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Adolescent Risk Behaviors: Examining Latent Classes And Latent Transition Statuses In A Longitudinal Bahamian Sample

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ADOLESCENT RISK BEHAVIORS:
EXAMINGING LATENT CLASSES AND LATENT TRANSITION STATUSES IN A
LONGITUDINAL BAHAMIAN SAMPLE

by

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DISSERTATION

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Advisor   Date

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DEDICATION

I dedicate this work to my husband, Pashk.

Of all the decisions I have ever made, you are the one that I never question.

Thank you being my partner in life.

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This work would have not been possible without the support of my dissertation committee. Dr. Partridge, thank you for all your support and patience over the years and continually serving as my advisor and as well as an endless source of knowledge even when our research interests began to diverge. Dr. Chen, under your guidance I have gained so much knowledge. Also, I appreciate the wonderful conversations that we shared discussing ideas; your passion for research is really infectious. Dr. Abbey, thank you for always taking the time out to help me and guide me, not only for my dissertation but for my graduate training and professional development. Dr. Stanton, I could go on for days; therefore, I will just say this: the GREAT fortune of having been given the opportunity to work as your research assistant has with absolute certainty changed the trajectory of my professional life.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1

CHAPTER 1

Introduction

Since the scientific study of adolescence began, risky behaviors have been a focal point for research in this developmental period. In his seminal work, *Adolescence,* Stanley Hall (1904) popularized the expression of "storm and stress" to describe adolescence. The expression describes the notion that adolescents are often filled with much angst and prone to engaging in delinquent behaviors. Over time parents would begin to adopt this assertion to explain the behaviors they would observe in adolescents (Buchanan et al., 1990; Buchanan & Holmbeck, 1998). Although substantially overgeneralized, the concerns regarding adolescent risk taking are not entirely unwarranted. Epidemiological evidence has shown that adolescents are more likely to engage in risk taking behaviors compared to other age groups. This is apparent by the number of deaths and injuries caused by violent altercations, reckless driving, accidents, drug experimentation (National Research Council and Institute of Medicine, 2007) and increases in HIV prevalence among youth groups (Centers for Disease Control and Prevention, 2013). Beyond these most serious consequences, early engagement in risk behaviors can be problematic in ways that are less apparent; it can lead to other negative outcomes such as decreased functioning in adulthood, poor health, and long-term involvement in risk behaviors (Roisman, Aguilar, & Egeland, 2004; Wei, Loeber, & Stouthamer-Loeber, 2002). While society may be focused on the mistakes made by youth and nostalgically recall the days of yesterday, two thoughts should be considered: adolescence is a universal developmental period and deviant adolescents do not necessarily start as such. It is this latter point that underscores the question as to the nature of the necessary factors that propel youth to engage in risk behaviors, potentially changing the course of their developmental trajectories.

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Adolescent risky behavior can set the trajectory for future negative behaviors and outcomes; but, identifying at-risk youth prior to the onset of these behaviors is difficult. Identifying these youth using early predictors and intervening to prevent these behaviors to set them on a positive developmental trajectory early would have a profound impact on adolescent risk reduction. Using a Bahamian sample of youth who were followed longitudinally from grade six to grade 12, the current study was designed to examine three dimensions of adolescent risk taking: identification and categorization of risk behavior profiles, changes in risk behavior engagement, and potential candidate variables predictive of the risk behavior profiles. A person-centered approach will be employed for the data analytic strategy, which unlike a variable-centered approach assumes that the data is heterogeneous and is designed to identify varying patterns of risk behaviors involvement; as well, it will also help identify factors that predict these patterns. The current study is designed to identify factors predicting the probability of belonging to specific risk behaviors statuses in early and later adolescence as well as the probability of transitioning between statuses (e.g., low to higher risk group or vice-versa), which is also important because it will identify factors that facilitate the initiation of engaging in risk behaviors.

Brief Overview of Adolescent Developmental Changes as a Context for Potential Risk Involvement

Adolescence is a complex and vulnerable developmental period. It is marked by many biological, social, and cognitive changes. Biologically, hormonal and physiological changes accompany the onset of puberty. For both girls and boys, youth typically experience a growth spurt that spans most of adolescence. As puberty progresses, youth are presented with the difficulty of having to adjust to rapid physical growth and development. The lack of familiarity

with all the changes associated with puberty can cause greater emotional distress for adolescents compared to pre-pubescent youth (Ge, Conger, & Elder, 2001; Susman, Dorn, Inoff-Germain, Nottelmann, & Chrousos, 1997). The onset of hormonal changes also brings about sexual maturation increasing sexual awareness (Boxer, Levinson, & Petersen, 1989). Sexual awareness can impact social and emotional development as youth have a greater interest in forming romantic bonds, often based on sexual attractions, while also having to navigate a new set of social norms that correspond to this type of relationship.

The desire to form extra-familial social bonds, romantic or otherwise, is a significant part of the developmental growth that adolescents experience (Laursen & Collins, 2009). Adolescents are provided greater opportunities of independence with the expectation that they become independent and capable of being self-sufficient without needing the continued aid of their caregivers (Spear & Kulbok, 2004). Thus, adolescents strengthen their social support network by including peers, mentors, coworkers, and so forth. Additionally, many cognitive changes begin to present themselves in adolescence. Piaget (1964) identified the cognitive abilities that are acquired in adolescence. He stated that formal operational thinking, defined by abstract thought and the ability to think logically, is a defining feature of the final stage of cognitive development. Empirical evidence has supported this statement, showing that adults and adolescents show little differences in reasoning ability in generic reasoning tasks (Reyna & Farley, 2006). However, inconsistent with these findings is that despite possessing the ability to reason and think hypothetically, adolescents are still prone to faulty thinking leading to poor decision-making (Gardner & Steinberg, 2005). Researchers suggest this may be due to an immature inhibitory control system (Casey, Getz, & Galvan, 2008). Other researchers suggest the lack of experience adolescents have in risky situations using the inhibitory responses rather than insufficient brain

maturation may lead to risk taking behaviors (Romer, Duckworth, Sznitman, & Park, 2010). Both hypotheses, however, suggest that although adolescents may be capable of reasoned thought, the capacity to execute the appropriate behavior is hindered by the inability to carry out the necessary inhibitory response. As mentioned, all these changes, physical, social and cognitive, individually contribute to the developmental demands of adolescence. Co-occurring, these changes provide favorable conditions for increased missteps and risky behaviors.

Overview of Theories of Adolescent Risk Behaviors

      Neurocognitive frameworks. In an attempt to curtail risk behaviors and the subsequent negative outcomes associated with them, much research has concentrated on why these behaviors occur (Chick & Reyna, 2012; Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008; Steinberg, 2007). Several theories have been developed regarding the factors increasing the likelihood for greater risk involvement in adolescents. For example, neurocognitive-based dual-process models (Casey et al., 2008; Chick & Reyna, 2012; Steinberg, 2008) suggest that there is an imbalance between the appropriate neurocognitive processing needed to inhibit risk behaviors (i.e. inhibitory control processing) and processing that promotes risk behaviors (i.e. increased reward reactivity). Researchers have agreed that a process of neural restructuring occurs immediately prior to and then during adolescence including both neural proliferation and pruning. Ultimately, the neural restructuring is expected to permit more efficient cognition (Chambers, Taylor, & Potenza, 2003). During this time there is increased demand or reactivity towards reward stimuli while areas associated with control and inhibitory responses are still gradually maturing (Casey et al., 2008; Steinberg, 2004). For example, certain circumstances such as the presence of peer influence ("high reward") may lower their ability to abstain from risk situations. The combination of both increased rewards reactivity activated by the presence

of peers and still developing cognitive control increase the likelihood of poor decision-making. Although the potential for greater risk involvement exists, many youth do not engage in risk behaviors. Thus, cognitive imbalance alone does not explain why differences in risk behavior involvement have been found between subsamples of adolescents (Chassin, Pitts, & Prost, 2002).

Problem-behavior theory. Neurocognitive based models describe one aspect of adolescents' neurocognitive vulnerability to engaging in risk behaviors. Other theories acknowledging increases in risk behaviors during this time period focus on youth who engage in risk behaviors in a broader context. Problem-behavior theory (Jessor & Jessor, 1977) is one of the more prominent theoretical frameworks used to describe the development of maladaptive behavior in youth. Problem-behavior theory posits that there are risk and protective factors that moderate risk behaviors in youth (Jessor, 1991). These risk and protective factors are identified in multiple conceptual domains: biology, social environment, perceived environment, personality, and behavior. The personality domain consists of factors that are more stable such as values, attitudes, and beliefs. Behavioral concepts include the risk and non-risk behavior engagement of the youth that predict "proneness" towards risk involvement. Contextual factors in the social and perceived environments are influences from an individual's ecological system including peers, family, neighborhood, and schools which shape social norms and provide social models. The presence or absence of these risk/protective factors function together influencing adolescent risk behavior.

Single-factor models. Problem-behavior theory (Jessor, 1991) emphasizes a "proneness" to risk behaviors that suggests engagement in one behavior is likely to lead to engagement in other risk behaviors (Jessor, 1991). All risk behaviors are said to represent behaviors that are similar psychologically, symbolizing concepts such as defiance and independence from authority

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and are highly simulating. The perceptions of these behaviors are informed by one's values and lead them to relate to other individuals who have similar perceptions allowing them to learn and engage in the behaviors together, socially reinforcing the behaviors.

Specifically, problem-behavior theory (Donovan & Jessor, 1985; Donovan, Jessor, & Costa, 1988; Jessor, 1991) argues that the structure of problem-behavior represents a single-factor where all risk behaviors are generalized into one construct. This concept of a problem-behavior syndrome was found among various samples in both adolescent and young adult populations (Donovan & Jessor, 1985; Donovan et al., 1988; Racz, 2011). The authors examined four types of risk behaviors that included: problem drinking, marijuana use, sexual intercourse, and general deviant behavior (shoplifting, vandalism, truancy, lying, violence, parental disobedience, and other behaviors). The domains and specific types of behaviors that represent problem-behavior may be insufficient to capture the complexity of risk behaviors. For instance, the item used to represent sexual risk behavior is whether they had engaged in sexual intercourse. Although considered deviant in this framework, the perception of sexual intercourse as being deviant changes as a function of generational factors. Therefore, other behaviors such as multiple sexual partners and unprotected sex could, more accurately, serve as indicators of sexual risk behaviors (Metzler, Noell, & Biglan, 1992). Furthermore, based on their analysis it is not clear how sexual behavior co-varies with other behaviors. Sexual behavior was not used in the factor analysis for the first study [although the data were available (Donovan & Jessor, 1985)], while it was included in the replication study (Donovan et al., 1988). Additionally, merging other risk behaviors together can lose their informational value. The broad generalization of the "general deviant behavior" domain used by the authors may be problematic. This domain included lying and parental disobedience, which was combined with risk behaviors

such as shoplifting, vandalism, or violence. Lying and parental disobedience, however, may be correlated with an array of risk behavior domains as many of these behaviors would likely require a level of lying and parental disobedience to engage in these risk behaviors without the knowledge of their parent. Youth engaging in any type of risk behavior would not have difficulty endorsing lying and parental disobedience items; thus, the inclusion of these items in the "general deviance" domain may be driving the relationship between "general deviance" and the other behavior domains.

Despite findings to support a one-factor model, which suggest all risk behaviors correspond with an over-arching desire to engage in risk behaviors, a one-factor model may have limited power to explain risk behaviors at great depth. While risk behaviors are highly correlated and may result in an overall tendency toward multiple risk behaviors, ignoring the distinctive features and contributions of each behavior may hinder our understanding of their unique risk factors and outcomes (Osgood, Johnston, O'Malley, & Bachman, 1988). Differentiating between specific domains of risk behaviors is important to take into consideration and to continue exploring further.

Multi-factor models. Models reflecting other perspectives to explain adolescent risk engagement have been proposed and subjected to analytic validation. Work by Williams, Ayers, Abbott, Hawkins, and Catalano (1996) specifically tested the factor structure of risk behaviors using a US sample measuring delinquency, substance use, and involvement in the juvenile justice system. They found that a two-factor model, substance use and delinquency, better fit the data than a one-factor model. Willoughby, Chalmers, and Busseri (2004) examined a high school sample and found a three-factor model better fit their data than a one-factor model. They found that very few youth engaged in all behaviors and identified three other factors of risk

behaviors: *problem syndrome* containing commonly studied risk behaviors such as substance you and sexual activity, *aggression*, and *delinquency*. However, factors were highly intercorrelated. The authors suggest there are specific behaviors that are likely to co-occur at higher rates such as delinquency, substance use and aggressive behaviors, but a single factor model did not adequately explain the variance in the model.

Research using latent class analysis has also found that subclasses of risk behavior profiles exist among adolescents (Cole et al., 2007; Sullivan, Childs, & O'Connell, 2010; Willoughby et al., 2004). One study identified four distinct groups of risk behavior latent classes among a cross-sectional sample of youth in grades nine through twelve (Sullivan et al., 2010). Two-thirds of youth were classified into two groups that either abstained from or occasionally experimented with risk behaviors. The remaining youth reported one of two distinct high risk behavior patterns. For instance, they found a subgroup of youth who participate in many risk behaviors but were not sexually active and a subgroup of youth who frequently engage in all behaviors. The authors also hypothesized there may be different factors correlated with each risk behavior group. It was found that when parent's knowledge of whereabouts was lower, the odds of belonging in the high risk group were higher than both the abstaining group and the experimenting group, but not the non-sexually active high risk group. While they found differences between groups, the cross-sectional data did not allow them to look at whether these factors prior to risk behavior onset would also be associated with future risk behaviors.

Moffitt's taxonomy of adolescent antisocial behavior. Theoretical work by Moffitt (1993) has suggested that adolescents may display two possible patterns of risk behaviors. She developed a taxonomy to describe anti-social behavior using two-theories: life-course persistent antisocial behavior theory and adolescence-limited antisocial behavior theory. Life-course

persistent antisocial behavior is described as stable and rarely changes in response to time or circumstance. Youth who continue the behavior into adulthood, becoming life-time offenders, are likely to exhibit problem behaviors early in adolescence and childhood. Moffitt (1993) suggests that these youth may have intrapersonal causes such as neurological deficits putting them at risk for difficult temperament and risk behaviors. Adolescence-limited antisocial behavior exhibits considerable discontinuity, alternating between periods of abstaining and engaging in antisocial behavior, depending on time and situation. Therefore, youth who display adolescence-limited patterns of antisocial behavior are likely to be greatly influenced by contextual factors such as peers or family. That is not to say that life-course persistent behavior is not influenced by contextual factors; rather, the impact likely occurs early in the child's life, which is suggested by the early onset of risk behaviors described by life-course persistent antisocial behavior theory, thereby setting the high-risk trajectory into motion. Altering the trajectory later in development is difficult; thus, promoting life-course persistent antisocial behavior.

Although it does not specifically describe which behaviors co-occur, the theory does suggest different types of offenders. Those who are indiscriminate risk takers engaging in multiple types of risk behaviors are likely to exhibit the same qualities of life-persistent offenders, whereas the adolescence-limited type is likely to be selective depending on their environment and what is more salient to the adolescent at that time. Therefore, adolescent-limited offending youth may also belong to subgroups of behavior clusters. Both Moffitt (1993) and Jessor (1991) suggest risk behavior involvement in adolescence is likely to include multiple risk behaviors. Moffitt's taxonomy, however, provides a framework that assumes adolescent risk

takers can be categorized into different risk-taking profiles. Identifying these profiles enables the study of adolescent risk taking to address the variability of risk behaviors.

Risk Behavior Domains

Adolescents engage in many behaviors that are considered delinquent or deviant behaviors. The term delinquency is broadly defined by researchers to include any deviant behaviors that are typically illegal or violate social norms (Cox, Conrad, & Allen, 1987). However, it has not been operationalized consistently in empirical research and can include a range of behaviors. Many of these behaviors are status offenses that are based on age such as truancy, running away, curfews, and substance use behaviors such as alcohol and tobacco use. These are differentiated from non-age defined delinquency (i.e. theft, arson, fighting).

Aggressive behaviors. While delinquency represents a broad class of risk behaviors research has also focused on specific behaviors such as aggression. Aggressive behavior is of interest because it is displayed in childhood and may serve as an early marker. Aggression typically peaks in childhood and declines through adolescence (Bongers, Koot, van der Ende, & Verhulst, 2004; Brame, Nagin, & Tremblay, 2001; Broidy et al., 2003). Early to middle childhood shows greater variations in aggressive behavior; while in adolescence aggressive behaviors are expected to decrease with the addition of greater socialization and increases in self-regulation. A study examining developmental trajectories of aggressive behavior found that aggressive behavior declined for the majority of youth in a low-income Canadian sample from kindergarten through adolescence (Brame et al., 2001). However, a small subset of youth displayed high childhood aggression that persisted through adolescence. Similarly, a multi-site cross-national study found a small high-aggression group that showed increasing aggressive scores whereas aggressive behaviors in the other groups either stabilized or declined (Broidy et

al., 2003). These findings indicate that within the domain of aggressive behaviors there exist different developmental profiles adding support to an antisocial behavior taxonomy (Moffitt, 1993)

Substance use. Society has developed many norms and laws determining when and if one can engage in substance use behaviors. Some substance use behaviors are only deviant because of the youths' age activities such as smoking cigarettes and drinking alcohol. However, it is during adolescence that youth are most likely to engage in substance use experimentation. For instance, in the US alcohol use is highly prevalent among 12th graders with 69% having tried alcohol (more than a few sips) and over half reporting having been drunk before (Johnston, O'Malley, Bachman, & Schulenberg, 2013). Also, by the end of grade 12, two-fifths of students (excluding drop-outs) had tried a cigarette. Other substance use behaviors, such as marijuana and other illicit drugs, is not considered permissible at any age. Yet, data has shown that nearly half of adolescents by the end of high school have tried one or more illicit drugs and 24% of students tried at least one illicit drug other than marijuana (Johnston et al., 2013).

The onset of substance use, however, can occur long before grade 12. Youth between the ages of 11-19 who reported having used drugs stated their age of first use ranged between 11 and 13 years old, depending on the drug (Pan American Health Organization (PAHO), 2012) Long-term, early onset substance use can be problematic because it increases the risk for addiction (Grant & Dawson, 1998) and the risk of using illicit drugs. Researchers suggest there is a continuum for substance use behavior in which smoking cigarettes, drinking, and marijuana-use can segway to more serious substances such as cocaine, opiates, hallucinogens, and prescription drugs (Choo, 2008). This finding suggests that the earlier substance use experimentation begins, the greater the opportunity to begin experimenting with illicit drugs.

Substance use in adolescence is also associated with other risk behaviors. For instance, Poulin and Graham (2001) observed that single substance use was also a risk factor for sexual intercourse. Cannabis use alone was a risk factor for multiple sexual partners. Having unplanned sexual intercourse while under the influence of cannabis in the past 12 months was a risk factor for having unprotected sex and multiple sexual partners. A cross-sectional, nationally representative study of latent classes for sexual risk behaviors found that the odds of sexual risk behaviors increased as the level of substance use increased (Connell, Gilreath, & Hansen, 2009). Odds ratios were highest for multiple drug use as a predictor of the high sexual risk class. Substance use is also shown to co-occur with violent and delinquent behavior. Walton et al. (2009) found that adolescents who were screened in an emergency department needing treatment as a result of peer violence were more likely to report higher binge drinking and marijuana use. In a Canadian sample, it was also found that increased drug and alcohol use co-occurred with gambling and delinquency at ages 16 and 17 (Vitaro, Brendgen, Ladouceur, & Tremblay, 2001).

Sexual risk behaviors. Sexual behavior is a complex behavior that impacts both social and health related outcomes. The behavior in and of itself is only a risk when it increases exposure to negative consequences. For instance, early onset of sexual behavior, having unprotected sex or sex with multiple partners can increase risks such as unwanted pregnancy and contracting sexually transmitted infections including HIV and AIDS (Lazzarin, Saracco, Musicco, & Nicolosi, 1991; Pettifor, van der Straten, Dunbar, Shiboski, & Padian, 2004). Research has suggested that early sexual debut is linked to serious delinquent behaviors (Wei et al., 2002). Whether the risk behaviors are the result of early onset of sexual behavior is unclear. Evidence has suggested when genetic and environmental confounds are taken into account, early sexual onset is no longer a significant predictor of delinquency (Harden, Mendle, Hill,

Turkheimer, & Emery, 2008). One possibility is that because youth, preadolescents in particular, are limited in their access to opportunities to engage in risk behaviors such as using illicit drugs, driving recklessly, carrying a weapon, or even access to contraception, engaging in sexual risk may be the most "accessible" to them and occur first. Furthermore, early sexual debut may indicate a preference for risk involvement in some youth such as those in high risk behavior groups.

Late Adolescence and Risk Behaviors

Late adolescence is a particularly salient time period for examining risk behavior involvement. Risk behaviors tend to peak during this period, typically declining afterwards (Bushway, Piquero, Broidy, Cauffman, & Mazerolle, 2001). The decrease in risk behaviors are often attributed to the onset of adulthood when career and family obligations begin to take precedence (Arnett, 1997). It is also in later adolescence, after 18 years of age, that criminal behavior is viewed much differently in the legal system; the more lenient punishments and expugnable records of the juvenile justice system are replaced by the more serious and permanent consequences of the adult justice system. Although behaviors such as smoking and drinking may become legal, addictions become more prevalent and difficult to overcome in adulthood if initiation had taken place in adolescence (Grant & Dawson, 1998). Greater risk involvement as an adolescent can lead to lower school achievement which can also limit the opportunities of achieving gainful employment. Furthermore, by adulthood the opportunity for intervention decreases as the venues for support (i.e. school-based curriculum, youth services) are greatly reduced.

Developmental trajectories of adulthood are not fixed at any time point but an individual's status at the onset of adulthood is contingent on his or her past behavior as an

14

adolescent. For instance, evidence has shown risk behavior involvement in late adolescence can negatively impact behaviors in adulthood. The negative impact that risk behavior involvement in late adolescence has on adulthood was observed when onset occurred in early adolescence as well as in mid-adolescence. Youth who had shown early onset and persistent antisocial behavior by age 16 had worse outcomes in adulthood than those with mid-adolescent onset of antisocial behavior or no antisocial behavior involvement; however, youth with risk behavior onset that began in mid-adolescence showed poorer outcomes than youth who did not engage in antisocial behavior (Roisman et al., 2004). The transition to adulthood is a significant developmental period and the changes associated with it can be both sudden and challenging. Possessing poor behavioral habits established in adolescence can contribute to these challenges.

Predictors of Risk Behaviors

Problem-behavior theory (Jessor, 1991) suggests a number of factors that can contribute to an adolescent's general propensity towards risk engagement. However, when risk-taking behaviors are operationalized as a uni-dimensional construct, it limits the ability to identify the predictors of these behaviors. The theory of triadic influence (Flay, Snyder, & Petraitis, 2009) describes a similar ecological perspective on the development of problem behavior; however, although risk behaviors may be similar, the theory suggests when examining the causal processes of risk taking, the differences of each behavior should be considered as well.

The theory of triadic influence states there are three streams of influence: cultural/attitudinal, social/normative, and intrapersonal. The cultural/attitudinal stream represents how one's culture shapes and forms their attitudes and expectations about the consequences of a risk behavior. For instance, culture can influence behavior by endorsing and supporting behaviors. These endorsements subsequently influence values and expectations

which then predict behaviors. The social/normative influence describes how one's immediate social environment such as parents and peers can influence one's social norms and interpersonal interactions; these norms and interpersonal relationships then influence behavior. The third stream, unlike the first two, is not a contextual influence but instead represents characteristics of the individuals (i.e. personality, genetics) that predispose them to engage certain behaviors. .

Further, these streams of influence are further subdivided by their level of proximity that impact the influence a factor has on behaviors (Flay, Petraitis, & Hu, 1995; Flay et al., 2009). *Proximal* level influences are more immediate and affect specific aspects of behavior, whereas *distal* influences may have an indirect impact. *Ultimate* level factors are macrolevel factors that are broadly defined and likely to predict long-term risk factors for risk behavior involvement. Flay et al. (1995) also describes the influence of related behaviors (e.g. smoking and alcohol use) and how the relationship between related behaviors may change as a function of other factors. In addition, closely similar risk behaviors are expected to share the same proximal level influences and dissimilar behaviors will have fewer proximal level influences in common, but will likely share the same broader, ultimate level influences. Using this ecological perspective to examine risk taking allows researchers to consider contextual (i.e. parental monitoring, peer influence and neighborhood) and intrapersonal (i.e. values orientation and sensation seeking) influences and their associations with the co-occurrence of risk behaviors during adolescence.

Parental monitoring. Social interactions impact behavior, values, and perceptions. Social learning theory (Bandura, 1977) states that learners identify models in their environment from whom to learn behaviors and social norms. Parents and family members are instrumental in the socialization process, serving as the first models that youth emulate. Therefore, high-risk families can inadvertently expose youth to risk behaviors at an early age in which the youth will

later engage in as a learned behavior (Karriker-Jaffe, Foshee, Ennett, & Suchindran, 2013). Families can also are serve as a buffer to risk exposure (Stanton et al., 2004; Van Ryzin & Dishion, 2012). Parental monitoring which is defined as the amount of knowledge parents have regarding the activities and whereabouts of their youth, which is used to help protect their child from risk. This knowledge allows them to intervene during situations in which they feel their child might be exposed to harm. The knowledge can be obtained in multiple ways including: solicitation, the parent asking the child; control, the parent requiring knowledge as to where the child is or the parent telling the child where to be; or, disclosure, the amount of information the youth divulges to the parent. One meta-analysis examined parenting styles and behaviors and found an effect on delinquency, which was defined broadly to include delinquency, crime, and anti-social behaviors (Hoeve et al., 2009). Results revealed significant effect sizes for both active monitoring by the parent and child's willingness to disclose information predicating adolescent delinquency.

The effect of parental monitoring is far reaching and can influence attitudes and provide protection even when other risk factors are high. For instance, the youth of parents in high-risk neighborhoods who were successful at parental monitoring exhibited decreased intention to initiate sex compared to those whose parents reported lower parental monitoring (Sieverding, Adler, Witt, & Ellen, 2005). Chuang, Ennett, Bauman, and Foshee (2005) also found that in low socioeconomic families, higher parental monitoring protected against alcohol use among adolescents. Parents have also shown to influence the impact of delinquent peer groups. Laird, Criss, Pettit, Dodge, and Bates (2008) found children who perceived increases in parental knowledge displayed decreased associations between their friends' antisociality at age 16 and their subsequent delinquent behavior one year later. Conversely, the authors also observed

decreasing perceptions of parental knowledge increased the relationship of delinquent behaviors at age 16 and their friends' antisociality one year later.

Peer influence. An association between risk behaviors and peer influence has been found consistently in the literature (Kiesner, Poulin, & Dishion, 2010; Monahan, Steinberg, Cauffman, & Mulvey, 2009; Oxford, Harachi, Catalano, & Abbott, 2001). The level at which someone finds the models in their environment salient will impact willingness to adopt the behavior; increased perceived salience or relevance leads to increased adoption (Bandura, 1977). Because adolescence is marked by an increase in peer salience, peers have a higher probability of influencing the behaviors of one another. Neurocognitive research has found that youth process peer acceptance in the same areas in which they process rewards (Guyer, Choate, Pine, & Nelson, 2011). The neurocognitive changes that occur during adolescence resulting in an imbalance between an under-developed cognitive control area and increased reward circuitry suggest that in situations when peers are present, the activation of reward processing would override inhibitory control responses (Steinberg, 2007). For instance, during a cyberball game designed to simulate a social situation inducing feelings of rejection, adolescents show increased activation in areas associated with social evaluation and lower activation in areas responsible for the regulation of rejection-distress emotions compared to adults who showed higher activation of the regulation area (Sebastian et al., 2011). Additionally, research has shown that in the presence of peers, adolescents are more likely to engage in risk behaviors if they feel that their peers are engaging in these behaviors, perhaps in an attempt to increase social acceptance from their peers. In a simulated driving task, adolescents (compared to adults) were more likely to engage in reckless driving behaviors causing more accidents when their friend was participating alongside them (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011). However, when friends were not

present during the experiment, adults and adolescents did not differ significantly in the number of accidents. These results presents neurocognitive explanations as to why youth engagement in risk behaviors may be influenced by peers and reinforce their importance in studying adolescent risk behaviors.

Neighborhood and community. Ecological models highlight the importance of community level factors suggesting that neighborhoods can influence development. Neighborhood level factors include the level of crime, disorganization, and available resources. For instance, neighborhood socioeconomic status is often studied as a predictor of risk exposure (Chuang et al., 2005), but is associated with a number of other risk factors such as family structure, school quality, and social support which may be the mechanisms driving the relationship between socioeconomic status and risk behaviors (Evans, 2008). Neighborhoods not only represent the resources available in the community, but can also serve as a form of socialization influencing social norms and youth behaviors. Research has found that exposure to community violence can lead to increased violence even when other confounds (i.e. family and peer factors) are accounted for (Patchin, Huebner, McCluskey, Varano, & Bynum, 2006). Additionally, exposure to violence can impact development and overall well-being (Cooley-Quille, Boyd, Frantz, & Walsh, 2001; Schwab-Stone et al., 1999). Communities with high rates of substance use or violence also offer a greater opportunity for youth to engage in risk behaviors. For example, youth in high risk neighborhoods are significantly more likely to be offered drugs (Crum, LillieBlanton, & Anthony, 1996). Neighborhoods where youth witness violence, substance use, and other crimes provide a context to engage in the behaviors while having the social reinforcement from members of their community who also engage in the same behaviors. How youth respond to negative neighborhood factors may influence risk behavior

involvement indicating that specific subsets of adolescents may be more vulnerable to neighborhood effects. One study examined the effect of neighborhood income level and the co-occurrence of risk behaviors (Hair, Park, Ling, & Moore, 2009). The authors found that high socioeconomic status in addition to lower family routines and shared activities predicted membership in a moderate risk behavior group of sexual behavior and drinking. Although it was not expected that high income would increase risk behaviors it was only specific to the one subgroup that also displayed poor family processes which suggests, that income is not the most effective indicator of neighborhood effect. These results also suggest looking beyond socioeconomic status and into more socially-oriented facets of neighborhood effects (i.e. neighborhood risk involvement) can provide additional information for risk behavior trajectories (Sampson, Morenoff, & Gannon-Rowley, 2002).

Sensation seeking. To understand the development of risk behaviors researchers must also examine individual attributes that may predispose someone to engage in these behaviors (Flay et al., 2009; Jessor, 1991; Moffitt, 1993). For example, sensation seeking is a trait that describes the desire for new or novel experiences and stimuli (Zuckerman, 1979). It is hypothesized that individuals who are high in sensation seeking are more likely to seek out stimulating experiences despite their risk. Sensation seeking is said to have biological correlates such as neurotransmitters, hormones, and enzymes (Zuckerman, Buchsbaum, & Murphy, 1980) suggesting a biological predisposition to sensation seeking which could be assessed as an early indicator to risk behavior at later ages.

Zuckerman (1979) suggests there are four factors within the sensation seeking trait: thrill and adventure seeking (physical activities); experience seeking (new experiences); disinhibition (sensations from social activities); and, boredom susceptibility (the level of intolerance for

repetitive and monotonous activities). These constructs suggest an association between risk behavior and sensation seeking. Sensation seeking is an important construct during adolescence because it increases from pre- to mid-adolescence and then stabilizes (Steinberg et al., 2008). Youth high in sensation seeking tend to display greater risk taking behaviors, such as increased substance use (i.e. binge drinking and established smoking) (Sargent, Tanski, Stoolmiller, & Hanewinkel, 2010), risky sexual behavior (Wang et al., 2013) and general deviance (Newcomb & Mcgee, 1991). Newcomb and Mcgee (1991) found that at later time periods, sensation seeking was less likely to predict general deviance but rather specific domains of risk behaviors. However, their results also found that the structure of the "general deviance" domain had weakened over time, which may have impacted the influence of sensation seeking on "general deviance." These findings underscore the importance of looking at how the development of specific risk behavior profiles can be differentially impacted by individual-level factors.

Values orientation. Values are another individual level attribute that could be used as an early indicator of future risk behavior involvement. Values is a broadly defined concept representing what is important to people based on their beliefs and desires which inform their goals and motivate our behavior (Schwartz, 1992). Values differ from personality traits in that values are used to rate how desirable an individual finds certain behaviors, whereas personality would describe a pattern of behavior that the individual displays. Additionally, values will vary depending on the level of importance given to the attribute for the desired goal. Personality can vary based on the extent individuals display the attribute. Although, they serve different functions, values and personality are interrelated in their development. Values will motivate people to display a certain behavior or attribute while these attributes and behaviors will represent their personality.

The motivational component is viewed as the distinguishing feature that differentiates between values (Bilsky & Schwartz, 1994). Schwartz's values theory (2006) consists of 10 values that are organized in a circumplex model based on a continuum of motivational concerns that each value addresses (See Figure 1). Values closest together are complementary and those furthest apart are competing. The model is deconstructed into four higher order values that form two dimensions representing two main conflicts. First, *openness to change* (stimulation, self-direction, and hedonism values), the desire to pursue whatever interests regardless of the outcome, is in conflict with *conservation* (conformity, tradition, and security values), the desire to maintain stability by preserving the status quo. In the second dimension, *self-enhancement* (achievement, power values, and hedonism), which represents the desire to pursue self-interests for personal gain with no regard to others, conflicts with *self-transcendence* (benevolence and universalism), the desire to promote the well-being of others. Because of the conflict in motivational concern, valuing one competing value will likely cause the other to be devalued.

The universality of values makes it advantageous in studying different cultures and age groups. For instance, a cross-cultural study of Chinese and US samples found four clusters which coincided with the four higher order values and the competing and complementary motivations (Lee, Soutar, Daly, & Louviere, 2011). Despite the values orientation that each sample reported, both cultures showed similar patterns of relationships between values which supported Schwartz' values theory. Developmentally, Schwartz et al. (2001) suggested that the value structure was not fully developed in preadolescent youth based on results of a study conducted validating the Portrait Values Questionnaire among an Israeli youth sample. Bubeck and Bilsky (2004), however, did find a highly matured value structure similar to that of adults in a German sample of youth. They suggest there may be differences in the developmental experiences of each

culture that impact their value structure. However, regardless of the structure or differentiation of the value dimensions, it is possible that the ten individual values can predict future risk behaviors.

Several researchers have studied the association between values and behaviors. Bardi and Schwartz (2003) found that value orientation was associated with actual behaviors based on self-report and behaviors based on observer reports. The behaviors they chose to assess were directly representative of the respective values. Values have also been used to predict other behaviors that are indirectly associated to the core values. In a college sample, increased drinking levels was associated with hedonistic and stimulation values compared to youth who reported lower levels of drinking (Dollinger & Kobayashi, 2003). Risky sexual behaviors in an Eastern Europe sample was also examined using value orientations (Goodwin, Realo, Kozlova, Luu, & Nizharadze, 2002). Greater endorsement of openness to change, hedonism and self-enhancement were associated with greater risky sexual behavior. These values are at odds with conservation and self-transcendence values, which are oriented towards maintaining tradition and increasing good will towards others. Cole et al. (2007) found that youth who endorsed universalism, achievement, benevolence, conformity, tradition, and security reported fewer risk behaviors in the six months prior to assessing values. It was also predicted that hedonism and stimulation would be associated with risk behavior subclasses, but the hypothesis was not supported by the data. However, they did find stimulation and hedonism predicted specific risk behaviors within the subclasses.

Few studies have looked at the longitudinal predictive power of values on future risk behaviors. In a Scottish sample values were predictive of substance use at age 15 but not at ages 18/19 after prior substance use at age 15 was included in the model (Young & West, 2010).

Values endorsement could have more utility as a predictor at earlier ages, especially in preadolescence when risk behaviors have not occurred and cannot be used a predictor of future behaviors. Also within this sample, the authors found their results were consistently counter to Schwartz's theory. For instance, they found that "traditional" and "humanitarian" values increased substance use and "self-enhancement" decreased substance use. Further research is needed to better understand these findings; however, they do offer some possible explanations. They suggest self-enhancement values may lead to more success oriented behavior such as decreased substance use. Cole et al. (2007) also found that achievement, which is a value under "self-enhancement," predicted lower risk involvement. Additionally, the measurement scale that Young and West (2010) used had not been tested for validity and reliability to the extent that Schwartz' scale had been. The items that addressed "traditional" values included traditional gender role beliefs. The authors suggest that traditional masculine gender-role beliefs may promote greater substance use.

Bahamas and Risk Behaviors

The Bahamas is an island nation with a population of approximately 367,000 (The Bahamas Department of Statistics (2013). The island of New Providence is the most populous island with approximately 70% of the population concentrated in "urban" areas. Adolescent in the Bahamas also experience high rates of risk taking behaviors such as those in other nations. For instance, one of the highest causes of death among adolescents and young adults was related to injuries including homicide (PAHO, 2012). Additionally, national data suggests that youth in the Bahamas shows similar patterns of adolescent substance use experimentation to that of their US counterparts with 68% of secondary school youth (age not specified) reporting having tried alcohol and 13% having tried marijuana (PAHO, 2012). Adolescent and young adult populations

also report the highest increases in new HIV cases of any age group (The Ministry of Health in the Bahamas, 2011).

Person Centered Approach to Examining Risk Behaviors

When attempting to understand behavior researchers, typically use a variable-centered approach to examine the relationship among a set of constructs within a given sample. Using this nomothetic approach to generalize results to a population typically requires making the assumption that the population is homogenous in how its members would respond to each variable. However, behavioral data rarely fits this assumption. An alternative would be a person-centered approach to examine subgroups of individuals who display similar characteristics or patterns of relationships for the same set of constructs (Magnusson, 2003). A benefit of this approach is that it removes the within variation that is found in heterogeneous samples, improving predictive validity (Mandara, 2003). This approach has many applications in developmental research. The presence and timing of numerous contextual factors can change the trajectory of an individual's development. The initial conditions may change the status at the next time point and so forth, creating a ripple effect of change. However, it is known that developmental conditions can vary among individuals. Much information can be derived from looking at subgroups of individuals and examining the factors that predict these different outcomes. Therefore, not only can a person-centered approach examine relationships between constructs, it can also examine how these relationships differ within subgroups.

Mixture growth modeling and trajectory analyses have been used to analyze longitudinal data using a person centered approach. These models look at subgroup differences in the quantitative changes of an outcome over time. Analysis of trajectories can help determine the developmental trends related to negative long-term consequences (Nagin & Tremblay, 2005).

There are a number of studies, including those previously mentioned (Chen et al., 2004; Cole et al., 2007; Connell et al., 2009; Hair et al., 2009) that have used person-centered analyses such as cluster analysis and latent class analysis to identify subgroup clusters using categorical data; however, these analyses cannot be used to look at the developmental changes in longitudinal data. Because risk behavior involvement may be discontinuous for certain subgroups of youth as suggested by adolescent limited antisocial behavior, looking at the transition from one group to another group between time points could be used to identify the factors that predict these variations over time. Latent transition analysis was developed to look at such qualitative changes (Collins & Lanza, 2010). There has been some work that looked at the transitions in risk behaviors such as marijuana use in high school youth (Chung, Flaherty, & Schafer, 2006), sexual behavior in older adolescents and young adults (Lanza & Collins, 2008), and alcohol use in college youth (Lanza & Collins, 2006). However, relatively few researchers have looked at the combination of multiple risk behaviors. Monahan, Rhew, Hawkins, and Brown (2013) examined at substance use and delinquency from grade six to grade 10 using a latent variable Markov model, which is a special case of the latent transition model. They estimated four groups: abstaining or no problem behavior; delinquent behavior only; substance use only; and, both co-occurring substance use and delinquent behavior. Their results, which indicate that for these two specific problem behaviors youth were more likely to transition from abstaining to one delinquent behavior and then both delinquent behaviors, suggest a gradual progression of risk behavior involvement. The least stable groups were the single problem behavior groups, showing greater probability of transitioning from one grade to the next. Once youth were engaging in both behaviors, the probability of transitioning to a lower risk group was decreased. Peer substance use and peer delinquency predicted transitioning to and from groups. Once problem behavior

onset has already occurred, the effect of peer risk behaviors was general (i.e. peer substance use can influence substance use or delinquency); however, prior to the onset of the problem behavior the effect of peers was specific (i.e. peer substance can influence substance use only). Thus the influence of certain risk factors can vary as a function of the timing of onset.

Present Study and Hypotheses

The present study examines the development of risk behaviors in an adolescent group of Bahamian youth who were followed longitudinally from grade six to grade twelve. Using a person-centered approach, the results are expected to inform future research by identifying risk behavior subgroups. This approach has important prevention implications because it suggests ways to identify youth who are vulnerable to risk group membership based on individual level predictors and environmental predictors prior to the onset of these behaviors. Additionally, risk behaviors can increase or decrease over the course of adolescence. However, the factors that contribute to these fluctuations over time need further investigation to help identify factors that predict cessation of these behaviors once onset has begun.

A. Risk behavior classes and covariates. The first goal is to identify the risk behavior subgroups in late adolescence and the early factors that predict future group membership. Accomplishing this goal would provide evidence for risk behavior subgroups and explain why some youth are more vulnerable to risk behavior involvement. Specifically, among those who engage in risk behaviors, what are the factors that predict whether they are indiscriminate about the risk behaviors in which they partake versus those who only engage in a smaller subset of behaviors?

Aim A1. Identify risk behavior latent classes in grade 12 youth. To achieve this goal, the first aim is to evaluate whether youth in grade 12 can be divided into subgroups of risk

behaviors. It is hypothesized, that analyses will reveal multiple classes of risk behavior involvement. One group is hypothesized to contain those who do not engage in any risk behaviors which is likely to represent a large majority of the youth. Another group is hypothesized to consist of a smaller subset of youth who engage in all behaviors which is consistent with life-course persistent antisocial behavior theory and problem behavior theory. The other groups will consist of more moderate and specific risk taking. Based on results from previous studies there is likely to be a sexually active and substance use group (Cole et al., 2007; Sullivan et al., 2010) corresponding to more "normative" risk behavior experimentation as suggested by adolescence-limited antisocial behavior theory.

Aim A2. Identify factors that predict grade 12 latent classes. The second aim of this goal is to determine which early factors present in grade six predict risk behavior subgroups in grade 12. Based on the latent class analysis, group membership is used in a multinomial logistic regression to determine whether environmental factors related to peers, neighbors, and parental monitoring contribute to the risk behavior subgroups. Furthermore, other intrapersonal factors such as sensation seeking and values orientation are examined. It is hypothesized that those who engage in fewer risk behaviors may be exposed to greater protective factors like greater parental monitoring, lower perceived peer delinquency, and lower exposure to neighborhood risk involvement. It is predicated that those with high sensation seeking and value orientations towards greater openness to change and lower self-transcendence will report engaging in a greater number of risk behaviors.

B. Determine risk behavior status stability and identify covariates. The second goal of this study is to derive meaningful latent statuses of risk behaviors. Instead of limiting examination of group membership to a single point in time, changes in risk behavior

involvement over time will be examined. For certain statuses, membership is expected to vary across time. Therefore, the target is to better understand whether those who are engaging in multiple risk behaviors such as delinquency, violence, and substance use, start out as such by transitioning directly to the high risk group from the no risk group or if they proceed through intermediate, gradually escalating stages. Additionally, among those who transition to the high risk group, what is the probability that they will transition back to a low risk group? The factors that predict latent status transitions at different periods will also be explored.

Aim B1. Identify latent status membership and the changes in status membership. First, transitions from one latent status to the next will be examined. In contrast to using latent class analysis to estimate latent class membership, latent transition analysis estimates latent statuses that are comparable to latent classes but can change from one time point to the next. Latent transition analysis will predict the probability of belonging in a status at time one and then changing to another status at time two (in contrast to latent class analysis which will determine the probability of belonging in the latent status at time three independent of time two). It is predicted that the transition from high risk statuses to low risk statues will be minimal and the high risk subgroup will remain high or they will be less likely to transition to the lower risk groups. Those who are in the intermediate risk groups are likely to transition between different statues throughout adolescence displaying characteristics of more adolescence-limited risk taking. Furthermore, the probability of transitioning to a different status will decrease in later adolescence (grades nine to 12) as risk behavior patterns become more stable.

Aim B2. Identify factors that predict initial status and transition probabilities. Finally, to better understand these transitions, factors that predict changes in latent statues will be explored.   It is predicted that statuses in the intermediate groups will be impacted by

environmental factors. Specifically, higher perceived peer delinquency, higher neighborhood risk involvement, and lower parental monitoring will increase the probability of transitioning from a no risk to a moderate or high risk group and from a moderate risk group to a high risk group.

CHAPTER 2

Method

Data and Participants

FOYC and BFOOY trials. Participants included youth who participated in two randomized control trials of an HIV prevention intervention program on the island of New Providence, The Bahamas. The grade six trial, (N=1360) assessed the effect of Focus on Youth in the Caribbean (FOYC). FOYC is a cultural adaption of Focus On Kids. Focus On Kids has been adapted and assessed in many different settings including China (Li et al., 2008), Vietnam (Kaljee et al., 2005), Namibia (Stanton et al., 1998), Baltimore, MD (Galbraith et al., 1996) and now the Bahamas (Chen et al., 2009; Deveaux et al., 2007). The intervention is an evidence based program (Centers for Disease Control and Prevention, 2012) designed using the protection motivation theory (Rodgers, 1983). The intervention was developed to target and enhance coping and threat appraisals that would endorse using healthy sexual practices by increasing knowledge and improving perceptions. The intervention also emphasized skill building, decision-making, negotiation, and communication. The control condition, Wondrous Wetlands (WW), was an environmental intervention focused on water conservation in the Caribbean. Parents were also assigned to receive one or two interventions. The first, Caribbean Informed Parents And Children Together in the Caribbean (CImPACT) was a parental monitoring intervention (one session) where the parents viewed a video teaching them how to communicate with their child and they received a condom use demonstration afterwards. The intervention was adapted from the Informed Parents and Children Together (ImPACT) to reflect the Bahamian culture for the parents of the grade six youth in the Bahamas. The control counterpart for the parents, Goal For It (GFI), was a career planning intervention (one session) to teach parents how to help their child

set future goals. Participants were recruited over two years (2004-2005) and data was collected from 2004/05 to 2007/08

In grade 10 the same cohort of youth (N=2564) were randomized to participate in another HIV prevention trial of Bahamian Focus On Older Youth (BFOOY) which is a developmentally appropriate adaption of FOYC for high school youth. The control condition was the current standard of care in the Bahamian health classes, "Health and Family Life Education" (HFLE). HFLE is a health focused class that provides information on a broad range of health issues including sexually transmitted infections and HIV/AIDS. The parents of these youth were randomized to an intervention condition, CImPACT, GFI or none with four possible conditions: BFOOY+ImPACT, BFOOY+GFI, BFOOY only, and HFLE only. Recruitment occurred over two years (2008-2009) and data were collected from 2008/2009 to 2011/2012. When the youth were recruited to participate in the grade 10 study they consented to having their grade six data linked to their grade 10 data. Not all youth who participated in the grade six study participated in the grade 10 study and vice versa. However, there is a subset of youth (n=598) who participated in both trials with potential assessment data from baseline up to 72 months post-intervention for six and a half years of longitudinal data.

Procedure

Youth were randomized by school (N=15) to receive the interventions, FOYC+CImpACT or FOYC+GFI, or the control intervention, WW+GFI. At the baseline assessment, all youth received the assigned intervention, irrespective of whether they were given parental consent to participate in the assessment in the longitudinal trail. The intervention is a 10-session program taught over the course of the semester. After the intervention was implemented the youth were assessed again to measure intervention response at six, 12, 18, 24, and 36 months

post-FOYC until grade nine. In the grade six study youth who assented and whose parents consented to letting them participate were pulled from their classrooms for the assessments. During administration of the questionnaire, youth were given a questionnaire with a folder (used to cover their responses) and a pencil/eraser. Each question was read out loud as the youth followed along marking their responses. In the grade 10 study, students completed the baseline questionnaire. After the baseline assessment youth then received their randomized grade 10 intervention assignment (randomized by class N=148), BFOOY+ImPACT, BFOOY+GFI, BFOOY only, and HFLE only. The intervention was taught over the course of the semester. After receiving the intervention curriculums, the youth were assessed again at six, 12, 18 and 24 months post-BFOOY (54, 60, 66, and 72 months post-FOYC). Data were collected for all youth and those without consent were given to the Ministry of Education in the Bahamas. The Ministry of Education was given permission to collect data (de-identified) from non-consenting youth for curriculum evaluation.

The current study was approved by institutional review board of Wayne State University.

Measures

Risk behaviors. To assess risk behaviors the students were given The Bahamian Youth Health Risk Behavioral Inventory (BYHRBI) which is a cultural adaptation of the Youth Health Risk Behavior Inventory (Stanton et al., 1995), which assessed youth involvement in health related risk behaviors. Although there is limited national data, reports suggest that The Bahamas shows similar patterns of adolescent experimentation of substance use behavior to that of their US counterparts with 68% of secondary school youth (age not specified) reporting having tried alcohol and 13% having tried marijuana (PAHO, 2012). Therefore, this assessment tool is an appropriate measure of risk behaviors in the Bahamian youth sample. These findings also

suggest their behavior patterns may be similar to other cultures. The questionnaires in the grade six and grade 10 trials each contained the same items used for the current study (see Appendix). Risk behaviors were measured using yes(1)/no(0) responses to having engaged in a risk behavior in the past six months. Items from the BYHRBI were used to derive eight indicator items for latent models. Substance use items included: drank alcohol or used an illicit drug which was determined by responding yes to one of two items assessing whether they have tried cocaine or have used marijuana. Violence related items included getting in a physical fight (with a non-sibling) or carrying a gun or knife to use as a weapon. Delinquency items included selling drugs and being truant from school. Sexual risk behavior assessed whether the youth had sex in the last six months or engaged in sexual risky behaviors including having had multiple sexual partners or having had unprotected sex. Those who did not have sex in the last six month were coded as a "0" to indicate no risk equal to not having unprotected sex or not having multiple sex partners.

Exposure to neighborhood risk involvement. The youth were asked to report how often they observe certain risk behaviors in their environment among their neighbors (see Appendix). Mean scores were calculated including items: "How often have you seen a person who lives in your neighborhood drink alcohol", "....push or carry drugs", "...use marijuana", "...use crack or other illicit drugs". All items were answered using a three-point Likert scale with responses: "very often", "sometimes", and "never" (Cronbach's α ranged from .77 to .84 for the three time points).

Perceptions of peer involvement in risk behaviors. Youth were also asked to respond to items that assessed their perceptions of the peers risk behaviors (see Appendix). An example item is "How many of your close friends have had sex?" Questions also assessed perceptions of peer condom-use, drinking alcohol, smoking marijuana, using cocaine/crack, and selling drugs.

Responses were assessed on a three-point Likert scale including: "most", "some", or "none". Mean scores were calculated for perceptions of peer risk involvement (Cronbach's α ranged from .80 to .83).

Parental monitoring. Parental monitoring was measured using Silverberg and Small's (1991) eight item parental monitoring scale (see Appendix). This scale includes a range of questions that assess how often the child perceived their parent to be active and aware of their activities. Example questions include, "My parents know where I am after school", "If I am going to be home late, I tell my parents", and 'When I go out, my parents ask me where I'm going." Responses are on a 5-point Likert scale ("never", "hardly ever", "sometimes", "most of the time", "always") (Cronbach's α ranged from .84 to .88).

Sensation seeking. Sensation seeking was measured by the Brief Sensation Seeking Scale (BSSS-4) (Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2002) (see Appendix) based on the Sensation Seeking Scale (Zuckerman, Eysenck, & Eysenck, 1978). The scale consisted of four questions: "I would like to explore strange places", "I like to do frightening things", "I like new and exciting experiences even if I have to break the rules", and "I prefer friends who are exciting and unpredictable." Using a five-point Likert scale youth were asked to rate how they felt about each item ranging from "strongly agree" to "strongly disagree" (Cronbach's α = .65). The sensation seeking scale was only administered in grade six during the first year of recruitment at the baseline assessment.

Value orientation. Portrait Values Questionnaire (PVQ) (Schwartz et al., 2001) (see Appendix) consists of 40 items to assess values. The scale was modified by removing one item, "It's very important to him to show his abilities. He wants people to admire what he does," because it was considered inappropriate for the Bahamian culture. The final scale consists of 39

items for the 10 core values that make up the four higher order values of the two dimensions or conflicts: *self-transcendence* [benevolence (4 items), universalism (6 items)] (Cronbach's α = .84) *vs. self-enhancement* [hedonism (3 items), achievement (3 items), and power (3 items)] (Cronbach's α = .80); and *openness to change* [self-direction (4 items), stimulation (3 items), and hedonism (3 items)] (Cronbach's α = .72) *vs. conservation* [security (5 items), conformity (4 items), and tradition (4 items)] (Cronbach's α = .86). The responses are measured on a 6-point Likert scale ("very much like me" to "not at all like me"). The PVQ was only administered in grade six during the first year of recruitment at the baseline assessment.

Data analysis

Aim A1. Identify risk behavior latent classes in grade 12 youth. The first aim used latent class analysis (LCA) using PROC LCA in SAS 9.4. The risk behaviors at grade 12 were entered as the observed variables that served as the indicator items. Latent class analysis requires that the number of classes is identified a priori. Multiple models were conducted with varying number of classes starting with the most parsimonious, one-class, up to six to determine the number of appropriate classes. The fit of each model was compared using information criteria model fit indices, Bayesian Information Criteria (BIC) (Schwarz, 1978) and Akaike Information Criteria (AIC) (Akaike, 1974). Models with lower information criteria indicated the better fitting model. Final models were based on model fit and theoretical interpretation. Latent class analysis produces the latent class membership probabilities or the γ's (gammas) for each latent class. Item response probabilities or the ρ (rho) probabilities for each class are used to categorize and describe each class based on the indicator items each class has the highest probability of displaying.

Aim A2. Identify factors that predict grade 12 latent classes. After latent classes were determined, the results were used to examine grade six factors that predict latent class membership. Individuals were assigned to the latent class with the highest probability and means and standard deviations were computed. Although, it is not recommended to assign individuals to latent classes outside of the latent class modeling framework because it does not take into account measurement error as it would in latent class analysis, analysis of variance (ANOVA) was conducted for descriptive purposes. Tukey's corrections were applied for pairwise comparisons (Tukey, 1991). In the LCA modeling framework multinomial logistic regression was used to calculate the odds ratios (OR) with 95% confidence intervals (CI) and beta estimates (β) and standard errors (SE) for each covariate. Odds ratios and 95% CI was used to indicate significant predictors indicated by odds ratios being greater or less than 1 with confidence intervals that do not span the null value (1).

Aim B1. Identify latent status membership and the changes in status membership. Latent transition analysis (LTA) was utilized to examine risk involvement stability from grade six to grade nine then grade nine to grade 12. PROC LTA in SAS (PROC LCA & PROC LTA, 2013) was used as the platform to test the model. In latent transition analysis the subgroup that the student belongs to at a given time point is their "status" rather than "class". As with latent class analysis, the number of latent statuses must be indicated a priori. Multiple models were run to determine the number of latent statuses that best fit the data using information criteria indices. The program provided data for the item response probabilities (ρ) of latent status membership using all times points. Measurement invariance was enforced for all models. This would cause the rho probabilities for each status to be equal at each transition to determine whether status membership remained stable from one time point to the next. The delta probabilities (δ)

estimated the latent status membership probabilities at each time point. This is analogous to the gamma probabilities in latent transition analysis. The latent transition analysis will focus on the tau probabilities (τ) or the probability of transitioning from one status at time t to another status at time $t+1$.

Aim B2. Identify factors that predict initial status and transition probabilities. After a baseline model was established and the number of risk statuses were identified, predictors of latent status at time 1 and predictors of the probability of transitioning to a different status were entered as covariates. First, odds ratios with hypothesis testing for each covariate of time 1 latent status memberships were calculated. PROC LTA conducts hypothesis testing for the time 1 status covariates but not the transition probabilities. Hypothesis testing was calculated by taking the 2*log-likelihood of the complex model (model with all variables) and subtracting the 2*log-likelihood of the simpler model (model excluding the variable in question). The log-likelihood ratio test results were interpreted using a chi-square distribution. The degrees of freedom were calculated by subtracting the degrees of freedom of the simpler model from the complex model. Odds ratios and beta estimates for predictors of status transitions probabilities from time t to time $t+1$ were obtained in the LTA modeling framework using multinomial logistic regression. The multinomial logistic regression estimates the odds for membership in all the possible transition probabilities for each covariate. PROC LTA does not compute the 95% CI for OR and SE for the beta estimates and membership probabilities.

Because the data was from a risk-reduction program trial, there was concern of the intervention impacting the development of risk behaviors. Although analyzing those that had received only the control condition, Wondrous Wetlands, would be ideal, it would reduce the sample size significantly. I examined whether those who had been exposed to the intervention

differed in the amount of risk behaviors. There were only 45 students who had not received exposure to one or both of the risk-reduction interventions in either grade six or grade 10. Using chi-square difference tests on eight risk behaviors at grades six, nine, and 10, for youth who did and did not receive any intervention, exposure differences were found only for items: "had sex" and "drank alcohol" at grade 9 only. Both groups were comparable and therefore controlling for intervention exposure was deemed unnecessary and inefficient use of valuable degrees of freedom. Furthermore, previous results examining risk behavior involvement found that once gender and school performance was controlled for differences between intervention groups were eliminated (Dinaj-Koci et al., 2012).

CHAPTER 3

Results

Data preparation

Before testing the hypotheses, data were screened for accuracy of data entry and missing values. No out of range values were detected. At baseline, grade six, there were 598 students who had enrolled in both intervention trials. Because the data for this study was collected over a six year period over two studies some students were lost to follow-up. Both LCA and LTA *without* covariates use expectation maximization (EM) algorithm to obtain maximum likelihood estimates for the missing data. However, *with* covariates, LCA and LTA delete cases with missing data on covariates using listwise deletion, causing the data to have different samples sizes for each analysis; thus, it is important to address the issue particularly when examining nested models and determining significance of covariates. Therefore, before the LTA and LCA were run, listwise deletion was used for cases with data missing on covariates at time 1 and time 2 resulting in a final sample of 551 youth. Analyses containing the PVQ scales and sensation seeking only included youth from the first cohort of the FOYC trial (N=326). Both scales were removed prior to the baseline assessment for the second cohort due to its considerable length.

According to Lanza and Collins (Collins & Lanza, 2010) it is not necessary to transform covariates; however; it is recommended that covariates be standardized to facilitate interpretation of results. All covariates were standardized using PROC STANDARD in SAS 9.4. Additionally, LCA assumes two conditions, local independence and exhaustiveness. Local independence assumes that the responses to the observed indicator variables are independent within each latent class. Exhaustiveness requires that each case is assigned to only one latent

class in LCA or one status in LTA. The assumptions were explored after baseline LCA and LTA analyses were performed and no violations were found.

Risk behaviors

Figure 2 shows the frequency of each risk behavior at each time point. The prevalence rates of risk behaviors reported in the last six months in grade six were all low and less than 10% except for physical fighting (29.9%) and alcohol use (22.0%) (Table 1). Most risk behaviors increased over time with the exception of getting in a physical fight, which declined at both grade nine and grade 12. The behaviors were also examined by gender to determine if there were differences in risk behavior involvement (Table 2). Generally, males display greater rates of risk behaviors than females. At grade six, they reported greater involvement in fighting and carrying a weapon. At grades nine and 12 males also report greater sex related behaviors, fighting, carrying a weapon and selling drugs and higher truancy rates in grade nine. However, while the level of risk involvement rates is higher overall for males, the pattern of these behaviors, whether they increase or decrease overtime, were similar for males and females (see Figures 3A and 3B). Because the sample size is small and risk behaviors are scarce for many domains, looking at separate models for each gender would lead to an unstable model that should be interpreted with caution. Thus, gender was instead included as a covariate in all models rather than a grouping variable.

Hypothesis A1. There are multiple classes of risk behavior involvement.

Latent class analysis (LCA) at grade 12.

Model fit. For the latent classes of risk behaviors at grade 12, the appropriate number of classes was determined first. Table 3 presents the model fit indices for models with one latent class up to six latent classes. These results, along with model interpretability and practicality

issues, were used to determine the appropriate number of classes. The BIC was lowest for the 3-class model (BIC=301.0) and AIC was lowest for the five-class model (AIC= 167.7). As indicated in Figure 4, model fit stabilizes between three and five latent classes and model selection was based on these three models. Sparse data was a concern for the low prevalence of risk behaviors; the five-class model likely would have exacerbated this issue by increasing the number of cells. Additionally, the BIC of the five class model (BIC=347.6) was higher than both the three- and four- class (BIC=320.3) models. A three class model would not permit examining variation in risk behavior subgroups. Theoretically, a four-class model would have greater interpretability than the three-class model. Accordingly, a four-class model was chosen based on both interpretability and model fit.

Latent classes. Table 4 displays the item response probabilities for each latent class. The largest class, the *low risk class*, had a class membership probability of 0.67 (SE = 0.04) and exhibited low prevalence rates of all risk behaviors. The other three classes all displayed high probabilities of alcohol use, but differed on the other types of behaviors they displayed (see Figure 5). The next largest class, the *alcohol use and sexual activity (ETOH/SEX) class*, engaged primarily in drinking alcohol (ρ = 0.73, SE=0.06) and having sex (ρ = 1.00, SE = 0.01) and risky sexual behaviors (ρ = 0.74, SE = 0.12). The membership probability of this class equaled 0.18 (SE = 0.03). The *alcohol use and violence (ETOH/VIO) class* had a membership probability of 0.10 (SE = 0.03) and displayed high alcohol use (ρ = 0.82, SE=0.09) and violent behaviors such as physical fighting (ρ = 0.61, SE = 0.11) and moderate rates of carrying a gun (ρ = 0.47, SE = 0.14). Rates of having sex and other risk behaviors were low. The *high risk class* reported high probabilities of having engaged in alcohol use (ρ = 0.82, SE = 0.09), using illicit drugs (ρ = 0.73, SE = 0.13), having sex (ρ = 0.99, SE = 0.02), engaging in risky sexual behaviors (ρ = 0.75, SE =

0.12), carrying a weapon ($\rho = 0.95$, SE = 0.10), physical fighting ($\rho = 0.78$, SE = 0.11), and selling drugs ($\rho = 0.52$, SE = <0.00). This group had the lowest class membership ($\gamma = 0.05$, SE = 0.01).

Hypothesis A2. Youth who engage in more risk behaviors will be exposed to greater contextual risk factors and display greater intrapersonal risk factors.

LCA at grade 12 with grade six and grade nine covariates.

Descriptive and bivariate analysis. For descriptive purposes one-way ANOVA was used to compare groups on predictor variables (see Table 5). The *low risk class* was significantly lower in perceptions of risk involvement compared to the *high risk class* at grade six and was significantly lower compared to all three risk classes (*high risk*, *ETOH/VIO,* and *ETOH/SEX)* at grades nine and 12. Perception of neighborhood risk exposure for the *low risk class* was significantly lower than the other three classes at grades nine and 12. The *high risk class* also reported higher perceptions of neighborhood risk exposure than the *ETOH/SEX class* at grade 12. At grade nine, higher parental monitoring was reported in the *low risk class* compared to the *ETOH/SEX* and *high risk classes* and the *ETOH/SEX class* compared to the *high risk class*. Parental monitoring was highest for the low risk class compared to all three classes exhibiting risk behaviors at grade 12. The four latent classes did not differ on the values subscales or sensation seeking.

Multiple logistic regression in LCA modeling framework. All models included gender as a covariate and the *low risk class* was used as the reference class. The first model examined environmental factors including parental monitoring, perceptions of peer risk involvement, and perceptions of neighborhood risk involvement. The first LCA model with covariates looked at all the predictors measured at grade 6 (Table 6). With the exception of gender (Log-likelihood ratio

= 19.71, p < 0.05), none of the other variables significantly contributed to the model. Compared to the *low risk class* the *ETOH/VIO class* was 2.78 times more likely (OR = 0.36, 95% CI [0.19-0.66]) to be a male and the *high risk class* was 4.55 times more likely to be a male (OR = 0.22, 95% CI [0.10, 0.48]) (Table 7).   When examining predictors from grade nine, results found that in addition to gender (Log-likelihood ratio = 15.76, p < 0.05), perceptions of peer risk involvement (Log-likelihood ratio = 34.84, p < 0.05) and perceptions of neighborhood risk involvement (Log-likelihood ratio = 8.72, p < 0.05) were significant predictors of latent class membership at grade 12 (Table 8). The *high risk class* was 4.55 times more likely to be male (OR = 0.22 95% CI [0.11, 0.45]) and 2.73 times more likely to report higher peer risk involvement (95% CI [1.85, 4.02]) than the *low risk class* and 1.63 times more likely to report lower parental monitoring (OR = 062 95% CI [0.44, 0.86]) (Table 9). The *ETOH/VIO class'* odds of being a male was 2.38 greater (OR = 0.42 95% CI [0.23, 0.78]) than in the *low risk class*. The *ETOH/VIO class* also had a greater odds of reporting neighborhood risk involvement (OR = 1.75 95% CI [1.29, 2.38]). The *ETOH/SEX class* reported higher perceptions of peer risk involvement (OR = 1.93 95% [CI 1.54, 2.42]) and slightly higher perceptions of neighbors' risk involvement (OR = 1.32 95% [CI 1.06, 1.66]).

The model included the intrapersonal related variables, grade six values orientation and sensation seeking, as predictors of grade 12 latent class membership. The variables, self-transcendence, conservation, openness-to-change, self-enhancement, and sensation seeking were entered in one model. No variables added significantly to the model.

Hypotheses B1. Transition from the high risk status to low risk statues will be minimal, intermediate risk groups are likely to transition between different statues throughout adolescence.

Latent transition analysis (LCA)

Model fit. LTA was conducted to determine whether the behaviors youth engage in are constant or do the behaviors they engage in vary over time. The baseline model with the eight indicator variables with three time points for two possible transition periods was tested. First, the number of latent statuses was determined by running the model with two statues up to six. Similar to the LCA, comparing model fit indices (BIC, AIC) were used to determine the model with the best fit. The BIC was lowest for the four status model (BIC=1956.63) while the AIC was lowest for the for the six status model (AIC=1633.18) (Table 10). The G^2 shows its greatest drop at the three-status to the five-status models indicating that model fit likely levels off at that point (Figure 6); therefore, it gives greater confidence to a four-status model. Additionally, the four-status model would likely be more stable than the five- or six-status models given the available sample size.

Latent statuses descriptions. The four-status LTA model (Table 11) was similar to the latent classes found in the LCA. The **low risk status** displayed low item response probabilities for all of behaviors. The prevalence of this status membership was the highest at each time period; however, it decreased each follow-up (time 1 $\delta = 0.83$; time 2 $\delta = 0.71$; and time 3 $\delta = 0.48$). The next status labeled as the **alcohol and sexual activity (ETOH/SEX) status** displayed high probabilities of having sex ($\rho = 1.00$) and moderately high risky sexual behaviors ($\rho = 0.47$) as well as using alcohol ($\rho = 0.59$). This status increased from less than 0.01 at grade six to 0.25 at grade 12. The third status, the **alcohol and violence (ETOH/VIO) status** displayed high alcohol use ($\rho = 0.79$) and moderately high physical fighting ($\rho = 0.47$). The prevalence of this status remained fairly stable from 0.16 at grade six increasing slightly at grade nine ($\delta= 0.19$) then decreasing slightly at grade 12 ($\delta=0.17$). The final status, the **high risk status**, was high in

alcohol use (ρ = 0.0.83), having sex (ρ = 1.00), risky sexual behaviors (ρ = 0.66), carrying a weapon (ρ = 0.83), physical fighting (ρ = 0.77). Using illicit drugs was also moderately high for this status (ρ = 0.47). The prevalence of this status membership was very low at baseline with a rate of <0.01 and, although increased at grade 12 to 0.04, it remained relatively low.

Transition probabilities. In contrast to the LCA which predicts class membership probabilities at a given time point, the purpose of the LTA was to examine the probability of transitioning from one status at a time point to a different status at the next time point. The transition probabilities are displayed in Table 11. The probability of remaining in the **low risk status** at grade nine was τ = 0.82 which was highest of all four statuses. Although relatively low, their probability or transitioning to another status was highest when going to the **high risk status** (τ = 0.12). The probability of transitioning to the **ETOH/VIO status** (τ = 0.04) and the **ETOH/VIO status** (τ = 0.03) was low. The other status groups showed greater variability. Those in the **ETOH/SEX status** at grade six had the highest probabilities of transitioning to the **low risk status** (τ = 0.50). The transition probabilities of the **ETOH/SEX status** to either the **high risk status** or the **ETOH/VIO status** were 0.00. The **high risk status** was the least stable during the first transition (τ = 0.32) and had greater probability of transitioning to the **ETOH/VIO status** (τ = 0.68) and had a τ of 0.00 for transitioning to either the **ETOH/SEX status** or the **low risk status**. The **ETOH/VIO status** had the highest probability of transitioning to the **high risk status** (τ = 0.22), followed by the **low risk status** (τ = 0.16) and the **ETOH/SEX status** (τ = 0.05).

From grade nine to grade 12 the transitions differ slightly, likely due to the greater prevalence rates of risk behaviors from grade nine to grade 12. The **low risk status** (τ = 0.68) and the **ETOH/SEX status** (τ = 0.96) remain fairly stable. The probability of transitioning from

the **low risk status** was highest for transitioning to the **ETOH/SEX status** (τ = 0.21) followed by the **ETOH/VIO status** (τ = 0.10) and the **high risk status** (τ = 0.02). Transitioning from the **ETOH/SEX status** was highest moving to the **low risk status** (τ = 0.07). The probability of remaining in the **high risk status** was 0.50 and there a less than 0.01 probability of transitioning to the low risk status. The **high risk status** was more likely to transition to the other two moderate risk statuses, **ETOH/SEX** (τ = 0.32) and **ETOH/VIO** (τ = 0.18). The **ETOH/VIO status** was also unstable (remaining in the **ETOH/VIO status** τ = 0.40); they had a transition probability of 0.33 of going into the **ETOH/SEX status** and 0.21 probability of going into the **high risk status**. The youth in the **ETOH/VIO status** also had a less than 0.01 probability of going back into the **low risk status**.

Hypothesis B2: Youth who transition from the low risk group to the higher risk groups will be exposed to greater contextual risk factors.

    LTA with covariates.

    Model estimation and parameter restrictions. The final analysis investigated whether covariates can predict latent status membership at time 1 and status transitions between two time points. Based on results from the baseline LTA without covariates, parameter restrictions were imposed and fixed to zero when transition probabilities were less than 0.009. Transitions from the **ETOH/SEX status** to the **high risk status** or the **ETOH/VIO status**, and the **high risk status** to the **low risk status** transitions at both transitions were fixed to zero. Also the transition of the **high risk status** to the **ETOH/SEX status** during the first transition and the **ETOH/VIO status** to the **low risk status** at during the second transition were also fixed to zero. Making these restrictions aided model estimation; otherwise the logistic regression model would be unable to estimate odds ratios for the low probabilities and sparse data.

Covariates of initial latent status at grade six. LTA with covariates allows you to determine which variables are associated with initial status. Perceptions of peer risk involvement was a significant predictor of status at grade nine (log-likelihood ratio = 13.79, df =3, *p* < 0.01) (see Table 12). Youth in the **ETOH/SEX status** were 2.04 times more likely to peer risk involvement than those in the **low risk status** (Table 13). No other variable was significant.

Covariates of latent status transitions. When examining the covariates of transitions, there was a concern that the sample size may have not been sufficient to include so many covariates into the model simultaneously. Therefore, each covariate was included in the model independently to see whether there was a significant contribution to the model and the model was also run with all the variables simultaneously (Table 14). Independently, gender (log-likelihood ratio = 39.66, p < 0.001), perceptions of peer risk involvement (log-likelihood ratio = 40.38, p < 0.001) and neighbor risk involvement (log-likelihood ratio = 26.66, p = 0.045) significantly added to the model. However, when all four variables were run simultaneously in the model they became insignificant and in some case caused negative log-likelihood ratios. After removing parental monitoring and neighborhood risk exposure, which both used up valuable degrees of freedom, the model was ran again. When gender (log-likelihood ratio = 29.72, p < 0.05) and perceptions of peer risk involvement (log-likelihood ratio = 29.00, p < 0.05) were entered in one model both variables remained significant. Males were 3.85 times more likely to transition from the **low risk status** to the **ETOH/SEX status** (OR = 0.26), 1.79 times more likely to transition to the **ETOH/VIO status** (OR= 0.56), and 9.09 times more likely to transition to the **high risk status** (OR = 0.11) during the first transition (see Table 15 for beta estimates and Table 16 for odds ratios). Males were also 1.85 more likely to transition from the **ETOH/VIO status** to the **high risk status** (OR = 0.54). Over the second transition, males were

also more like to transition from the **low risk status** to the **high risk status** (OR= 0.44) and the **ETOH/VIO status** (OR=0.42).   Males were also 1.92 more likely to transition from the **ETOH/VIO status** to the **high risk status** (OR = 0.54).   Also, the odds of having high perceptions of peer risk involvement were higher when transitioning from the **low risk status** to the **high risk status** (OR= 2.56) and from the **low risk status to** the **ETOH/SEX status** (OR=1.71).

CHAPTER 4

Discussion

The current study was designed to understand the evolution of risk behaviors through the course of adolescence using a person-centered analytic approach. First, analyses revealed four distinct risk behavior profiles: a high risk class, a low risk class and two moderate risk classes. Furthermore, the changes in risk behavior were investigated. Although risk status membership remained relatively stable, certain statuses of risk behaviors were more or less likely to transition to and from other risk behavior statuses; however, once risk engagement occurred, the probability of continued risk involvement increased. Finally, the results identified gender and perceptions of neighborhood risk involvement and perceptions of peer risk involvement as risk factors for adolescent risk behavior patterns.

The risk patterns identified in grade 12 youth by latent class analysis were as predicted. The largest class (67%) consisted of adolescents who had not engaged in risk taking behaviors in the last six months. These results corroborate other research findings, which had found that the majority of adolescents do not regularly engage in risk taking behaviors (Hair et al., 2009; Sullivan et al., 2010). The remaining three latent classes engaged in multiple risk behaviors. At 5% , the high risk class was the smallest class and was comprised of youth who in engaged in multiple types of risk behaviors including drinking, using drugs, having sex, risky sexual activity, fighting, carrying a gun, and selling drugs. As predicted, the proportion of youth engaging in extensive risk taking is low in relation to the other classes identified. Youth in the high risk class likely represent a subclass of atypical offenders (Wareham, Dembo, Poythress, Childs, & Schmeidler, 2009; Wu, Witkiewitz, McMahon, & Dodge, 2010). Engaging in numerous risk behaviors is a potential indication of pathological offending such as those

described in Moffitt's (1993) life-persistence adolescent antisocial theory. In other samples, youth who display either chronic or high levels of conduct problems are shown to have other psychopathic traits such as high callousness, unemotionality and impulsivity (Andershed, Kerr, & Stattin, 2002; Wareham et al., 2009).

The remaining classes exhibited moderates levels of risk behaviors. The *alcohol and sexual activity (ETOH/SEX) latent class* showed high probability rates of drinking, having sex, and engaging in risky sexual behaviors (i.e. multiple partners and unprotected sex). High alcohol use and physical fighting categorized the *alcohol and violence (ETOH/VIO) latent class*. Co-occurring risk behaviors examined in other similar studies found comparable results. For instance, Monahan et al. (2013) studied that co-occurrence of delinquency and substance use behaviors. Similar to the current findings, the authors describe four distinct risk behavior patterns: an abstaining group that did not engage in risk behaviors, a high risk group engaging in both delinquent and substance use behaviors, and two moderate risk groups engaging in either substance use or delinquent behaviors. However, Monahan et al. (2013) did not include sexual risk behaviors. Cole et al. (2007) included a broader range of risk behaviors in a latent class analysis using the grade six students from the baseline assessment of the FOYC trial. Risk behaviors occurred at a lower rate than in the latent classes identified in the current study examining grade twelve; however, the authors found a three-class model with similar classes. One class was low in all behaviors, the second was sexually active and had high alcohol use and the last had high alcohol use, fighting, and repeating a grade. The current findings suggest, a comparable high risk group would have been too small to identify using the grade six youth only, but the moderate risk groups were similar to that of the current study. Weden and Zabin (2005) used both retrospective and prospective assessments of adolescent risk taking behaviors in an

51

older cohort of youth and found a low risk group, a high risk group, and two moderate risk groups, a sexually active group and a non-sexually active delinquent group, among two different longitudinal samples.

The groupings from the aforementioned studies as well as the current findings do exhibit slight variations which is likely an effect of each study assessing different types of risk behaviors. The field has yet to establish guidelines on how risk behaviors are measured and operationalized; therefore, risk behaviors that are measured are able to vary by individual study. However, each subgroup in the current study possessed similar characteristics to subgroups from other samples. Additionally, the proportions of the class sizes were also comparable. The current findings add to a growing body of literature that suggests that adolescents who engage in risk behaviors cannot be catalogued into an overarching group of risk-takers. While there may be a propensity towards risk taking as problem-behavior theory (Jessor, 1991) suggests, there are gradations that are unique to each group.

While results from the latent class analysis at grade 12 were able to describe subgroups of risk takers in late adolescence it does not provide any information as to the stability of such groupings over time. The current study also utilized latent transition analysis to determine how the risk behaviors change with time (e.g. do high risk takers remain high risk takers) and what are the factors that impact changing from one status to another. Results from the latent transition analysis found almost identical classifications to that of the latent class analysis (see Table 4 and Table 11). The ρ probabilities differed slightly to those of their comparable latent classes but contained the same general characteristics. Differences identified are attributed to how the groupings were estimated. The latent transition analysis used three time periods to estimate latent statuses, (grade six, nine and 12), whereas the latent class analysis used only grade 12 data

estimate the latent classes. The inclusion of other time points, particularly grade six when risk behavior occurrence is much lower than in grade 12, cause the probabilities of these behaviors to decrease in the latent transition statuses.

The *ETOH/VIO class* was similar to the **alcohol and violence (ETOH/VIO) status** in the level of alcohol use; however, at 0.48 the level of fighting was just below 0.50 making it insignificant in terms of probability. However, in comparison to all other risk behaviors in the **ETOH/VIO status**, fighting and carrying a weapon were highest. Additionally, with the exception of the **high risk status** all other status groups had low levels of violent behaviors (i.e. fighting, carrying a weapon) in comparison to the **violent status**. The **alcohol and sexual activity (ETOH/SEX) status** was slightly different from the *ETOH/SEX class* because the level of risky sexual behaviors was 0.47 and did not reach significance. Additionally, the **high risk status** exhibited slightly lower illicit drug use (0.47) and selling drugs (0.30); yet, these two behaviors were highest for this status group compared to the other groups. Both the *low risk class* and the *low risk status* displayed no significant risk behavior.

The membership probabilities for the latent statuses at each time point were as expected. The **low risk status** had the highest proportion of youth at all three time points. However, it was the only status to decrease at each time period. This is expected by grade 12 when certain risk behaviors become increasingly normative. The **high risk status** had the lowest membership rates at grade 12 and was only slightly higher than the **ETOH/SEX status** at grade six (0.01 vs < 0.01) and grade nine (0.06 vs 0.04). Again, this classification would be indicative of atypical and perhaps pathological behavior that does not seem to follow developmental trends in risk prevalence. Engagement in this type of risk behavior pattern seems to peak at grade nine and then remain at that level at grade 12. The **ETOH/VIO status** showed membership probabilities

increasing slightly at grade nine and decreases again at grade 12. Aggressive behaviors in youth are expected to decline after childhood; the overall rates of violent behaviors for the current sample followed this trend (see Figure 2). Also, similar to results of the latent transition analysis, there is evidence suggesting that there are youth who continue to show aggressive behaviors throughout adolescence or show increases in early/mid- adolescence before declining again in later adolescence (Brame et al., 2001; Broidy et al., 2003). Alcohol use is also expected to increase with age as the behavior becomes more normalized. The drinking age in the Bahamas is 18 years of age and by grade 12 the opportunity to drink may increase when many become of legal drinking age. The status that has the largest increase was the **ETOH/SEX status**. Status membership increased from 0.04 to 0.27 between grade nine and grade 12. The youth in this status are likely to represent the more prototypical adolescent risk taking that occurs during adolescence. Although still considered risky and highly discouraged, both alcohol use and sexual initiation become normative as a function age; thus, increases in these behaviors are expected as youth transition into adulthood (O'Donnell, O'Donnell, & Stueve, 2001).

An indication that the **ETOH/SEX status** likely represents more developmentally normative or prototypical adolescent risk taking is the transition probabilities of going from the **ETOH/SEX status** to the **high risk status** or to the **ETOH/VIO status** were both zero. The probability for remaining in **ETOH/SEX status** from grade nine to grade 12 was high. If the youth did transition out of the **ETOH/SEX status,** they transitioned to the **low risk status**. Additionally, early in development youth in the **low risk status** were more likely to transition to the **ETOH/VIO status** from grade six to grade nine. Later in adolescence, from grade nine to grade 12, when sexual behaviors increase and violent behaviors decrease, the probability of transitioning from the **low risk status** to the **ETOH/SEX status** increased. The probability of

transitioning from the **high risk status** and **ETOH/VIO status** to the **ETOH/SEX status** also increased from grade nine to grade 12. These findings suggest that sexual activity may not be a precursor to non-normative risk behaviors but rather a co-occurring behavior. Otherwise it seems that the **ETOH/SEX status** should transition to the other risk statuses rather than only transitioning to the **low risk status** group or remaining in the same **ETOH/SEX status**. Furthermore, although moderately high in the **ETOH/SEX status**, sexual risk behaviors such as unprotected sex and multiple sexual partners were highest in the **high risk status** (0.47 vs 0.66) indicating greater risk severity for the **high risk status** in this domain. Furthermore, transitions of statuses that include more antisocial behaviors such as fighting or using illicit drugs (i.e. **ETOH/VIO status** and **high risk status)** showed greater variability; they were more likely to transition to and from the other. At grade nine the probability of transitioning from the **high risk status** to the **ETOH/VIO status** was 0.68 and 0.22 for the **ETOH/VIO risk** to the **high risk status**. It must be noted that the behaviors are questioned in reference to behaviors reported in the last six months rather than lifetime prevalence. Thus, both severe and moderate levels of risk taking are likely to show greater variability in status membership from one time period to the next. Nonetheless, the youth in the **ETOH/VIO** and **high risk statuses**, consistently showed little probability of abstaining from risk taking at later time periods. However, by mid- to late adolescence, most youth continue to engage in risk behaviors regardless of risk classification. At grade nine (ages 13-14) the probability of transitioning to the **low risk status** at grade 12 from the **high risk status** and the **ETOH/VIO status** was almost zero; there was only a 7% probability of transitioning from the **ETOH/SEX status**. These findings suggest pre-adolescence may be a critical period wherein risk reduction interventions should be

implemented. As risk behaviors become more established in middle to late adolescence it may be a less effective time period to try to modify behavior.

While these results show that distinctive subgroups of risk behavior involvement exists, results also support problem-behavior theory (Jessor, 1991) suggesting that engaging in risk behaviors in one domain increases the probability of engaging in other risk behavior domains and is indicative of a proneness to engaging in risk behaviors. All three groups that had significant levels of risk behavior probabilities were characterized by two or more risk behaviors. However, in line with Moffitt's (1993) taxonomy of adolescent antisocial behavior, varying levels of risk involvement (i.e. high risk latent class vs. sex latent class) suggest that greater attention to the complexity of risk behaviors such as severity, onset, duration, and the relationship with other risk behaviors should be considered when studying adolescent risk-takers.

In addition to past risk behavior involvement, there are other risk and protective factors of varying domains that can influence risk behavior involvement (Flay et al., 1995; Flay et al., 2009). The current study identified early predictors of risk behavior classes in grade 12 using other intrapersonal factors and environmental contextual factors. It was hypothesized that values orientation, sensation seeking, neighborhood exposure to risk involvement, perceptions of peer involvement in risk behaviors, and parental monitoring would be significantly associated with risk behavior latent classes. Latent class analysis of grade 12 risk behaviors found that the only grade six predictor that was significant was gender. The *ETOH/VIO class* was almost three times as likely to consist of males. Other studies have found similar results showing males are more likely to engage in aggressive behavior than females (Lindberg, Boggess, & Williams, 2000).

When examining grade nine predictors, neighborhood risk exposure, peer risk behaviors and gender were all significant predictors of grade 12 latent class membership. Exposure to neighborhood risk behaviors was associated with membership in the *ETOH/SEX* and *ETOH/VIO classes*. Peer risk behavior was associated with the *high risk* and *ETOH/SEX classes.* These findings were as predicted. Peers have been shown to influence sexual behaviors (Santelli et al., 2004; Wang et al., 2013), substance use and other delinquent behaviors (Kiesner et al., 2010; Monahan et al., 2009; Oxford et al., 2001). The *ETOH/VIO class,* however, was not associated with perceptions of peers. Sullivan, Farrell, and Kliewer (2006) suggest that poor peer relationships can be a risk factor for aggressive behaviors. The perceptions of peer risk involvement may have a lower influence on the *ETOH/VIO class* than on the *ETOH/SEX class* and *high risk class,* particularly if the cause of their aggressive behaviors is linked to poor peer relationships and peer rejection. Although youth in the high risk class also exhibit violent risk behaviors, perhaps the cause of their violent behavior is associated with their relationships with individuals outside their friendship group. Additionally, other factors related to peer relationships may influence their tendency to engage in the other risk behaviors. For instance, Flay et al. (1995) showed that prior cigarette smoking was more likely to lead to alcohol use when peer refusal skills were low. Therefore, risk factors may influence specific risk behaviors as well the co-occurrence of these behaviors.

Results using grade six predictors indicated that the constructs measured may not have been sensitive enough to predict differences in grade 12 youth; however, in grade nine there are potential ways to identify future risk behavior involvement in grade 12. Research suggests that social risk factors measured during preadolescence may not be as successful at predicting later risk involvement as factors measured at later time periods (Herrenkohl et al., 2000). By the

junior high years the behaviors of the adolescent have a higher probability of occurring and a higher probability of being influenced by their social network including neighbors and peers, or conversely, influence the selection of their social network. However, unlike the results of the latent class analysis, when ANOVA (Table 4) was conducted peer risk behaviors differed between the *low risk class* and the other risk class at grade six and grade nine. The ANOVA results also show that adolescents in the *low risk class* showed significantly lower perceptions of risk behavior exposure from neighbors and higher parental monitoring at grade nine and 12. Therefore, the limited sample size may have not been sufficient to completely undercover these differences directly within the latent class models.

This study examined personality dispositions and values orientation in pre-adolescence on risk behavior classes in grade 12. Rather than using the 10 individual values the current study utilized the four higher-order values that represented the two competing dimensions of Schwartz values theory (2006). However, no significant variables were identified in either the latent class analysis with covariates or the one-way ANOVA. It is likely that at age 10 values orientation is not established and over six years values orientation may change substantially during adolescence which is a critical time in moral and personality development. While Bubeck and Bilsky (2004) found matured values structure similar to adults in a German sample of youth, Schwartz et al. (2001) did not find that the value structure was developed in an Israeli sample of youth. Also, Young and West (2010) found that values at mid-adolescence did not predict risk behaviors at late adolescence; however, it did predict risk behaviors during mid-adolescence.

Also contrary to previous work (Newcomb & Mcgee, 1991; Sargent et al., 2010; Wang et al., 2013), the current study did not find sensation seeking as a significant predictor of risk behaviors. Wang et al., 2013 also utilized the data from the grade six FOYC trial found that

sensation seeking and parental monitoring had significant *indirect* relationships with risk taking behaviors. These relationships were mediated by peer influence. Friends and peers may serve as a key factor of risk engagement whereas personality factors and parent influence may indirectly impact risk involvement by influencing the adolescent's selection of friends or the people with whom they interact.

Looking at latent status transitions predictors of both initial status and the probability of transition were examined. Results from the latent transition analysis with covariates found that perception of peer involvement in risk behaviors was a significant predictor of initial status at the first time point, grade six. Youth in the **low risk status** are two times more likely than the **ETOH/SEX status** to report lower perceptions of risk involvement among their peers and three times more likely than the **high risk status**. Predicting status changes during transitions from grade six to grade nine and grade nine to grade 12, two significant predictors were identified. Males were also more likely to transition from the **low risk status** to other three risk statuses at grade nine. Males were also more likely to transition from the **low risk status** to the **high risk status** and the **ETOH/VIO status** at grade 12. Males were also more likely to transition to the **high risk status** from the **ETHO/VIO status**. These results are consistent with other findings that show males are more likely to engage in high-taking behaviors including violent behaviors (Weden & Zabin, 2005). Results also showed peer risk behavior was a significant covariate of transitioning from the **low risk status to** the **high risk status** and the **ETOH/SEX status** at grade 12 but not at grade nine.

Because of the small sample size in terms of number of indicators and number of covariates, results from the latent transition analysis with covariates should be interpreted with caution; however, the findings consistently identified peers as a significant predictor of risk

behavior classifications. Peer influence was a significant predictor of grade 12 latent classes, initial statuses at grade six, and changes in latent status from grade nine to grade 12. It is clear that peers are integral to risk behavior involvement. There results support other research that has found that perceptions of their peers risk behaviors are associated with their own risk behaviors (Monahan et al., 2009). Adolescents may seek friends with similar propensity towards risky behaviors (Hoffman, Monge, Chou, & Valente, 2007) or they may imitate the behaviors of their friends (Bandura, 1977; Lee, Akers, & Borg, 2004). The current findings are supported by previous research that has shown that peer acceptance appeals to the reward-seeking adolescent (Sebastian et al., 2011) and can increase risk related decisions when in the presence of peers (Chein et al., 2011; Gardner & Steinberg, 2005). Adolescent social situations have the potential to be greatly rewarding; however, the potential of engaging in risk related behaviors increases.

Limitations and Future Directions

The current study has several limitations. First, it is limited by the unique sample of Bahamian students. Therefore, generalizing the results to other populations should be done with caution. For instance, the way Bahamian youth interpret measures such as the PVQ may differ from other samples. Risk behaviors measures could also be problematic. In many Caribbean countries the legal age of alcohol consumption is 18 years old and the social norms associated which alcohol may differ slightly than the US, although, as previously stated, Bahamian youth do show similar rates of substance use behaviors (PANO, 2012). They also show similar increases in sex-related behaviors during mid to late adolescence (O'Donnell et al, 2001) and show similar decreases in aggressive behaviors through adolescence (Broidy et al., 2003). Second, due to the sensitive nature of the behaviors in question self-report measures were utilized which can haves potential biases. Direct observation was not feasible in this longitudinal

study. Lastly, the analyses were rather complex for both latent transition analysis and latent class analysis with covariates. For a longitudinal study beginning at grade six with follow-up to grade 12 the sample size is reasonably large. In fact, a sample size of 300 or larger is considered acceptable for latent transition and class analysis (Collins & Lanza, 2010). The current study with 598 youth would seem sufficient; however, for the models tested, the actual occurrence of behaviors within groupings was sparse at the earliest time points and such analyses could benefit from a larger sample.

Despite these limitations the current study has many implications for future research. Distinct risk behavior profiles were identified, which indicate that risk behavior involvement is more complex than a general proneness to risk taking. Categorizing all youth into one group may limit the ability to address the nuances of each subgroup. Those with more severe levels of risk taking may need different services than those that are displaying more prototypical adolescent risk taking. Clinicians have recently begun to utilize person-centered approaches in designing their treatment programs to address differential treatment response (Bagby et al., 2008). Risk reduction interventions could also use this approach to improve intervention response. Prior to intervention exposure, screenings would determine the appropriate form of the intervention that would best suit the individual to maximize efficiency by applying the necessary, but sufficient, components of the intervention. The findings also suggest a critical period when risk taking becomes a regular aspect of an adolescent's behavioral repertoire. As the latent transition analysis found, the high risk groupings that displayed more antisocial behaviors (i.e. fighting, illicit drug use) show the greatest rates of increase by mid-adolescence. Furthermore, continued engagement in risk taking behaviors was probable at each subsequent time point. Therefore, the onset of adolescence is the period that youth begin to set their risk behavior

trajectories and once they are on this course it less probable that they will deviate from it. These results also emphasize the impact of peers and other contextual factors on risk behaviors. Research has consistently showed that that although adolescents are capable of distinguishing a good decision from a poor decision, the potential to choose the poor decision increases when placed in an emotionally driven situation among friends (Chein et al., 2011; Gardner & Steinberg, 2005). Future work should examine how these risk behavior profiles develop among different social and friendship networks. Synthesizing knowledge on the formation of social networks, which can fluctuate throughout adolescence, with the study of adolescent risk taking may explain the variations in risk behaviors profiles that are seen over time (Burt & Rees, 2014). Finally, these subgroups could potentially provide information on later adulthood outcomes. Using the same analytic framework researchers can use latent risk classes in adolescence to predict distal outcomes in adulthood (Collins& Lanza, 2010) such as academic attainment, incarceration, employment, health related issues and numerous other outcomes related to quality of life.

In summary, the current study was designed to address the prevalence of risk behaviors in youth populations by investigating three different components of adolescent risk taking. First, incorporating a broad range of risk behaviors, the analyses identified four distinct patterns that categorize youth risk involvement. Much research has examined adolescent risk behaviors individually or as an overall construct of risk taking behavior. Bridging these two approaches the current findings add to a growing body of research that suggests adolescent researchers should investigate the co-occurrence of multiple risk behaviors that form specific profiles of adolescent risk-takers. Second, results describe the stability of these risk behavior profiles over time and identify a possible critical period for intervention. Youth who engage in multiple risk behaviors,

particularly antisocial behaviors (i.e. fighting, selling drugs), and are engaging in these behaviors by the onset of adolescence have a relatively lower probability of discontinuing risk engagement and a greater probability of engaging in a greater number of risk behaviors. Lastly, covariates of these risk patterns were identified. Gender and social influences such as peers and neighbors were associated with risk behavior classes in later adolescence, initial risk behavior status and the probability of changing risk behavior status from mid to late adolescence. Overall, this study illustrates the complexity of adolescent risk behaviors and applying a person-centered approach can provide an additional level of information that a variable-centered method alone would not have detected.
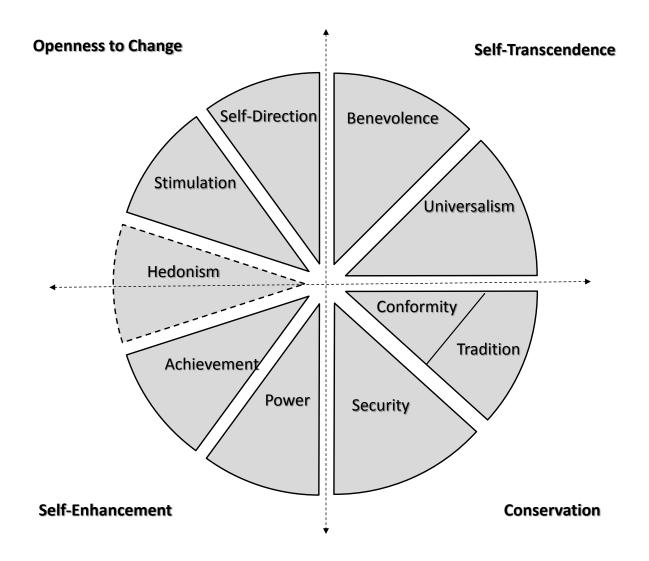
APPENDIX A: FIGURES
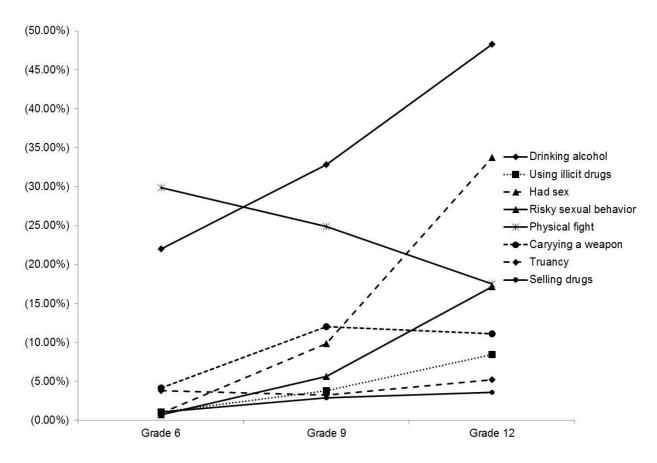

Figure 1. Schwartz Values Theory

Figure 2. Risk behavior Frequencies for all Youth from Grade Six to Grade 12.
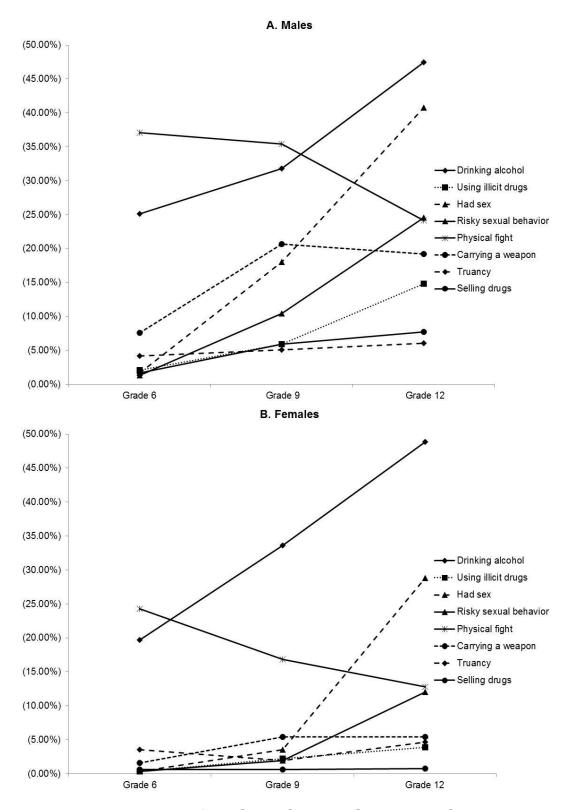
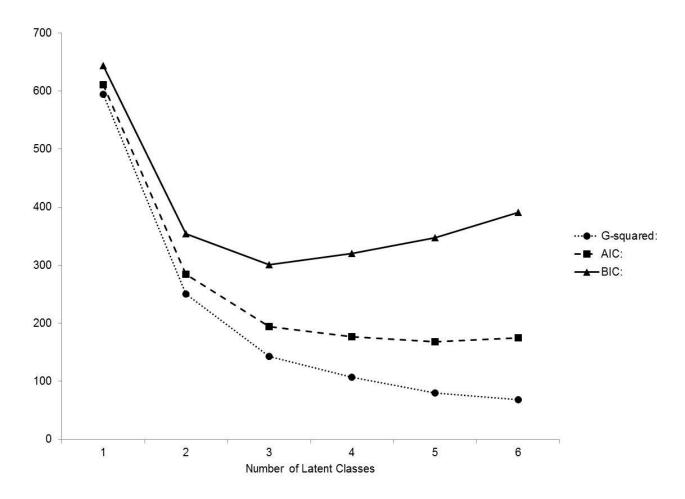*Figure 3.* Risk Behaviors from Grade Six up to Grade 12 by Gender

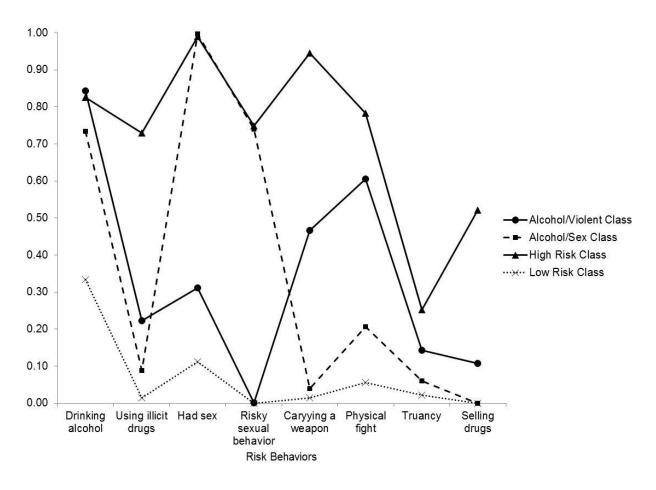*Figure 4.* Model Fit Indices for Latent Class Analysis
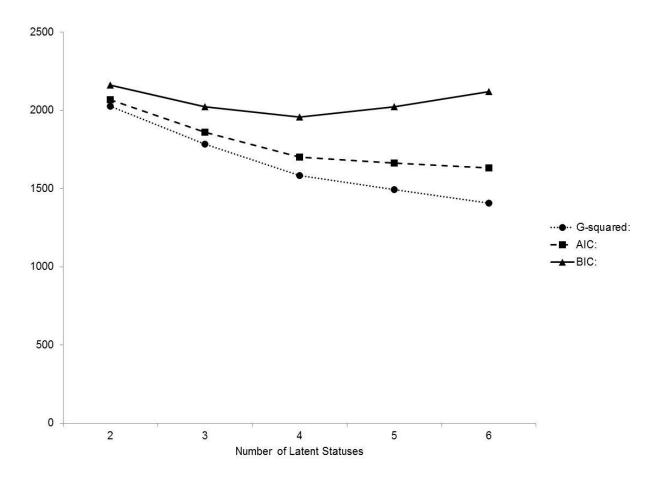
Figure 5. Latent Class Item Response Probabilities

Figure 6. Model Fit Statistics for Latent Transition Analysis

APPENDIX B: MEASURES

Bahamian Youth Health Risk Behavioral Inventory:

PLEASE CIRCLE THE CORRECT ANSWER.

1. How old are you?

    13   14   15   16   17   18   19

2. Compared to other students in your class, what kind of student are you?

    1. one of the best
    2. in the middle
    3. near the bottom

3. Think back over the last six (6) months, how many whole days of school have you missed? _____

3a. If you missed any days of school, did you miss school because you were suspended from school?

    Yes_1 No_0

3b. If you missed any days of school did you miss school because you played hooky?

    Yes_1 No_0

4. In the last six (6) months, did you carry a knife, screwdriver or cutlass to use as a weapon?

    Yes_1 No_0

5. In the last six (6) months, have you carried a gun to use as a weapon?

    Yes_1 No_0

6. In the last six (6) months, have you been in a physical fight, other than with your brother sister?

    Yes_1 No_0

7. In the last (6) months, have you been involved in stealing or burglarizing a home or shop/business?

    Yes_1 No_0

8. In the last six (6) months, have you smoked a cigarette or Backwoods?

    Yes_1 No_0

9. In the last six (6) months, have you had a drink of alcohol, beer, wine, rum, or bush rum or liquor (not including when you are taking communion)?

    Yes_1 No_0

10. In the last six (6) months, have you used marijuana (weed, pot, grass)?

    Yes_1 No_0

11. In the last six (6) months, have you tried any form of cocaine, including powder, crack, freebase or rock?

    Yes_1 No_0

12. In the last six (6) months, have you pushed or carried any drugs?

    Yes_1 No_0

13. In the last six (6) months, have you been asked to sell drugs or be a look-out?

    Yes_1 No_0

14. In the last six (6) months, have you talked with your family or other adults? about HIV and AIDS?

    Yes_1 No_0

15a. Do you have a boyfriend/girlfriend?

Yes$_1$ No$_0$
15b.   If yes, how old is your boyfriend or girlfriend?
13 years or younger 14   15   16   17   18   19   20   21 years or older

WE ARE GOING TO ASK YOU SOME MORE PERSONAL QUESTIONS NOW. PLEASE
CIRCLE THE RESPONSE THAT BEST DESCRIBES YOU.
REMEMBER NO ONE WILL KNOW HOW YOU ANSWERED THE QUESTIONS.
IF ANY QUESTION MAKES YOU FEEL UNCOMFORTABLE OR YOU DON'T FEEL YOU
CAN ANSWER HONESTLY, YOU MAY SKIP THE QUESTION.
 1.   Have you ever had sex? That is when the boy or man puts his penis in the girl's vagina?
       a. *No*, I have never ever had sex$_0$
       b. *Yes*, I have had sex (including just having sex once)$_1$
2.   How old were you the first time you had sex?
       a. 10 years or younger   11   12   13   14   15   16   17 years or older
       b. I have never ever had sex
3.   Have you had sex in the last six months?
       a. Yes, I have had sex in the last six months
       b. No, I have not had sex in the last six months
       C. No, I have never ever had sex
4.   In the last six months with how many people did you have sex?
                        a.   0
                        b.   1
                     c.   2
                     d.   3 or more
                     e.   I have never ever had sex
 5.   In the last six months, how many times did you have sexual intercourse?
                        a.   0
                        b.   1
                     c.   2
                        d.   3 or more
                        e.   I have never ever had sex
6.   Did you talk about using condoms with your most recent sexual partner?
                     a. Yes$_1$ b. No$_0$ c. I have never ever had sex
7.   The last time you had sex, did you or your partner use a condom?
                     a. Yes$_1$ b. No$_0$ c. I have never ever had sex$_{-8}$
8.   How often did you use a condom when you had sex?
       a. I never used a condom when I had sex
       b. Sometimes
       c. Always
       d. I have never ever had sex

Environmental Risk Exposure:
Circle the best response to show how often you see relatives or people in your neighborhood do
any of these activities. The responses are Very Often (VO), Sometimes (S), and Never (N).

B)		Very Often (VO₁)	Sometimes (S₂)	Never (N₃)
1.	How often have you seen one of your relatives drink alcohol?	VO_1	S_2	N_3
2.	How often have you seen one of your relatives push or carry drugs?	VO_1	S_2	N_3
3.	How often have you seen one of your relatives smoke marijuana?	VO_1	S_2	N_3
4.	How often have you seen one of your relatives use crack, cocaine or other illegal drugs?	VO_1	S_2	N_3
5.	How often have you seen one of your relatives with a gun?	VO_1	S_2	N_3
6.	How often have you seen a person who lives in your neighborhood drink alcohol?	VO_1	S_2	N_3
7.	How often have you seen a person who lives in your neighborhood push or carry drugs?	VO_1	S_2	N_3
8.	How often have you seen a person who lives in your neighborhood use marijuana?	VO_1	S_2	N_3
9.	How often have you seen a person who lives in your neighborhood use crack, cocaine or other illegal drugs?	VO_1	S_2	N_3
10.	How often have you seen a person who lives in your neighborhood with a gun?	VO_1	S_2	N_3
11.	How often have you seen physical fighting in your neighborhood?	VO_1	S_2	N_3

Perceived Peer Risk Involvement:

In this exercise, we want you to tell us how many teenagers you know who are about your age who are having sex. How many of them use condoms? If you do not know, try and guess as best as you can.

1. How many of your close friends have sex?
    a. $Most_1$ b. $Some_2$ c. None of them are having sex_3

2. Of your close friends who have had sex, how many use condoms?
    a. $Most_1$ b. $Some_2$ c. None use $condoms_3$
    d. None of them are having sex $_{-8}$

3. How many of the boys you know have sex?
    a. $Most_1$ b. $Some_2$ c. None of them are having sex_3

4. Of the boys who have had sex, how many use condoms?
    a. $Most_1$ b. $Some_2$ c. None use $condoms_3$

L)		Never (N₁)	Hardly Ever (HE₂)	Sometimes (S₃)	Most of the Time (MOTT₄)	Always (A₅)
7.	When I go out, my parents/guardian tell me what time I'm going to return.	N_1	HE_2	S_3	$MOTT_4$	A_5
8.	When I go out at night, I always return on time.	N_1	HE_2	S_3	$MOTT_4$	A_5

Sensation-seeking:
Circle the best response to show how you feel about the following statements. The responses are Strongly Agree (SA), Agree (A), Don't Know (DK), Disagree (D), and Strongly Disagree (SD).

		Strongly Agree (SA)	Agree (A)	Don't Know (DK)	Disagree (D)	Strongly Disagree (SD)
1.	I would like to explore strange places.	SA	A	DK	D	SD
2.	I like to do frightening things.	SA	A	DK	D	SD
3.	I like new and exciting experiences even if I have to break the rules.	SA	A	DK	D	SD
4.	I prefer friends who are exciting and unpredictable.	SA	A	DK	D	SD

Values Portrait Questionnaire:
Here we briefly describe some people. Please read each description and think about how much each person is or is not like you. Please circle the answer that shows how much the description is like you. The options are Very Much Like Me (VMLM), Like Me (LM), Somewhat Like Me (SLM), A Little Like Me (ALLM), Not Like Me (NLM), and Not Like Me At All (NLMAA).

1.	Thinking new ideas and being creative is important to him. He likes to do things in his own original way.
2.	It is important to him to be rich. He wants to have a lot of money and expensive things.

3.	He thinks it is important that every person in the world be treated equally. He believes that everyone should have equal opportunities in life.
4.	It is important to him to live in secure surroundings. He avoids anything that might endanger his safety.
7.	It is important to him to listen to people who are different from him. Even when he disagrees with them, he still wants to understand them.
8.	He thinks it's important not to ask for more than what you have. He believes that people should be satisfied with what they have.
9.	He seeks every chance he can to have fun. It is important to him to do things that give him pleasure.
10.	It is important to him to make his own decisions about what he does. He likes to be free to plan and to choose his activities for himself.
11.	It's very important to him to help people around him. He wants to care for their well being.
12.	Being very successful is important to him. He likes to impress other people.
13.	It is very important to him that his county be safe. He thinks the country must be on watch against threats from within.
14.	He likes to take risks. He is always looking for adventures.
15.	It is important to him to always behave properly. He wants to avoid doing anything people would say is wrong.
16.	It is important to him to be in charge and tell others what to do. He wants people to do what he says.
17.	It is important to him to be loyal to his friends. He wants to devote himself to people close to him.
18.	He strongly believes that people should care for nature. Looking after the environment is important to him.
19.	Religious beliefs are important to him. He tries hard to do what his religion requires.
20.	It is important to him that things are organized and clean. He really does not like things to be a mess.
21.	He thinks it is important to be interested in things. He likes to be curious and try to understand all sorts of things.
22.	He believes all of the worlds' people should live in harmony. Promoting peace among groups in the world is important to him.
23.	He thinks it is important to be ambitious. He wants to show how capable he is.
24.	He thinks it is best to do things in traditional ways. It is important to him to keep up the customs he has learned.
25.	Enjoying life's pleasures is important to him. He likes to "spoil' himself.
26.	It is important to him to respond to the needs of others. He tries to support those he knows.

27.	He believes he should always show respect to his parents and to older people. It is important to him to be obedient.
28.	He wants everyone to be treated justly, even people he doesn't know. It is important to him to protect the weak in society.
29.	He likes surprises. It is important to him to have an exciting life.
30.	He tries to avoid getting sick. Staying healthy is very important to him.
31.	Getting ahead in life is important to him. He strives to do better than others.
32.	Forgiving people who have hurt him is important to him. He tries to see what is good in them and not to hold a grudge.
33.	It is important to him to be independent. He likes to rely on himself.
34.	Having a stable environment is important to him. He is concerned that the social order be protected.
35.	It is important to him to be polite to other people all the time. He tries to never disturb or irritate others.
36.	He really wants to enjoy life. Having a good time is very important to him.
37.	It is important to him to be humble and modest. He tries not to draw attention to himself.
38.	He always wants to be the one who makes the decisions. He likes to be the leader.
39.	It is important to him to adapt to nature and to fit into it. He believes that people should not change nature.

APPENDIX C: TABLES

Table 1
Frequency (%) of risk behaviors for all youth at grades six, nine and 12

	Grade 6		Grade 9		Grade 12	
Drinking alcohol	121	*(22.04%)*	180	*(32.85%)*	211	*(48.28%)*
Using illicit drugs	6	*(1.09%)*	21	*(3.83%)*	37	*(8.43%)*
Had sex	5	*(0.92%)*	54	*(9.84%)*	147	*(33.72%)*
Risky sexual behavior	4	*(0.74%)*	31	*(5.65%)*	75	*(17.20%)*
Physical fight	163	*(29.85%)*	136	*(24.91%)*	77	*(17.50%)*
Carrying a weapon	23	*(4.19%)*	66	*(12.02%)*	49	*(11.14%)*
Truancy	21	*(3.84%)*	18	*(3.28%)*	23	*(5.25%)*
Selling drugs	6	*(1.10%)*	16	*(2.92%)*	16	*(3.64%)*

Table 2
Frequency *(%)* of Risk Behaviors by Gender and Grade

	Boys	Girls	χ^2	p-value
Drinking alcohol				
Grade 6	60 *(25.10%)*	61 *(19.68%)*	2.31	0.128
Grade 9	75 *(31.78%)*	105 *(33.65%)*	0.21	0.644
Grade 12	85 *(47.49%)*	126 *(48.84%)*	0.08	0.781
Using illicit drugs				
Grade 6	5 *(2.10%)*	1 *(0.32%)*	3.95	0.047
Grade 9	14 *(5.91%)*	7 *(2.24%)*	4.91	0.027
Grade 12	27 *(14.84%)*	10 *(3.89%)*	16.54	<0.001
Had sex				
Grade 6	4 *(1.69%)*	1 *(0.33%)*	2.74	0.098
Grade 9	43 *(17.99%)*	11 *(3.55%)*	31.74	<0.001
Grade 12	73 *(40.78%)*	74 *(28.79%)*	6.79	0.009
Risky sexual behavior				
Grade 6	3 *(1.29%)*	1 *(0.33%)*	1.65	0.199
Grade 9	25 *(10.46%)*	6 *(1.94%)*	18.41	<0.001
Grade 12	44 *(24.58%)*	31 *(12.06%)*	11.61	<0.001
Physical fight				
Grade 6	88 *(37.13%)*	75 *(24.27%)*	10.59	0.001
Grade 9	84 *(35.44%)*	52 *(16.83%)*	24.85	<0.001
Grade 12	44 *(24.18%)*	33 *(12.79%)*	9.58	0.002
Carrying a weapon				
Grade 6	18 *(7.56%)*	5 *(1.61%)*	11.91	<0.001
Grade 9	49 *(20.68%)*	17 *(5.45%)*	29.52	<0.001
Grade 12	35 *(19.23%)*	14 *(5.43%)*	20.55	<0.001
Truancy				
Grade 6	10 *(4.20%)*	11 *(3.56%)*	0.15	0.699
Grade 9	12 *(5.06%)*	6 *(1.92%)*	4.19	0.041
Grade 12	11 *(6.08%)*	12 *(4.67%)*	0.42	0.515
Selling drugs				
Grade 6	4 *(1.69%)*	2 *(0.65%)*	1.34	0.248
Grade 9	14 *(5.91%)*	2 *(0.64%)*	13.15	<0.001
Grade 12	14 *(7.69%)*	2 *(0.78%)*	14.50	<0.001

Table 3
Model Fit Indices for Latent Class Analysis

	Log-Likelihood	G^2	AIC	BIC	Entropy	DF
1 class	-1425.0	594.8	610.8	643.5	1.00	247
2 class	-1252.7	250.5	284.5	354.0	0.81	238
3 class	-1199.0	142.7	194.7	301.0	0.87	229
4 class	**-1181.2**	**107.2**	**177.2**	**320.3**	**0.84**	**220**
5 class	-1167.5	79.7	167.7	347.6	0.90	211
6 class	-1161.9	68.6	174.6	391.2	0.91	202

Note: Four class model selected for analyses

Table 4

Item Response Probabilities (SE) and Group Membership Probabilities for Grade 12 Latent Classes

	Latent Class							
	High Risk Class		ETOH/VIO Class		ETOH/SEX Class		Low Risk Class	
Class membership probabilities (γ)	0.05	(0.01)	0.10	(0.03)	0.18	(0.03)	0.67	(0.04)
<u>*Risk Behaviors*[1]</u>								
Drinking alcohol	**0.82**	(0.09)	**0.84**	(0.09)	**0.73**	(0.06)	0.33	(0.03)
Using illicit drugs	**0.73**	(0.13)	0.22	(0.09)	0.09	(0.04)	0.01	(0.01)
Had sex	**0.99**	(0.02)	0.31	(0.12)	**1.00**	(0.01)	0.11	(0.03)
Risky sexual behavior	**0.75**	(0.12)	0.01	(0.01)	**0.74**	(0.12)	<0.00	(0.00)
Physical fight	**0.78**	(0.11)	**0.61**	(0.11)	0.21	(0.06)	0.06	(0.02)
Carrying a weapon	**0.95**	(0.10)	*0.47*	(0.14)	0.04	(0.03)	0.01	(0.01)
Truancy	0.25	(0.11)	0.14	(0.07)	0.06	(0.03)	0.02	(0.01)
Selling drugs	**0.52**	(0.13)	0.11	(0.06)	<0.00	(0.00)	0.00	(0.00)

Note: [1] Item response probabilities (ρ) in **bold** are greater than 0.50

Table 5
Means *(SD)* for Model Variables by Latent Class Membership at Grade 12

	Latent Class							
	High Risk Class		ETOH/VIO Class		ETOH/SEX Class		Low Risk Class	f-value
Grade six	21		39		88		292	
Neighborhood	1.80	*(0.69)*	1.63	*(0.65)*	1.58	*(0.50)*	1.59 *(0.58)*	0.89
Peer risk behaviors	1.40	*(0.37)*	1.34	*(0.37)*	1.26	*(0.32)*	1.21 *(0.31)*	4.28**
Parental monitoring	3.85	*(0.96)*	4.16	*(1.00)*	4.25	*(0.88)*	4.33 *(0.81)*	2.45
Grade nine								
Neighborhood	2.19	*(0.61)*	2.06	*(0.64)*	1.99	*(0.58)*	1.67 *(0.61)*	12.93***
Peer risk behaviors	1.86	*(0.43)*	1.62	*(0.39)*	1.72	*(0.36)*	1.38 *(0.38)*	26.82***
Parental monitoring	3.74	*(0.72)*	4.17	*(0.72)*	4.18	*(0.70)*	4.44 *(0.66)*	9.97***
Grade 12								
Neighborhood	2.44	*(0.43)*	2.14	*(0.57)*	2.02	*(0.57)*	1.65 *(0.59)*	24.11**
Peer risk behaviors	2.11	*(0.19)*	1.94	*(0.28)*	1.95	*(0.23)*	1.65 *(0.37)*	31.93***
Parental monitoring	3.57	*(0.71)*	3.81	*(0.70)*	4.00	*(0.81)*	4.32 *(0.73)*	12.95***
Grade six intrapersonal								
Self-transcendence	4.63	*(0.93)*	4.11	*(0.98)*	3.92	*(1.29)*	4.14 *(1.09)*	1.33
Conservation	4.72	*(0.98)*	4.26	*(0.83)*	3.93	*(1.19)*	4.31 *(1.01)*	2.51
Self-enhancement	4.33	*(0.76)*	4.08	*(0.81)*	3.69	*(1.40)*	3.98 *(1.17)*	1.28
Openness to change	4.37	*(0.64)*	4.12	*(0.90)*	3.81	*(1.22)*	4.08 *(0.99)*	1.31
Sensation-seeking	2.83	*(0.73)*	2.86	*(1.01)*	2.70	*(0.88)*	2.67 *(0.90)*	0.39

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

81

Table 6
LCA Hypothesis Tests for Grade Six Covariates

Grade 6 Covariates	LL Covariate Removed	Likelihood-Ratio Statistic[2]	df	p-values
Environmental Factors Model[1]				
Gender	-1173.85	19.71	3	<0.001
Neighborhood	-1164.04	2.09	3	0.554
Peer risk behaviors	-1164.76	3.53	3	0.317
Parental monitoring	-1163.95	1.91	3	0.592
Intrapersonal Factors Model[2]				
Gender	-657.58	17.18	3	0.001
Self-transcendence	-648.82	-0.35	3	.
Conservation	-650.65	3.31	3	0.346
Self-enhancement	-649.11	0.22	3	0.974
Openness to change	-649.12	0.25	3	0.970
Sensation-seeking	-649.00	0.01	3	1.000

Note: LL=Log-likelihood; Likelihood-ratio statistic=2*(Complex model – Null model)
[1]Log-likelihood of overall model = -1163.00
[2]Log-likelihood of overall model = -649.00

Table 7

Beta Estimates (β) and Odds Ratios (OR) for Covariates at Grade Six for Grade 12 LCA

	Latent Class			
	High Risk Class	ETOH/VIO Class	ETOH/SEX Class	Low Risk Class
Intercept				
β *(SE)*	-0.49*(0.57)*	-0.32*(0.47)*	-0.65*(0.35)*	Ref
OR *(95% CI)*	0.62*(0.21-1.87)*	0.73*(0.29-1.82)*	0.52*(0.26-1.03)*	
Gender				
β *(SE)*	-1.52*(0.40)*	-1.03*(0.31)*	-0.41*(0.21)*	Ref
OR *(95% CI)*	0.22*(0.10-0.48)*	0.36*(0.19-0.66)*	0.66*(0.44-1.01)*	
Neighborhood				
β *(SE)*	0.23*(0.17)*	0.09*(0.15)*	-0.10*(0.11)*	Ref
OR *(95% CI)*	1.26*(0.90-1.77)*	1.10*(0.82-1.47)*	0.91*(0.73-1.12)*	
Peer risk behaviors				
β *(SE)*	0.27*(0.18)*	0.11*(0.15)*	0.25*(0.11)*	Ref
OR *(95% CI)*	1.31*(0.92-1.85)*	1.11*(0.82-1.51)*	1.28*(1.02-1.60)*	
Parental monitoring				
β *(SE)*	-0.32*(0.16)*	0.03*(0.15)*	-0.05*(0.10)*	Ref
OR *(95% CI)*	0.72*(0.53-0.99)*	1.03*(0.77-1.39)*	0.95*(0.77-1.16)*	

Table 8
LCA Hypothesis Testing for Grade Nine Covariates

Covariate	LL[1] Covariate Removed	Likelihood-Ratio Statistic	*df*	p-values
Gender	-1129.33	15.76	3	0.001
Neighborhood	-1126.81	8.72	3	0.033
Peer risk behaviors	-1138.87	34.84	3	<0.001
Parental Monitoring	-1122.34	1.77	3	0.621

Note: LL=Log-likelihood; Likelihood-ratio statistic=2*(Complex model – Null model)
[1]Log-likelihood of overall model = -1121.45

Table 9

Beta Estimates (β) and Odds Ratios (OR) for Grade Nine Covariates for Grade 12 LCA

	High Risk Class		ETOH/VIO Class		ETOH/SEX Class		Low Risk Class
Intercept							
β *(SE)*	-0.53	(0.54)	-0.61	(0.50)	-0.61	(0.35)	Ref
OR *(95% CI)*	0.59	(0.21-1.70)	0.54	(0.21-1.42)	0.55	(0.28-1.08)	
Gender							
β *(SE)*	-1.53	(0.37)	-0.86	(0.31)	-0.40	(0.21)	Ref
OR *(95% CI)*	0.22	(0.11-0.45)	0.42	(0.23-0.78)	0.67	(0.44-1.02)	
Neighborhood							
β *(SE)*	0.23	(0.19)	0.56	(0.16)	0.28	(0.11)	Ref
OR *(95% CI)*	1.26	(0.87-1.83)	1.75	(1.29-2.38)	1.32	(1.06-1.66)	
Peer risk behaviors							
β *(SE)*	1.00	(0.20)	0.16	(0.17)	0.66	(0.12)	Ref
OR *(95% CI)*	2.73	(1.85-4.02)	1.17	(0.84-1.63)	1.93	(1.54-2.42)	
Parental monitoring							
β *(SE)*	-0.48	(0.17)	-0.04	(0.18)	-0.13	(0.12)	Ref
OR *(95% CI)*	0.62	(0.44-0.86)	0.96	(0.68-1.36)	0.88	(0.69-1.11)	

Table 10
Model Fit Indices for Latent Transition Models

	Log-likelihood	G^2	AIC	BIC	*df*
2 statuses	-3373.8	2026.9	2068.9	2159.5	16777194
3 statuses	-3252.4	1784.1	1860.1	2024.0	16777177
4 statuses	**-3152.4**	**1584.2**	**1702.2**	**1956.6**	**16777156**
5 statuses	-3107.2	1493.9	1661.9	2024.1	16777131
6 statuses	-3063.9	1407.2	1633.2	2120.4	16777102

Note: Four class model selected for analyses

Table 11
Latent Transition Analysis Results

	High Risk Status	ETOH/VIO Status	ETOH/SEX Status	Low Risk Status
	Latent Status			
Item Response Probabilities				
Drinking alcohol	**0.83**	**0.79**	**0.59**	0.15
Using illicit drugs	***0.47***	0.09	0.05	<0.00
Had sex	**1.00**	0.00	**1.00**	0.00
Risky sexual behavior	**0.66**	0.00	***0.47***	0.00
Physical fight	**0.77**	***0.48***	0.23	0.15
Carrying a weapon	**0.83**	0.25	0.01	0.01
Truancy	0.22	0.10	0.05	0.01
Selling drugs	***0.30***	0.06	0.00	0.00
Status Prevalence				
Grade 6	0.01	0.16	<0.01	0.83
Grade 9	0.06	0.20	0.04	0.71
Grade 12	0.08	0.17	0.27	0.48

Transition Probabilities
Status at grade 9

Status at grade 6	High Risk Status	ETOH/VIO Status	ETOH/SEX Status	Low Risk Status
High Risk Status	**0.32**[1]	0.68	0.00	0.00
ETOH/VIO Status	0.22	**0.58**	0.05	0.16
ETOH/SEX Status	0.00	0.00	**0.50**	0.50
Low Risk Status	0.03	0.12	0.04	**0.82**

Status at grade 12

Status at grade 9	High Risk Status	ETOH/VIO Status	ETOH/SEX Status	Low Risk Status
High Risk Status	**0.50**	0.18	0.32	0.00
ETOH/VIO Status	0.21	**0.45**	0.33	<0.01
ETOH/SEX Status	0.00	0.00	**0.93**	0.07
Low Risk Status	0.02	0.10	0.21	**0.68**

Note: Item response probabilities (ρ) in **bold** indicate probabilities above 0.50; ***bold/italics*** indicate differences from latent classes.
[1]Diagonal in **bold** represents the probability of remaining in the same status from time t to time $t+1$

Table 12
LTA Hypothesis tests for Latent Status Membership at Grade 6

Covariate	LL^1 Covariate Removed	Likelihood- Ratio Statistic[2]	*df*	p-values
Gender	-3122.19	4.29	3	0.231
Neighborhood	-3120.74	1.39	3	0.707
Peer risk behaviors	-3126.84	13.60	3	0.004
Parental Monitoring	-3119.37	-1.34	3	.

Note: LL=Log-likelihood; Likelihood-ratio statistic=2*(Complex model – Null model)
[1]Log-likelihood of overall model = -3120.04

88

Table 13
Beta Estimates (β) and Odds Ratio (OR) for Status Probabilities at Grade Six

| | | Latent Status | | | |
		High Risk Status	ETOH/VIO Status	ETOH/SEX Status	Low Risk Status
Intercept					
	β	-4.19	-1.48	-5.63	Ref
	OR	0.02	0.23	0.00	
Gender					
	β	-0.92	-0.43	-0.19	Ref
	OR	0.40	0.66	0.83	
Neighborhood					
	β	0.55	0.16	-0.18	Ref
	OR	1.73	1.17	0.84	
Peer risk behaviors					
	β	0.22	0.35	0.71	Ref
	OR	1.24	1.42	2.04	
Parental Monitoring					
	β	-0.48	-0.05	0.94	Ref
	OR	0.62	0.95	2.55	

Table 14
Hypothesis Testing for Covariates of Transition Probabilities for Latent Statues

	Independent			Simultaneously			Simultaneously		
	LL Covariate Removed	Likelihood-Ratio Statistic	df	LL Covariate Removed	Likelihood-Ratio Statistic	df	LL[1] Covariate Removed	Likelihood-Ratio Statistic	df
Gender	-3124.19	39.66**	16	-3129.27	18.46	16	-3123.83	29.72**	16
Neighbors	-3130.69	26.66*	16	-3118.74	-2.60	16			
Peers	-3123.83	40.38***	16	-3124.55	9.02	16	-3124.19	29.00*	16
Parental monitoring	-3139.79	8.46	16	-3114.87	-10.34	16			
Comparison model Loglikihood	*-3144.02*			*-3120.04*			*-3109.33*		

Note: LL=Log-likelihood; Likelihood-ratio statistic=2*(Complex model – Null model)
 * p < 0.05; ** p < 0.01; *** p < 0.001

Table 15

Beta Estimates for Covariates of Transition Probabilities for Latent Statuses

| | Latent Status Transitions | | | |
	ETOH/SEX Status	High Risk Status	ETOH/VIO Status	Low Risk Status
Grade 6 (row) to Grade 9 (column)				
Intercept				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	-0.41
High Risk Status	1.00[a]	Ref	0.73	1.00[a]
ETOH/VIO Status	-2.01	0.02	Ref	-1.23
Low Risk Status	-1.30	-1.15	-1.34	Ref
Gender				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	0.02
High Risk Status	1.00[a]	Ref	-0.01	1.00[a]
ETOH/VIO Status	-0.16	-0.61	Ref	-0.12
Low Risk Status	-1.34	-2.25	-0.58	Ref
Peer risk behaviors				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	0.02
High Risk Status	1.00[a]	Ref	-0.01	1.00[a]
ETOH/VIO Status	-0.13	0.01	Ref	0.07
Low Risk Status	0.11	-0.12	0.12	Ref
Grade 9 (row) to Grade 12 (column)				
Intercept				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	-20.59
High Risk Status	-0.92	Ref	-1.78	1.00[a]
ETOH/VIO Status	-0.26	0.59	Ref	1.00[a]
Low Risk Status	-0.87	-2.37	-0.92	Ref
Gender				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	-0.47
High Risk Status	0.48	Ref	0.02	1.00[a]
ETOH/VIO Status	-0.06	-0.66	Ref	1.00[a]
Low Risk Status	-0.13	-0.82	-0.87	Ref
Peer risk behaviors				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	-0.05
High Risk Status	-0.13	Ref	-0.25	1.00[a]
ETOH/VIO Status	0.06	0.33	Ref	1.00[a]
Low Risk Status	0.54	0.94	0.35	Ref

[a]Parameters were not estimated because transitions were fixed to zero

Table 16
Odds ratios for Transition Probabilities for Latent Statuses

	Latent Status			
	ETOH/SEX Status	High Risk Status	ETOH/VIO Status	Low Risk Status
Grade 6 (row) to				
Grade 9 (column)				
Intercept				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	0.67
High Risk Status	1.00	Ref	2.07	1.00[a]
ETOH/VIO Status	0.13	1.02	Ref	0.29
Low Risk Status	0.27	0.86	0.26	Ref
Gender				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	1.34
High Risk Status	1.00[a]	Ref	1.00	1.00[a]
ETOH/VIO Status	0.85	0.54	Ref	0.89
Low Risk Status	0.26	0.11	0.56	Ref
Peer risk behaviors				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	1.02
High Risk Status	1.00[a]	Ref	0.99	1.00[a]
ETOH/VIO Status	0.88	1.01	Ref	1.07
Low Risk Status	1.12	0.89	1.13	Ref
Grade 9 (row) to				
Grade 12 (column)				
Intercept				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	0.00
High Risk Status	0.40	Ref	0.17	1.00[a]
ETOH/VIO Status	0.77	1.80	Ref	1.00[a]
Low Risk Status	0.42	0.09	0.40	Ref
Gender				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	0.63
High Risk Status	1.62	Ref	1.12	1.00[a]
ETOH/VIO Status	0.94	0.52	Ref	1.00[a]
Low Risk Status	0.88	0.44	0.42	Ref
Peer risk behaviors				
ETOH/SEX Status	Ref	1.00[a]	1.00[a]	0.95
High Risk Status	0.88	Ref	0.78	1.00[a]
ETOH/VIO Status	1.07	1.39	Ref	1.00[a]
Low Risk Status	1.71	2.56	1.41	Ref

[a]Parameters were not estimated because transitions were fixed to zero

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ABSTRACT

ADOLESCENT RISK BEHAVIORS: EXAMINING LATENT CLASSES AND LATENT TRANSITION STATUSES IN A LONGITUDINAL BAHAMIAN SAMPLE

by

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Adolescence is a developmental period marked by much change across physical, cognitive, psychological, and social domains leading to greater vulnerability for poor decision making. As a result, adolescence is a period of increased risk taking behaviors. Prevention of risk behaviors would benefit from early intervention prior to the onset of these risk behaviors. Unfortunately, it is difficult to identify those youth who may be most at risk. Risk-taking adolescents may choose to engage in specific risk behaviors; as well, risk factors that influence risk taking may also differ as a function of the specific domains of risk behaviors. The present study assesses youth from a longitudinal trial of two HIV intervention prevention programs following the same cohort of youth from grade six to grade 12 in the Bahamas. A person-centered approach was used to examine risk behaviors and determine whether there are certain behaviors that co-occur among different subsets of youth. Latent class analysis and latent transition analysis revealed four distinct profiles of risk behavior involvement. Latent classes of grade 12 behaviors included a low risk class, a high risk class and two moderate risk behaviors classes. The patterns of the four risk statuses identified in the latent transition analysis were

similar to the latent classes. Results showed that involvement in risk behaviors at a previous time point increased the probability of remaining in either the same risk status or transitioning to another risk status compared to transitioning to the low risk status. Furthermore, it was hypothesized that contextual factors including perceived peer involvement in risk behaviors, parental monitoring, and neighborhood exposure to risk behaviors and individual level factors such as sensation seeking and values orientation would predict group membership. Results showed peer involvement in risk behaviors, neighborhood risk involvement, and gender were significant predictors of latent classes and peer involvement in risk behaviors and gender were significant predictors of latent statuses.

AUTOBIOGRAPHICAL STATEMENT

The author was born in Detroit, MI on May 5, 1983. She attended Wayne State University and received her Bachelor of Science and Masters of Arts in psychology. She is in the Cognitive Development and Social Psychology doctoral program at Wayne State University. She is a research assistant for Dr. Bonita Stanton in the department of pediatrics in the Pediatric Prevention Research Center.