until proven wrong. To explore whether the effect of any independent variable varied over time, statistical interactions between independent variables and time indicators were examined. Significant interactions between an independent variable and time indicators imply that the proportionality assumption is violated. If a violation of the assumption was detected, the interaction terms remained in the hazard model to ensure the appropriate estimation of the effect of the independent variable. If the assumption was not violated, the interaction terms were removed.

Before using the logistic regression program to conduct the discrete-time survival analysis, the data structure was altered to create a separate observational record for each of the time (grade) intervals. Thus, the standard one-person, one-record data set (person-data set) was converted to a one-person, five-period (grade) data set. A set of dummy variables was created to take on values that indicated the particular time interval to which the record referred (grades 6, 7, 8, 9, 10). The dummy variables for event occurrence (first drink) was exposure = 1, no exposure = 0. All observational records of all subjects were then combined into a single data file with the person-period as the unit of analysis (Singer & Willett, 2003). This file included the

dichotomous outcome variable (exposure of first drink onset), dummy variables that specified the time (grade) intervals, and all other time-invariant and time-variant independent variables.

A series of nested logistic regressions was evaluated for each category. The model fitting exercise relied on likelihood ratio chi-square tests to evaluate each predictor's improvement in model fit, with significance at the 0.05 level as the criterion for inclusion in the final model. Once best-fitting models were selected, standard errors of parameter estimates, transformed into odds ratios for ease of interpretation, were evaluated at the 0.05 level of significance using two-tailed tests.

The censored observations (i.e., cases with no exposure to first drink onset) were subjects whose length of survival is unknown because they were still abstinent by the end of the study period. These censored observations were non-informative and operated independent of event occurrence, and the risk of event occurrence. The validity of a survival analysis rests on the assumption that censoring is non-informative (Singer & Willett, 2003). Right-censoring prevents direct estimation of the sample survival probability (because no information is available about the outcome status of censored cases). But, because there is an inextricable link between the survival and hazard probabilities, the sample survival function can be estimated indirectly by linear interpolation using the sample hazard function. At the end of data collection, individuals that had yet to experience an event (first drink) were assigned the event time they possessed at the end of data collection (censored event times). For any given period, the survival probability was multiplied from previous period by 1 minus the hazard probability for that period (given that censoring was independent of first drink occurrence) (Willett & Singer, 2003).

Main effect and interaction effect. To evaluate the importance of each independent variable on the hazard for first drink (i.e., the main effect models), the interaction terms of the

independent variables and time indicators were added to the main effect model to check the viability of the proportionality assumption. The effect of the time interaction was evaluated by examining its contribution to the prediction of the hazard. The model Goodness of Fit was summarized by the "-2 log-likelihood" statistic, which was asymptotically distributed as chi-square. Thus, the standard decrement to chi-square was examined to see if the extended model fit better than a reduced model. This Goodness of Fit statistic was also used for subsequent analyses in building the hazard models. If the extended model (i.e., a model with time interaction terms) significantly improved the prediction of hazard, it implied that the proportionality assumption was violated and the time interaction terms needed to remain in the hazard model (Singer & Willett, 2003).

Build hazard models. The simplest possible discrete-time hazard model with no substantive independent variables was fitted as the first step. The initial model contained five intercept terms, one per time period (grade) under study. The five intercept terms together described the shape of the overall fitted logit-hazard (log-odds) profile and served as a benchmark to which more complex models could be compared. Then, the main effect of each independent variable (substantive predictors) and its interaction effect with time (if significant in the previous analysis) were added to each subsequent model to examine any significant improvement in the prediction of hazard. The independent variables were entered into the model mechanically for first drink onset and time indicator interactions, race, and sex (covariates).

Perhaps the best form of data for answering questions about alcohol onset and risk factors is an event history (Allison, 1982). Although event histories are almost ideal for studying the causes of events, they also typically possess two features—censoring and time-varying

explanatory variables that create major difficulties for standard statistical procedures (Singer & Willett, 2003).

Logistic Regression

In addition to measuring confidence intervals of the relative risk associated with predictive factors and corresponding p-values, measures of the variation of first drink onset as explained by predictive factors was required. The statistical measure, R-square (R^2), represents the percentage of first drink onset that can be explained by the predictor variables. The R-square values range from 0 to 100. An R-square value of 100 meant that first drink onset was completely explained by the predictor variables. A high R-square has a range between 85 and 100. A higher R-square value indicated a more useful beta figure. In a logistic regression, the maximum R-square is less than one, therefore the adjusted R-square was used to achieve one at its maximum (Nagelkerke, 1991).

Problems of censoring and time-varying explanatory variables are major impediments to the application of standard analytic techniques to longitudinal data on the occurrence of events. The essence of the methods in a survival analysis is to break up each individual's event history into a set of discrete time units in which an event either did or did not occur. Pooling these time units over all individuals, helps one obtain maximum-likelihood estimators for binary regression models (Allison, 1982). The resulting estimators are true maximum-likelihood estimators of models that are exact analogs to those for discrete-time data. The methods can be readily extended to the analysis of repeated events and multiple kinds of events (Allison, 1982).

Chapter 5: Results

Main Effects

Life tables. The goal of the current study was to investigate the occurrence of first drink onset and to identify the predictor(s) that place middle school students at risk. The fundamental problem in a study such as this, is how to handle censored observations. That is, the observations of those students who do not experience the target event during data collection. Survival analysis was used to overcome these difficulties and to describe patterns of occurrence, which were compared among predictor variables. Statistical models of the risk of occurrence over time were then built. The research questions examined whether or not students drank alcohol, which students drank alcohol (sex and race), and when those students drank alcohol (in which grade). These questions were answered using life tables, hazard functions, and survival functions. The predictors that significantly influenced first drink onset were shown using discrete-time analyses.

All essential elements of the life tables were calculated through cross-tabulation of period and event in the person-period data set. Each row, in Table 6, Table 7, and Table 8, describes the event histories of those students in the risk set during the time period. Table 6 indicates age of onset for alcohol use beginning in the sixth grade with a total of seven students reporting first drink. The youngest student in the sixth grade was 11 years old at the time of data collection. These findings support the first hypothesis that first drink would occur at age 11 years. Out of the 663 students, approximately 43 percent did not report alcohol onset by tenth grade (see Table 8).

First drink estimates by sex showed little to no difference in risk for first drink. The second hypothesis that onset of first drink for boys would be earlier than for girls was not supported

according to this finding. The hazard probability (first drink) in Table 8 shows a significant increase in first drink onset from eighth to ninth grades than for previous grades, and an even greater percent of first drink onset from ninth to tenth grade for the total sample (18 to 20 percent, respectively).

The hazard probability did not indicate racial differences in age of onset of alcohol use (see Table 7). The third hypothesis, that Caucasian students would have an earlier onset of alcohol use than African American students, was not supported. As a result of the findings, the fourth hypothesis that Caucasian boys would have earlier first drink onset than Caucasian girls, and African American boys and girls was also not supported (Table 8). By the tenth grade however, more Caucasian boys experienced first drink onset compared to African American boys (Table 8). Caucasian and African American girls were similar in their reports of first drink onset in every grade. The hazard and survival functions illustrate first drink patterns of the sample.

Table 6.

Life Table Describing the Grade at First Drink by Sex

Grade	N= No first drink	N=Students who drank alcohol	Hazard probability	Survival probability
Girls				
6	387	5	0.01	0.99
7	382	8	0.02	0.97
8	374	49	0.13	0.84
9	176	41	0.23	0.64
10	65	21	0.32	0.44
Boys				
6	276	2	0.01	0.99
7	274	9	0.03	0.96
8	265	41	0.16	0.81
9	126	25	0.20	0.65
10	55	19	0.35	0.43

Table 7.

Life Table Describing the Grade at First Drink by Race

Grade	N= No first drink	N=Students who drank alcohol	Hazard probability	Survival probability
African American				
6	93	3	0.03	0.97
7	90	4	0.04	0.93
8	86	8	0.09	0.84
9	49	11	0.22	0.65
10	13	5	0.39	0.40
Caucasian				
6	570	4	0.01	0.99
7	566	13	0.02	0.97
8	553	82	0.15	0.83
9	253	55	0.22	0.65
10	107	35	0.33	0.44

Table 8.

Life Table Describing the Grade at First Drink by Sex and Race

Grade	N= No First Drink	N=Students who drank alcohol	Hazard probability	Survival probability
African American Girls				
6	52	2	0.04	0.96
7	50	3	0.06	0.90
8	47	1	0.02	0.89
9	32	8	0.25	0.66
10	7	2	0.29	0.47
Caucasian Girls				
6	335	3	0.01	0.99
7	332	5	0.02	0.98
8	327	48	0.15	0.83
9	144	33	0.23	0.64
10	58	19	0.33	0.43
African American Boys				
6	41	1	0.02	0.98
7	40	1	0.03	0.95
8	39	7	0.18	0.78
9	17	3	0.18	0.64
10	6	3	0.50	0.32
Caucasian Boys				
6	235	1	0.00	1.00
7	234	8	0.03	0.96
8	226	34	0.15	0.82
9	109	22	0.20	0.65
10	49	16	0.33	0.44
Total Sample				
6	663	7	0.01	0.99
7	656	17	0.03	0.96
8	639	90	0.14	0.83
9	302	66	0.22	0.65
10	120	40	0.33	0.43

Hazard and Survival Functions

The hazard estimate plots for first drink by sex demonstrate a growth trajectory of first drink among boys and girls in discrete time (grade). Figure 1 shows that the hazard probability associated with first drink increased steadily over time for both girls and boys. There are distinctive peaks that pinpoint periods of elevated risk beginning in the eighth grade for both boys and girls, but more particularly for boys. By ninth grade however, exposure for boys (first drink) seems to dip slightly, while girls continue increasing steadily until the tenth grade. The shape of the estimated hazard function, general profile, indicates the increase of first drink risk is monotonic from sixth grade to tenth grade.

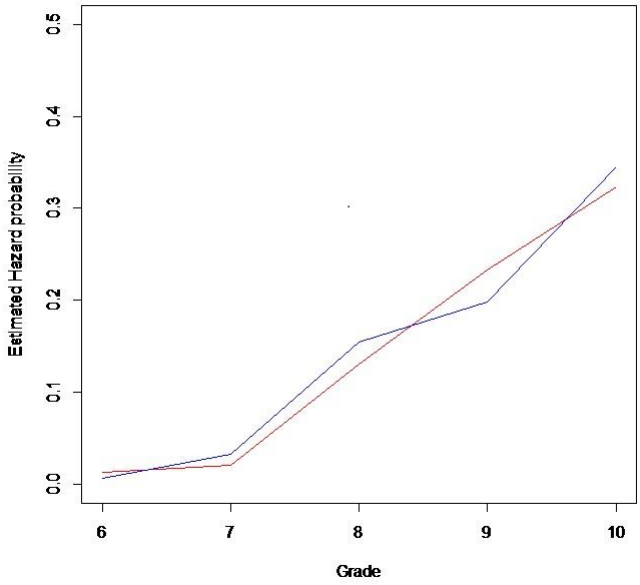

Figure 1. This figure shows the estimated hazard functions for grade at first drink by sex. Girls are represented by the red line, and boys by the blue line.

The survival function for first drink and sex shares a common shape with the hazard function, a monotonically decreasing function of time (see Figure 2). At sixth grade, each estimated survival function took on a value of 1.0, but over time as first drink occurred, each dropped

toward zero. Because some students may never drink alcohol regardless of how long data collection lasts, few estimated survival functions would fall to zero. The survival function estimates that 40 percent of the population survived (did not drink alcohol) by the last observation period (tenth grade). The survival function provided a context for evaluating the period-by-period risks reflected in the hazard function. When the estimated survival probability drops rapidly and the hazard is high, as in this case, many students were affected (at risk). Based on the hazard and survival functions, the hypothesis that onset of first drink for boys would be earlier than for girls was not supported.

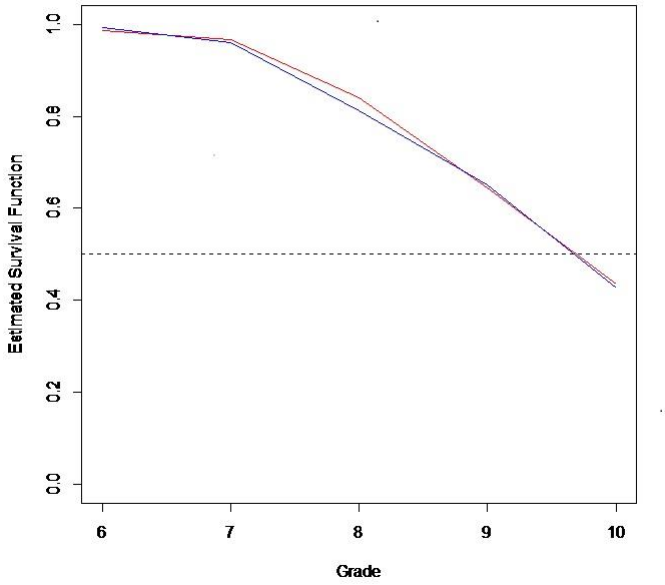

Figure 2. This figure shows the survival functions for grade at first drink by sex. Girls are represented by the red line, and boys by the blue line.

The hazard function estimates of first drink by race demonstrated a monotonically increasing function of time for both African American and Caucasian students. Figure 3 shows that the hazard probability associated with first drink increased steadily over time for both African American and Caucasian students. The plot indicates a peak in onset of alcohol use for

Caucasian students in the eighth grade, and a peak between eighth and ninth grades for African American students.

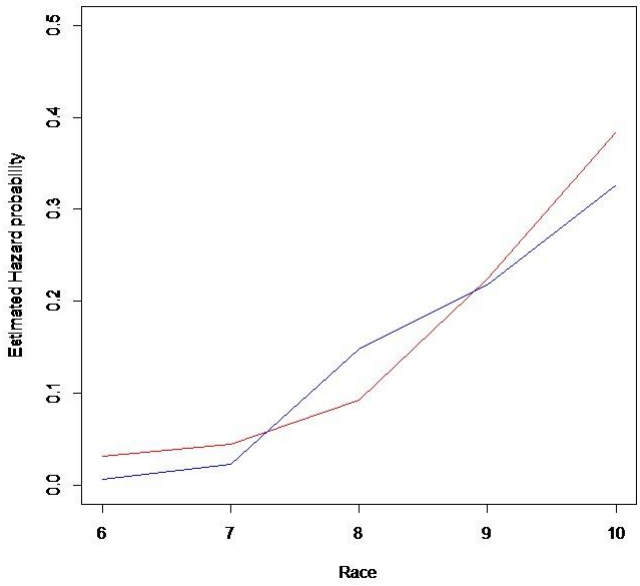

Figure 3. This figure shows hazard functions for grade at first drink by race. African American students are represented by the red line, and Caucasian students by the blue line.

The survival function accumulates risk for first drink to estimate the fraction of the population remaining in the next grades (students who did not drink), and its value indicates the proportion of students exposed to first drink in each grade. The survival function (see Figure 4) provides a context for evaluating both prevalence (event occurrence over sixth to tenth grades) and incidence (number of events at each grade). Based on the hazard and survival functions, there were patterns showing minimal differences between Caucasian and African American onset of first drink. The hypothesis that first drink onset for Caucasian students would be earlier than for African American students was not supported.

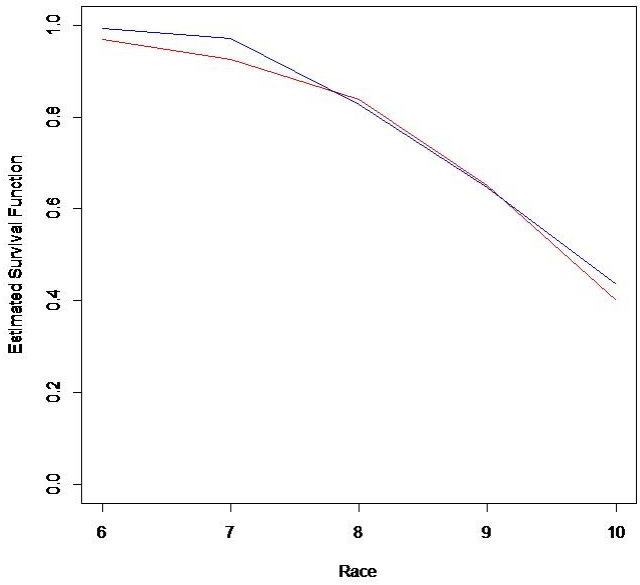

Figure 4. This figure shows survival functions for grade at first drink by race. African American students are represented by the red line, and Caucasian students by the blue line.

The estimated hazard function for first drink by sex and race indicates that 50 percent of African American boys drank by tenth grade (see Figure 5). The shape of the overall sample is, again, increasingly monotonic—meaning there is a steady increase of risk for first drink up to tenth grade. These estimates indicate that eighth grade is a risky time period for first drink occurrence for both African American and Caucasian boys and Caucasian girls. The hazard estimates that African American girls are more at risk in the ninth grade and actually are less at risk for first drink onset in the eighth grade. The model shows similar visual patterns of risk for first drink at each time period Caucasian boys and girls.

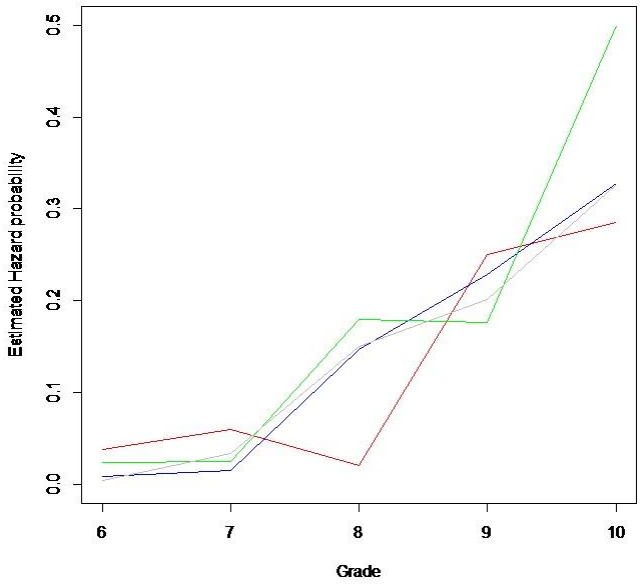

Figure 5. This figure shows the hazard functions by sex and race. African American girls are represented by the red line, Caucasian girls by the blue line, African American boys by the green line, and Caucasian boys by the gray line.

The survival function indicated that by sixth grade some African American girls and boys have had their first drink. Of these students, five were girls (two African American) and two were boys (one African American) (see Table 8). In Figure 6, as the first drink event occurred, the survival function declines toward 0 (its lower bound). The survival function drops rapidly because the hazard is high (first drink occurrence), especially between eighth and ninth grades. For African American and Caucasian girls, their estimated survival probability drops the most from eighth to ninth grade (first drink onset). African American and Caucasian boys have the largest decline in their estimated survival probability from ninth to tenth grades (first drink onset occurrence). The hazard and survival functions do not support the hypothesis that onset of first drink for Caucasian boys is earlier than for Caucasian girls and African American boys and girls. The results show very similar time periods for first drink onset for sex and race, until the tenth

grade. At that point, Caucasian boys experience first drink onset more frequently than African American boys.

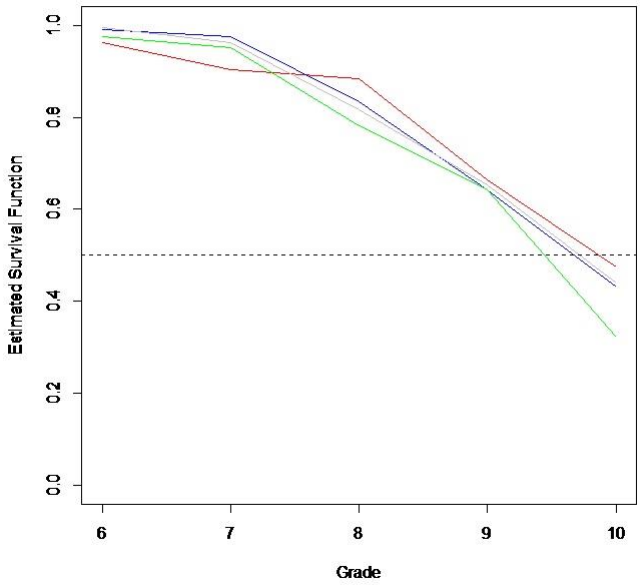

Figure 6. This figure shows the survival functions by sex and race. African American girls are represented by the red line, Caucasian girls by the blue line, African American boys by the green line, and Caucasian boys by the gray line.

Interaction Effects

Discrete-time hazard models. To address the research questions regarding what risk factor(s) place a middle school student at risk for first drink onset and at what point in time, discrete-time hazard models were fitted to the data. Goodness of Fit was established by the *LL* (lower limit) statistic. The smaller the *LL*, the better the fit. All discrete-time hazard models that were run had ideal *LL* statistics. The deviance-based hypothesis indicated statistical significance of the predictors. Discrete-time hazard models were used to introduce the possibility that the sample is heterogeneous, and that different students (distinguished on the basis of their values of the substantive predictors of alcohol onset) may have different hazard functions. The following tables introduce the predictor time varying variables (parental emotional support, involvement

and supervision, peer support, teacher support, neighborhood safety, depression, and anxiety). These predictors are operational variables supported by the ecological model framework.

Fitted discrete-time hazard models. Fitted discrete-time hazard models were examined separately for each predictor variable for risk of first drink and lack of parental emotional support (see Table 9), parental involvement (see Table 10), parental supervision (see Table 11), lack of teacher support (see Table 12), and depression (see Table 13). All of the predictors, but depression ($p < .10$) were significant at $p < .001$ for sixth and seventh grades. Parental supervision was also significant at $p < .001$ for eighth grade and at $p < .10$ for ninth grade. Teacher support was significant at $p < .10$ for tenth grade in predicting first drink onset. Feelings of depression significantly predicted first drink onset at $p < .10$ for students in sixth through tenth grades. Neighborhood safety and anxiety did not significantly predict first drink onset in this sample. There were no significant differences in predictor variables for sex and race. These findings partially support the fifth hypothesis that more proximal factors (parental emotional support, involvement, and supervision) and person characteristics would predict first drink onset. Moreover, depression was significant for first drink, but anxiety was not. Teacher support, a proximal relationship but typically more distal compared to parent-child factors, was significant in predicting onset. An interesting finding, despite literature to the contrary, was that peer support did not predict first drink onset in this sample.

Table 9.

Fitted Discrete-Time Hazard Model for Parental Emotional Support

	Estimate	SE	z value	Pr(>|z|)	Sig
Period 6	-2.48951	0.57928	-4.298	.000	***
Period 7	-2.03053	0.49044	-4.14	.000	***
Period 8	-0.47254	0.43825	-1.078	0.28	-
Period 9	0.05662	0.44241	0.128	0.90	-
Period 10	0.63819	0.4672	1.366	0.17	-
Sex	0.29807	0.41393	0.72	0.47	-
Race	0.09859	0.30448	0.324	0.75	-
Sex:Race	-0.26652	0.44594	-0.598	0.60	-
Parent Emotional Support	-0.45508	0.09828	-4.63	.000	***
Goodness of Fit					
LL	-584.772				
Deviance	1169.5				
n parameters	9				
AIC	1187.5				
BIC	1218				
Deviance-based Hypothesis Tests					
H0: βemo=0	20.86				
H0: βinv=0	-				
H0: βsup=0	-				

Table 10.

Fitted Discrete-Time Hazard Model for Parental Involvement

	Estimate	SE	z value	Pr(>|z|)	Sig
Period 6	-2.39895	0.561497	-4.272	.000	***
Period 7	-1.98672	0.46673	-4.257	.000	***
Period 8	-0.49818	0.402465	-1.238	0.22	-
Period 9	0.005745	0.401682	0.014	0.99	-
Period 10	0.558772	0.428577	1.304	0.19	-
Sex	0.286684	0.416505	0.688	0.49	-
Race	-0.0013	0.307266	-0.004	1.00	-
Sex:Race	-0.17206	0.448717	-0.383	0.70	-
Parent Involvement	-0.55749	0.104237	-5.348	.000	***
Goodness of Fit					
LL	-582.366				
Deviance	1164.7				
n parameters	9				
AIC	1182.7				
BIC	1213				
Deviance-based Hypothesis Tests					
H0: βemo=0	-				
H0: βinv=0	29.61				
H0: βsup=0	-				

Table 11.

Fitted Discrete-Time Hazard Model for Parental Supervision

	Estimate	Std. Error	z value	Pr(>|z|)	Sig
Period 6	-3.31955	0.50408	-6.585	.000	***
Period 7	-2.85592	0.40306	-7.086	.000	***
Period 8	-1.33194	0.33413	-3.986	.000	***
Period 9	-0.80644	0.33539	-2.404	0.02	*
Period 10	-0.24692	0.36926	-0.669	0.50	-
Sex	0.36884	0.41371	0.892	0.37	-
Race	0.0902	0.30417	0.297	0.77	-
Sex:Race	-0.28806	0.44532	-0.647	0.52	-
Parental Supervision	-0.33126	0.08139	-4.07	.000	***
Goodness of Fit					
LL	-587.966				
Deviance	1175.9				
n parameters	9				
AIC	1193.9				
BIC	1224				
Deviance-based Hypothesis Tests					
H0: βemo=0	-				
H0: βinv=0	-				
H0: βsup=0	17.97				

Table 12.

Fitted Discrete-Time Hazard Model for Teacher Support

	Estimate	SE	z value	Pr(>|z|)	Sig
Period 6	-2.2914	0.5519	-4.152	.000	***
Period 7	-1.8531	0.4585	-4.042	.000	***
Period 8	-0.2294	0.4105	-0.559	0.58	-
Period 9	0.3063	0.4151	0.738	0.46	-
Period 10	0.8997	0.451	1.995	0.05	*
Sex	0.2322	0.4021	0.578	0.56	-
Race	0.1003	0.2963	0.339	0.74	-
Sex:Race	-0.291	0.4346	-0.67	0.50	-
Teacher Support	-0.5898	0.104	-5.671	.000	***
Goodness of Fit					
LL	-587.329				
Deviance	1174.7				
n parameters	9				
AIC	1192.7				
BIC	1223				
Deviance-based Hypothesis Tests					
H0: βpeer=0	-				
H0: βneig=0	-				
H0: βteacher=0	32.09				

Table 13.

Fitted Discrete-Time Hazard Model for Depression

	Estimate	SE	z value	Pr(>|z|)	Sig
Period 6	-4.56724	0.51855	-8.808	.000	***
Period 7	-4.06779	0.42584	-9.552	.000	***
Period 8	-2.46314	0.36596	-6.731	.000	***
Period 9	-1.95128	0.37293	-5.232	.000	***
Period 10	-1.42101	0.41515	-3.423	0.00	***
Sex	0.3978	0.40117	0.992	0.32	-
Race	0.03845	0.29631	0.13	0.90	-
Sex:Race	-0.26217	0.43236	-0.606	0.54	-
Depression	0.24838	0.09821	2.529	0.01	*
Goodness of Fit					
LL	-600.621				
Deviance	1201.2				
n parameters	9				
AIC	1219.2				
BIC	1250				
Deviance-based Hypothesis Tests					
H0: βdep=0	6.45				
H0: βanx=0	-				

Parental predictors. In Table 14, the fitted discrete-time hazard model for parental time, with varying emotional support, involvement, and supervision together, indicated that lack of parental involvement and supervision significantly predicted the risk of first drink in sixth grade (p = .00), seventh grade (p = .00), and in tenth grade (p = .05). When parental predictors were fitted together, the significance in predicting first drink onset decreased for all three variables. The lack of parental emotional support was not found to significantly predict first drink when fitted with involvement and supervision. There were no significant sex or racial differences for parental predictors in risk for first drink.

Table 14.

Fitted Discrete-Time Hazard Model for Parental Emotional Support, Parental Involvement, & Parental Supervision

	Estimate	Std. Error	z value	Pr(>|z|)	Sig
Period 6	-1.9605	0.598639	-3.275	0.00	**
Period 7	-1.55401	0.508111	-3.058	0.00	**
Period 8	-0.0723	0.453403	-0.159	0.90	-
Period 9	0.405866	0.455018	0.892	0.37	-
Period 10	0.960354	0.478291	2.008	0.05	*
Sex	0.308978	0.417006	0.741	0.46	-
Race	0.001216	0.307921	0.004	1.00	-
Sex:Race	-0.20361	0.449396	-0.453	0.65	-
Parental					-
Emotional Support	-0.19311	0.125981	-1.533	0.13	-
Involvement	-0.33438	0.14185	-2.357	0.02	*
Supervision	-0.18644	0.089973	-2.072	0.03	*
Goodness of Fit					
LL	-576.823				
Deviance	1153.6				
n parameters	11				
AIC	1175.6				
BIC	1213				
Deviance-based Hypothesis Tests					
H0: βemo=0	20.89				
H0: βinv=0	11.46				
H0: βsup=0	4.4				

Peer support, teacher support, and neighborhood safety predictors. The fitted discrete-time hazard model for time with varying peer support, teacher support, and the more distal factor, neighborhood safety, indicated that teacher support, as shown in Table 15, significantly predicted the risk of first drink onset in the sixth grade ($p = .0005$) and in the seventh grade ($p = .0015$). In all model relationships, peer support and neighborhood safety did not predict first drink onset. Again, no significant differences in sex and race were found.

Table 15.

Fitted Discrete-Time Hazard Model for Peer Support, Neighborhood Safety, & Teacher Support

	Estimate	Std. Error	z value	Pr(>|z|)	Sig
Period 6	-2.4549	0.710386	-3.456	0.00	***
Period 7	-2.01459	0.634655	-3.174	0.00	**
Period 8	-0.43089	0.602775	-0.715	0.48	-
Period 9	0.069973	0.605174	0.116	0.91	-
Period 10	0.742894	0.623644	1.191	0.23	-
Sex	0.326533	0.417387	0.782	0.43	-
Race	0.12796	0.305672	0.419	0.68	-
Sex:Race	-0.37625	0.447213	-0.841	0.40	-
Peer Support	0.070257	0.131775	0.533	0.59	-
Neighborhood Safety	0.005452	0.088738	0.061	0.95	-
Teacher Support	-0.62472	0.111489	-5.603	.000	***
Goodness of Fit					
LL	-571.802				
Deviance	1143.6				
n parameters	11				
AIC	1165.6				
BIC	1203				
Deviance-based Hypothesis Tests					
H0: βpeer=0	1.68				
H0: βneig=0	0.10				
H0: βteacher=0	31.46				

All predictors. When all predictors were fitted into the discrete-time model, lack of teacher support was found to be significant in both sixth (p = .02) and seventh grades (p= .04) (see Table 16). The fifth hypothesis that more proximal factors, than distal (parent, peer, then teacher supports and neighborhood safety) with accompanying depression and anxiety, would significantly predict alcohol onset, was not supported by the fitted discrete-time full model. Teacher support was the only risk variable that predicted first drink onset for both African

American and Caucasian students regardless of sex or race. The full model did not identify any predictors influencing sex or race differently in predicting first drink onset.

Table 16.

Fitted Discrete-Time Hazard Model for All Predictors of Onset for First Drink

	Estimate	Std. Error	z value	Pr(>|z|)	Sig
Period 6	-1.93377	0.83594	-2.313	0.02	*
Period 7	-1.57066	0.76543	-2.052	0.04	*
Period 8	-0.08339	0.73584	-0.113	0.91	-
Period 9	0.33821	0.74213	0.456	0.65	-
Period 10	0.96737	0.7665	1.262	0.21	-
Sex	0.40051	0.42127	0.951	0.34	-
Race	-0.05429	0.31185	-0.174	0.87	-
Sex:Race	-0.27199	0.45034	-0.604	0.55	-
Parental Emotional Support	-0.07779	0.13916	-0.559	0.58	-
Involvement	-0.27585	0.1451	-1.901	0.06	-
Supervision	-0.13588	0.09088	-1.495	0.14	-
Peer Support	0.14806	0.13709	1.08	0.28	-
Neighborhood Safety	-0.0418	0.09258	-0.451	0.66	-
Teacher Support	-0.46054	0.12106	-3.804	0.00	***
Depression	0.09303	0.13776	0.675	0.50	-
Anxiety	0.04162	0.12384	0.336	0.74	-
Goodness of Fit					
LL	-560.834				
Deviance	1121.7				
n parameters	16				
AIC	1153.7				
BIC	1208				
Deviance-based Hypothesis Tests					
H0: βemo=0	21.32				
H0: βinv=0	10.38				
H0: βsup=0	3.41				
H0: βpeer=0	0.08				
H0: βneig=0	0.06				
H0: βteacher=0	14.45				
H0: βdep=0	1.18				
H0: βanx=0	0.12				

Logistic Regression

The logistic regression model explained the relationship between the predictor variables and first drink onset, indicating an overall Goodness of Fit for the data. Table 17 shows that the predictor variables collectively accounted for modest variance in meaning in first drink onset. It is important to note that even though adjusted R-square values are moderate, the study produced statistically significant predictors. Therefore, important conclusions about how changes in the predictor values are associated with changes in the response value can be drawn. Regardless of the adjusted R-square, the significant coefficients still represent the mean change in the response for one unit of change in the predictor while holding other predictors in the model constant.

Table 17.

Logistic Regression Model for Predictor Variables: Parental Emotional Support, Involvement, Supervision, Peer and Teacher Support, Depression, and Anxiety

Predictor Variable	Adjusted R-square*
No Predictors	0.162010
Sex	0.162196
Race	0.162023
Sex:Race	0.162655
All Predictors	0.243349
All Without Sex and Race	0.241787
Depression and Anxiety	0.169854
Depression	0.169699
Anxiety	0.165981
Parent Emotional Support/Involvement/Supervision	0.213717
Emotional Support	0.199188
Involvement	0.203435
Supervision	0.193297
Teacher/Peer/Neighborhood	0.223229
Teacher Support	0.194122
Peer Support	0.171098
Neighborhood Safety	0.185512

Note. In logistic regression, the maximum R-square is less than 1, the adjusted R-square was used which Nagelkerke (1991) proposed the adjustment of the R-square to achieve 1 at its maximum.

Summary

The results of the current study suggest that when predictors are fitted in a discrete-time model separately, lack of parental emotional support, involvement, supervision, teacher support, and depression predict first drink onset. When the discrete-time full model was run, teacher support was the most significant in predicting first drink onset. The multiple regression model found that both parental involvement and teacher support predicted onset. These findings partially support the fifth hypothesis that, along with person characteristics, lack of support from the most proximal relationships to the student will have the strongest influence in predicting first drink onset. The findings did not support hypotheses on sex and race. The hazard and survival functions indicated that sex and race do not factor into risk of first drink onset. A significant developmental finding of the hazard and survival functions was that the transition from eighth grade to ninth grade is a risky time for middle school students with respect to first drink onset.

Chapter 6: Discussion

Despite the declines in overall alcohol use among adolescents over a 22-year period, current data show that 30 percent of youth continue to drink (Centers for Disease Control and Prevention, 2011). Underage alcohol use can be viewed as a developmental phenomenon because many kinds of developmental changes and expectations appear to influence this behavior, and also because it has consequences for development (Masten, et al., 2009).

Risky personal characteristics and risky environments from infancy onward can funnel the individual onto a pathway of risk aggregation and cumulative disadvantage leading to a greater likelihood of early onset of alcohol and other drug use, delinquency, and depression in adolescence, as well as problem behaviors throughout the adult years (Fitzgerald et al., 2007; Fitzgerald, Wong & Zucker 2013; Mayzer, Fitzgerald, & Zucker, 2009). Therefore, many of the effects that alcohol use has on middle school students depends on the developmental timing of first drink onset. A review of literature about onset of alcohol use shows that the younger individuals are when they first begin drinking, the greater their level of problems associated with alcohol misuse later in life (Hawkins et al., 1997). However, it was not clear which set of multi-causal factors actually predict early onset drinking. Preventing the consequences of early onset drinking is, in part, dependent on what factors predict onset and for whom.

The current study sought to discern and expand the knowledge of causal factors for early onset drinking among early to middle adolescents and to identify which predictors seem most important at each age/grade level. Bronfenbrenner's bioecological model was used as a conceptual framework for understanding the proximal and distal interactions of family, peer, school, community, depression, and anxiety and their linkages to alcohol use onset. The use of a bioecological framework to better understand alcohol onset and associated predictors proved to

be a valuable model in this study. Additional knowledge was gained from this research regarding proximal and distal risk factors predicting the onset of alcohol use, and these offer important implications for prevention research.

First Drink Onset

Age of onset. The first hypothesis predicted that the age of onset would be 11-years-old. The hazard function probability on age of first drink confirmed this hypothesis and notably replicated findings from national survey-based studies. The life tables indicated that 14 percent of the sample had their first drink in the eighth grade, 22 percent in the ninth grade, and 33 percent in the tenth grade, replicating the proportions of eighth, tenth, and twelfth graders who reported first drink onset at 24 percent, and 37 percent, respectively in the Monitoring the Future survey (MTF; Johnston, et al., 2014). Although not surprising, this is a significant outcome in that youth whose use of alcohol begins earlier—in this case early adolescence—are much more likely to develop alcohol dependence later in life (Matsen et al., 2009). With major contemporary challenges to the non-replication of biomedical and social-behavioral research, these replications add significantly to recent findings about age of onset across diverse samples and research methods (Harris et al., 2013).

An interesting finding was the grade level associated with the greatest risk for first drink occurrence. The discrete-time hazard probabilities yielded that the time of greatest risk for first drink onset was most likely to occur in the eighth grade. Further, the hazard function illustrated a sharp increase in first drink occurrence from eighth to ninth grades specifically. This has significant implications in that both short-term and long-term effects of alcohol use vary in part as a function of the development of the child. Considering the utility of the bioecological model, it was prudent to examine the changing proximal processes occurring for eighth grade students.

Students in the eighth grade are, on average, 13-years-old and are more likely to be in the midst of puberty with girls about two years ahead of boys with respect to completion of pubescent changes. Notably, underage drinking can cause alterations in the structure and function of the developing brain and may have consequences reaching far beyond adolescence (Lemstra, Bennett, Neudorf, Kunst, Nannapaneni, Warren, & Scott, 2008). Moreover, the effects on neurobiological development may vary between genders given the maturational lag in boys. In addition, Weiss & Bearman, (2007) examined the effects of school transitions from eighth to ninth grades and found that significant exogenous changes that occur include: 1) parental involvement with youth changes as adolescents gets older, 2) parents generally give their students greater autonomy, and 3) the influence of peer groups increases. Little is known about the influence of these developmental social-behavioral changes with respect to their influence on continued risk for alcohol use disorders.

Sex as a factor in onset. The second hypothesis posited that boys would have an earlier onset than girls, but this was not supported by the discrete-time hazard analysis. The extant research using national databases indicates that girls are drinking alcohol earlier than in the past, but not quite as early as boys (Chen et al., 2015). However, Sentse et al. (2009) examined risk factors for alcohol use onset and did not find sex differences in their longitudinal study. Want et al. (2005) also failed to find sex differences in their longitudinal study examining risk factors in alcohol onset. It is important to note that the hazard function on sex did illustrate that the shape of the monotonic increase in onset was slightly sharper for boys by the tenth grade. Overall, this finding is in keeping with the extant literature that girls are taking their first drink earlier than in the past, but perhaps the rate of increase for boys during adolescence is sharper than that for

girls. The extent to which this sharp increase reflects the difference in maturational rates of boys and girls has not yet been addressed in the literature.

Race as a factor in onset. The third hypothesis predicted that Caucasian middle school students would experience first drink onset earlier than African American students. This hypothesis was not supported. The discrete-time hazard probabilities indicated that event occurrence was not statistically significant by race. The existing literature suggesting that Caucasians are taking their first drink earlier than their African American counterparts is well-established. However, the findings of the current study are inconsistent with the existing literature, as Caucasians did not experience onset drinking earlier than African Americans. However, the hazard function did illustrate interesting patterns in first drink onset over time by race. For instance, there was a sharp increase in first drink onset in eighth grade for Caucasian students, but not for African American students.

African American students were shown to experience an increase in first drink onset sharply from ninth grade to tenth grade, even surpassing Caucasian students in this study. There are developmental implications that may indicate that the vulnerability to risk factors are different by race at different time periods. It is known that African American rates for alcohol use disorder (AUD) are lower than those for Caucasians in general, although African Americans have higher rates of negative health outcomes associated with AUD. Differential rates of more acute health disorders among African American may or may not be related to age of onset, but the current study did replicate delayed onset in this population.

The fourth hypothesis was also not supported. It was expected that first drink onset would be earlier than for Caucasian boys than for Caucasian girls and African American boys and girls. The discrete-time hazard probabilities yielded no statistically significant differences by race or

sex. However, the hazard functions did illustrate interesting findings. Surprisingly, African American girls had a slightly earlier first drink onset than the rest of the sample, and a more predominant increase in the ninth grade than the rest of the sample as a whole. In comparison, Caucasian girls had a sharp increase in the eighth grade for first drink onset and then an even more pronounced increase in the tenth grade.

Research on the developmental implications for age and race effects on early onset is limited. Earlier onset drinking for African American girls may be embedded within the complexity of racial inequities and discrimination, but this explanation is weak in that African American boys also experience the same racial disparities. Coker et al. (2009) found that African American adolescents experience levels of discrimination that exceed those reported by adolescents of any other minority group, and these stressors take a toll on developmental outcomes. West, Sabol, and Greenman (2010) found that African American adolescents are six times more likely than Caucasians to be arrested, and three times more likely to drop out of school. Discrimination is stressful at any age, but its impact appears to be especially pronounced when it is experienced in early adolescence. Gibson, Gerrard, and Pomery (2010) found that African American youth report significant experiences with racial discrimination as early as 10 years of age and that these experiences are associated with elevated levels of depression, anxiety, and substance abuse. How these ecologically embedded factors related to discrimination may interact with developmental age—and particularly with peer influences during puberty—have yet to be determined. In addition, how factors related to racial inequities and discrimination factor into onset of substance abuse including alcohol, have yet to be fully explained. Within the current sample, African American children were also more likely to attend urban schools, perhaps leading to more closely knit peer group influences than the children from predominately

Caucasian schools in more rural areas of Genesee County. Peer influences have been connected to alcohol use, although peer support in the current study did not emerge as a predictor of onset. Clearly, more in-depth and focused studies of such contextual factors need to occur before drawing any conclusions about racial variations in onset based on the current findings.

Predictors for First Drink Onset

The final hypothesis predicted that multiple factors would forecast early onset of alcohol use, and that degree of prediction would vary as a function of the degree of proximity that those factors had to the students. Factors more proximal to the students were those related to parents, and included lack of support from parents (emotional support, involvement and supervision), followed by more distal factors such as lack of peer support, lack of teacher support, and lack of neighborhood safety. Person characteristics, such as depression and anxiety, can shape the course of development through their capacity to affect the direction and power of proximal processes, and it was thus necessary to consider them when examining predictors of first drink onset. This hypothesis was partially supported by the discrete-time hazard probabilities models.

When the fitted discrete-time hazard models were examined separately for each predictor for risk of first drink, lack of parental emotional support, parental involvement, and parental supervision, lack of teacher support, and student depression predicted onset of first drink. Lack of peer support, neighborhood safety, and student anxiety were not predictors of first drink. Consistent with person-oriented approaches to personality and behavior, depression—although not anxiety—predicted first drink. The more proximal processes such as parent variables and lack of teacher support predicted first drink, but peer support did not. Within the context of this study, it was not possible to determine whether intrapersonal or more proximal parental factors were causally linked to first drink. It was more likely, in fact, that parenting and early life-course

experiences contribute to the etiology of childhood depression and that mediational and/or moderational factors shape pathways leading to early alcohol use onset (Fitzgerald, Wong, & Zucker, 2013).

The correlation between parent factors and adolescent alcohol onset are well-established in the literature. Ryan, Jorm &, Lubman (2013) found evidence that parental monitoring and quality parent-child relationships were associated with delays in early alcohol initiation. Morton and Chen (2005) found that the growth in number of friends who drank was positively associated with adolescent drinking, but parental involvement and monitoring over time served as protective factors against persistent continued drinking. Sentse et al. (2009) found that when parent and peer contexts were examined, it was only parent factors that were associated with alcohol use. They concluded that parental support might enhance a child's social competence, which in turn may predict peer group selection processes leading adolescents to choose to associate with peers who do or do not drink.

Lack of neighborhood safety did not predict first drink in any analysis. Neighborhood safety was clearly the most distal predictor of those examined in this study. Wallen & Rubin (1997) found that children who lived in neighborhoods with high rates of violent crime and reported alcohol use were more likely to have emotional and social problems. Muller et al. (2000) found that correlations that were significant between violent neighborhoods and alcohol use depended on the extent of low social support. Dearing et al. (2009) pointed out that children who grow up poor and live in unsafe neighborhoods are more likely to use alcohol. Therefore, the fact that neighborhood effects were completely unconnected with early onset drinking was an unexpected finding. It is possible that the items in the current measurement tool were insufficient to detect

neighborhood effects in the current samples, or that the small sample sizes from rural schools versus urban schools somehow differentially dampened the impact of neighborhood.

The literature supporting depression and anxiety as factors predicting first drink is mixed. Indeed, in the current study only depression predicted onset. Cloninger, Sigvardsson, and Bohman (1988) argued that child characteristics have predictive utility in understanding later alcohol use and dependence. Oshri, Rogosch, Burnette, and Cicchetti's (2011) research did not support a pathway linking internalizing symptoms such as depression and anxiety to adolescent substance use. However, McCarty et al. (2013) found that when measuring depression as a risk factor for adolescent alcohol use, a pattern of growth in depression predicted later alcohol use, not the momentary or static level of depression at any particular point in time. Depression was the only predictor significant at every grade when assessed in a separate model.

When all of the predictors were fitted in the discrete-time hazard probabilities model, lack of teacher support was found to be significant in both sixth and seventh grades, independent of child sex or race. This was a surprising finding. Apparently, the quality of adolescents' relationships with their teachers plays an important role in determining their decisions about substance use. The students who reported teachers who offered or provided emotional support (trust, empathy), instrumental support (resources such as time), informational support (advice on a particular area), and appraisal (evaluative feedback to students) were more likely to delay substance use (Suldo et al., 2007).

Teacher support, although a proximal process according to the bioecological model, is considered more distal to the child in relationship to parent and peer factors. Even so, outside of the immediate family, the school setting has been identified as the most consistent institution in the lives of children and adolescents. The finding that lack of teacher support emerged as

significant above and beyond the other predictors is important because prior research has indicated that other factors such as peer relationships may explain the association between teacher support and alcohol use (Crosnoe, Erickson, & Dombusch, 2002; Suldo et al., 2008). Shekhtmeyster & Sharkey (2011) also found lack of teacher support to be the most significant risk factor predicting alcohol onset; they also reported no racial differences in their sample. Interestingly, Suldo et al. (2008) found that students who perceive higher levels of teacher support, also report greater levels of family support and are less likely to associate with rule breaking or drug using peers.

Predictors of first drink onset by grade. When examining the discrete-time hazard probabilities for each predictor separately, patterns emerged for first drink onset based on grade. The discrete-time model for depression was significant in every grade. Lack of parent support, monitoring and lack of teacher support predicted onset in sixth and seventh grades. Poor parental supervision was statistically significant at predicting first drink onset in the eighth and ninth grades. Interestingly, the eighth grade showed the greatest risk for first drink. Clearly, person characteristics are influential in shaping the course of development through their capacity to affect the direction and power of proximal processes. Future research on the maturational impact on 11 to 13-year-olds should be examined to better understand these findings.

Developmental Implications

The findings in the current study suggest that specific proximal processes should be targeted in prevention programs aimed at delaying first drink onset in early adolescence. Failing to meet developmental expectations may have serious consequences for a child's current and future opportunities. Therefore, validating predictors of first drink onset is critical to the eventual development of targeted interventions that have the potential to delay onset. Because people

develop and change across the lifespan, a systemic model of development is necessary to understand, prevent, and treat the causes and consequences of behavioral problems such as alcohol use. Therefore, the age at which proximal and distal risk factors have the strongest predictive power for first drink onset should be carefully examined.

Research that examined the effects of school transitions from eighth to ninth grades found that numerous exogenous changes during this transition are linked to early alcohol use (Weiss & Bearman, 2007). Research has demonstrated that the earlier the onset of alcohol use, the higher risk of developing alcohol dependence later in life. The findings of this study suggest that prevention programming must occur prior to children reaching the age of 11-years-old and it must also prepare parents for the school transitions that lay ahead. While the current study did not reveal significant racial associations to the predictive factors on early alcohol use, in other research, African American youth report significant experiences with racial discrimination as early as age 10 years and these experiences are associated with elevated levels of depression, anxiety, and substance abuse Gibson, Gerrard, and Pomery (2010). This provides a clear indication that racial discrimination should be considered in future studies and in prevention work aimed at delaying alcohol onset in African American students.

Implications for Practice

The connection between research and practice in real world settings has received a great deal of attention over the past decade. A bioecological approach to family intervention and treatment that is grounded in developmental research with a family focus is critical to positive family development (Stormshak & Connell, 2011; DeGarmo et al., 2005; Maughan, 2005). The recommendations that are suggested as a result of the current study, support a systemic model for prevention. Stormshak and Connell (2011) found that a shift in emphasis from traditional school

service delivery models, which tend to favor individual child outcomes over the role of parents and families, to those that are family-centered, is essential for reducing risk outcomes.

Chilenski and Greenberg (2009) suggest it may be important for school districts to integrate family outreach into their mission and practices, and to have better communication with parents and families with a more welcoming and inclusive environment. These concepts may have implications with regard to the findings of the current study. The systemic approach to treatment interventions for adolescent substance use, mirror what is currently known about its etiology. In addition to parent factors, teacher support was linked to first drink onset as well. For this study, teacher support was defined as the feelings of a teacher who cares, listens, and who converses freely. Findings suggest that a family-centered program nested within the school environment may provide the support children need from both parents and teachers. Stormstak et al. (2011) also found family-centered, school-based approaches to intervention within the community setting had a positive influence in delaying alcohol use in youth.

The effectiveness of community-based, family-centered prevention programs has been proven in longitudinal research to reduce substance abuse among adolescents (DeGarmo et al., 2005; Stormshak et al., 2011; Chilenski & Greenberg, 2009). Due to the challenges in departments of social service to do more with less, it is imperative to develop interventions that can produce effective outcomes, yet do so in cost effective ways. Because schools are faced with limited resources and increasing rates of mental health problems in their student populations, the infusion of multi-level, family-centered approaches addressing mental health problems may be the most effective way to reduce problem behavior at home and in school, as well as being the most cost efficient (Stormshak et al., 2011).

There is a well-established link to the effectiveness of parent-centered prevention programming and the need for school-based interventions. Based on the finding that teacher support was significant in predicting alcohol use onset in middle school students, teachers could play a key role in prevention programming. There are three particularly effective school-based, family-centered substance use prevention programs. EcoFit is a multi-level intervention located in middle schools that supports and motivates parents while providing culturally relevant, positive family management practices. The goals of the program are to establish an infrastructure for collaboration between school staff and parents, and provide a vehicle through which a program of specific family-centered interventions can be implemented and coordinated with educational services in the school (Stormshak et al., 2011).

The Oregon Model of Parent Management Training (PMTO) is another intervention strategy that evolved over three decades of programmatic work integrating theory, research, and practical application (DeGarmo et al., 2005). This model specifies that harsh contextual factors have indirect effects on child outcomes and are mediated by coercive processes and ineffective parenting skills (Forgatch, Patterson & DeGarmo, 2005). Coercive parenting practices are assumed to flourish in stressful contexts. Parents then tolerate and reinforce certain patterns of social interaction more than others leading to the development of negative habitual behavioral patterns. Coercive patterns then generalize from the settings in which they are learned to other social environments. The hallmark of PMTO interventions are a focus on enhancing effective parenting and diminishing coercive practices while making relevant cultural adaptations for diverse families.

The third family-based prevention program is the Incredible Years IY). Webster-Stratton and Herbert (2011) developed this family-based prevention program for addressing delinquent

behaviors in children, and it is also located in a school setting. The significant proximal processes that influence positive development the strongest (parent and teacher support) are present. This program offers preventive group interventions to promote positive parenting behaviors based on the same literature demonstrating that early parenting practices are critical to the healthy development of children. Backed by a large body of evidence for both prevention and early intervention, IY uses a collaborative group process model (e.g., schools, communities, and family) to facilitate engagement, empowerment, and support for participating parents (Borden, et al., 2010). Through this collaborative approach, IY aims to strengthen parenting practices as a means to prevent outcomes such as conduct problems, substance abuse, and violence.

Recruitment and attendance of parents in family-centered treatment programs are often issues. This has led to the development of brief parenting interventions and tailored, individualized family interventions (Stormshak, 2011). It is also imperative to parental participation that adaptations are made to engage and retain culturally diverse families, as discussed in the previous models. When feasible, the matching of therapist ethnicity with family ethnicity can also be critical for family engagement.

Implications for Policy

Research forms the foundation of program development and policies. Public and institutional policies influence the drinking behavior of our youth. The National Institute on Alcohol Abuse and Alcoholism's initiative, Leadership to Keep Children Alcohol Free, reflects one community-based approach designed to prevent alcohol initiation and use by children. The initiative aims to educate the public about the incidence and impact of early alcohol use by children ages 9 to 15 years, mobilize the public to address these issues within their families,

schools, and communities, focus state and national policy maker's attention on the seriousness of early onset alcohol use, and make the prevention of alcohol use by children a national priority (Galson, 2009).

There are more than two million teens in the juvenile justice system in the United States, and as many as two-thirds have alcohol and other drug use problems (Nissen, Butts, Merriger, & Kraft, 2006). Yet, most juvenile justice systems do not have effective ways to help these young people. It is time to consider the family when developing policy and programs, and to move away from the individualistic perspectives that are currently in place in most juvenile courts. Several domains of parenting have been identified as important for adolescent well-being. Brown, Barrett, Ireys, Allen, Pires & Blau (2010) found that parental knowledge of their teen's activities and whereabouts, consistency, support, and parent-adolescent secure attachment are associated with fewer incidences of substance use and delinquency. Bogenschneider, Little, Ooms, Benning, Cadigan, and Corgett (2012) stated that when policies are enacted, policy decision makers need to consider how families are affected, how they can contribute, and that involving families in the response, results in more effective and efficient solutions. Public policy and programs need to focus on strengthening family functioning by implementing family-centered services. It is more important than ever to consider the juvenile drug court policy.

When considering the implementation of policy, it is not only important to show data driven success but also to establish cost effectiveness. McCart, Henggeler, Chapman, and Cunningham (2012) examined six juvenile drug courts serving 104 families in the U.S., and all stakeholders reported greater improvement on several domains including use of family engagement techniques, school conduct, and a decrease in recidivism of delinquency. Aos, Miller, and Drake (2006) found in a rigorous cost benefit analysis of 571 criminal justice prevention and

intervention programs, those most effective in reducing future crime and in producing benefits that substantially outweighed program costs were those that targeted juveniles. Of these, five of the most cost beneficial rehabilitation programs, and the single most cost beneficial program, had family-focused approaches.

Limitations

This study has many limitations. The first limitation is that the use of a convenience sample limits the generalizability of the findings. Requiring that each study participant be assessed at each of the three data collection points (differing periods), significantly reduced sample size. For example, this resulted in the African American children predominately attending urban schools, while the Caucasian students attended suburban and rural schools. It is possible therefore that the findings may not be fully generalizable.

The second limitation was the use of a self-report survey design. Respondents may not feel comfortable providing answers that present themselves in an unfavorable light when asked about drug use. However, each of the major national studies of adolescent drinking also involves self-report, so in that regard, limitations of self-report apply to many longitudinal and cross-sectional studies in use.

Finally, parental demographical data such as family structure, income, and substance abuse were not available. As a result, developmental implications related to child exposure to family conflict or substance abuse and self-reported onset of drinking could not be examined. School district information was used to lay a foundation for understanding family income level (i.e., free and reduced lunch) and racial make-up of the sample. Future research should examine the role of negative outcomes that stem from these risk factors.

Conclusion

Early onset of drinking is an established factor for later risk behaviors related to alcohol use. This study sought to add to the literature a set of multi-causal proximal and distal factors that predict early onset drinking. Preventing the consequences of early onset drinking is, in part, dependent on which factors predict onset and for whom. Not all children exposed to parental alcoholism or various forms of parental conflict or psychopathology develop alcohol-related problems. However, among those who do, the current study identified predictors that are most important at each age/grade level, and that may contribute to individual differences in first drink onset. Therefore, by validating predictors of first drink onset, this study contributes information that may be useful for developing targeted interventions that have the potential to delay onset.

The utility of Bronfenbrenner's earlier theorizing, which emphasized studying factors that are more proximal to the individual and progressing to those that are increasingly distal, contributes to issues related to practice and policy. The power of such processes influences development as a function of the characteristics of the developing person, in the immediate and more remote environmental contexts and time periods, in which proximal processes take place (Cairns & Cairns, 1994).

Though the methodology of the survival analysis has not been widely used in previous social science research, its usefulness in addressing important and pressing questions is becoming apparent (Keiley & Martin, 2005; Jester et al., 2009). The utility of the discrete-time hazard probabilities contributed to a deeper understanding of factors related to why and when middle school students take their to first drink and how first drink processes may change over the course of the middle school years.

APPENDICES

Appendix A. *Table Listing the Subscales Constructs, Items, Rating Scale, & Alpha Reliability Indices from the C^2S^2 Survey*

Table 18.

C^2S^2 Subscales Constructs, Items, Rating Scale, & Alpha Reliability Indices

Factors	Items	Ratings Scale	Reliability
Parent Support Emotional Support	How much do you agree or disagree with the following statements? Your parents/caregivers… a. Enjoy spending time with you. b. Listen to you. c. Know your friends. d. Do fun things with you.	– Strongly disagree – Disagree – Agree – Strongly agree	.89
Parental Involvement	How much do you agree or disagree with the following statements? a. Ask about what you have been doing in school? b. Check whether you have done your homework? c. See if your homework is correct? d. Come to your schools activities of help in your classroom? e. Spend time reading with you.	– Strongly disagree – Disagree – Agree – Strongly agree	.81
Parental Supervision	How much do you agree or disagree with the following statements? a. Limit amount of time you watch TV b. Limit the amount of time you play video games.	– Not at all – A little – Some – A lot	.85
Peer Support	How much do you agree or disagree with the following statements? a. My friends help me when I am having a hard time. b. My friends care about me. c. My friends are there when I need them. d. I trust my friends. e. I feel that I can talk to my friends about my problems.	– Strongly disagree – Disagree – Agree – Strongly agree	.92
Teacher Support	How much do you agree or disagree with the following statements? a. There is a teacher or some other adult who really cares about me at my school. b. There is a teacher or some other adult who listens to me at my school. c. It is easy to talk with a teacher or counselor at my school. d. The teachers are fair to students at my school.	– Strongly disagree – Disagree – Agree – Strongly agree	.84
Neighborhood Safety	How much to you agree or disagree with the following statements? In my neighborhood… a. I worry about people with guns and knives. b. Drug dealers are a problem. c. I am scared of some of the people. d. There are people who might hurt me.	– Strongly disagree – Disagree – Agree – Strongly agree	.87

Table 18. (cont'd)

Factors	Items	Ratings Scale	Reliability
Emotional Health Depression	During the PAST YEAR, how often did the following things happen? a. I felt upset. b. I felt that I could not stop being sad. c. I had a hard time sleeping. d. I talked less than usual. e. I felt lonely. f. I felt sad. g. I was bothered by things that usually don't bother m h. I felt down and unhappy. i. I felt like I was too tired to do things. j. I felt like crying.	– Not at all – A little – Some – A lot	.92
Emotional Health Anxiety	During the PAST YEAR, how often did the following things happen? a. I worried a lot. b. I worried about things that might happen. c. I worried about making mistakes. d. I worried about school. e. I got a funny feeling in my stomach. f. I worried about someone in my family g. I noticed my heart beating fast. h. I felt scared. i. I felt nervous	– Not at all – A little – Some – A lot	.91
Alcohol Use	In the past 30 DAYS, on how many days did you… – have at least on drink of alcohol (beer, wine, wine coolers, or liquor)	– 0 days – 1 or 2 days – 3 to 5 days – 6 to 9 days – 10 to 19 days – 20 to 29 days – Every day	

Note. C2S2 = Genesee County Coordinated Community Student Survey, 2004© Jessica Barnes-Najor. Questions reproduced by permission. For access to the questionnaire, contact Dr. Jessica Barnes-Najor (barnes33@msu.edu).

Appendix B. *Figure Depicting the Conceptual Model of Predictor Variables*

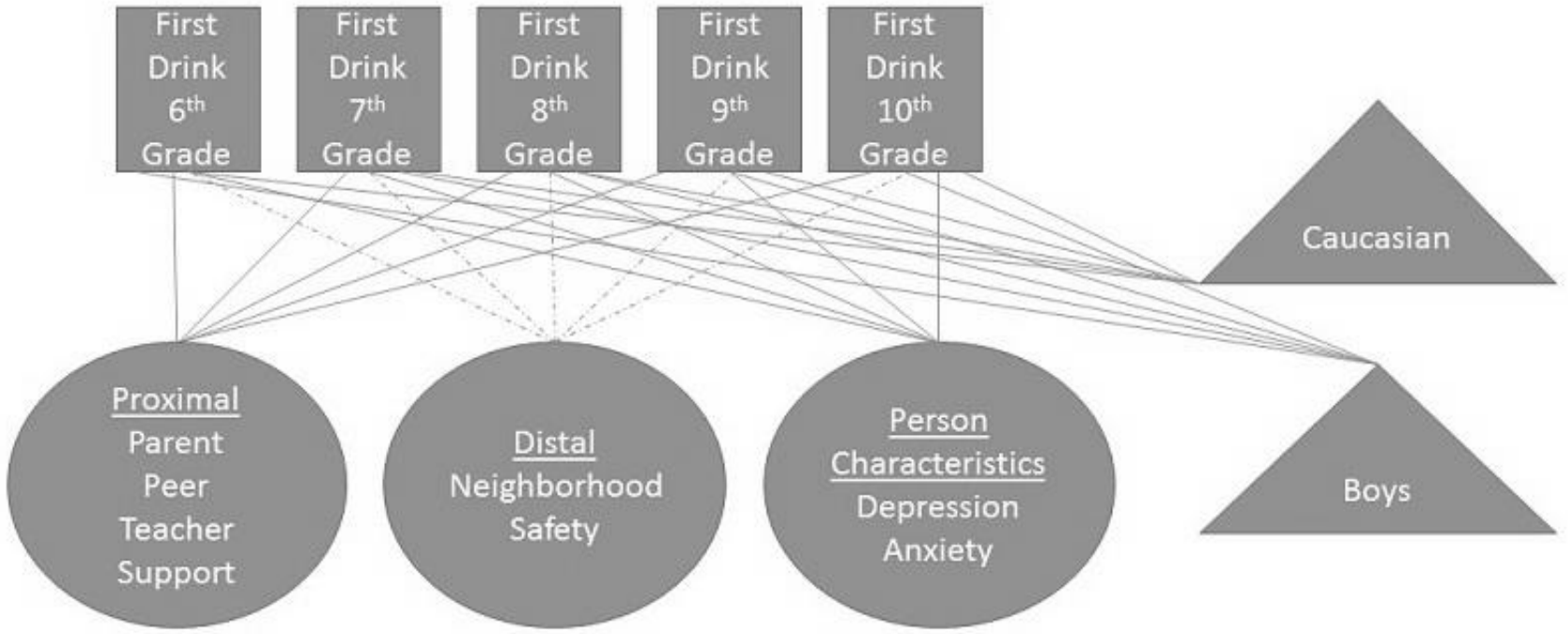

Figure 7. This figure depicts the conceptual model of the hypothesized relationships between the predictor variables.

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