

Expression as Prevention: Modeling the Impact of Family Emotional Expression on the  
Association between Temperament and Adolescent Substance Use

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By

Katherine Marie Zinsser,  
Bachelor of Arts  
Smith College, 2005

Director: Dr. Susanne A. Denham  
Psychology

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George Mason University  
Fairfax, VA

## **Dedication**

This thesis is dedicated to my wonderful parents, Ann and Tony, against whom I measure all environments of development, and to Caitlin for her never ending encouragement.

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## **Abstract**

### **EXPRESSION AS PREVENTION: MODELING THE IMPACT OF FAMILY EMOTIONAL EXPRESSION ON THE ASSOCIATION BETWEEN TEMPERAMENT AND ADOLESCENT SUBSTANCE USE**

Katherine M. Zinsser, MA

George Mason University, 2010

Thesis Director: Susanne A. Denham, Ph.D.

At moderate levels, adolescents' propensity to take risks is developmentally appropriate; however, some teens go beyond appropriate experimentation and develop dependencies on illicit substances. The connections between difficult temperament and later adolescent behavior problems have been well supported but not all children who display difficult temperaments develop serious behavior or conduct problems. Recently, researchers have turned to examining the home environment and its impact on the development of risky behavior problems such as substance use and abuse. This study examines the emotional environment in the home, temperament, and their connections to the development of substance use problems adolescence. Latent growth curve analyses were conducted using longitudinal data from the National Institute on Child Development's Study of Early Child Care and Youth Development (SECCYD) ( $N=1,364$ ) and revealed an indirect association between effortful control and adolescent

use of alcohol, tobacco, and illicit drugs that is transmitted through the change in positive family emotional expression over time. The inclusion of gender in the model exposed a stable drinking rate for girls across all levels of effortful control, but found that boys who drank tended to be rated lower by mothers on effortful control scales in preschool. The implications of these findings, and the role of prevention interventions in the home throughout childhood, are discussed.



## **Chapter 1: Purpose & Goals**

According to a report by the Substance Abuse and Mental Health Services Administration (SAMHSA, 2004), only 156,000 of the 2.2 million adolescents who suffered from alcohol and drug abuse problems in the U.S. in 2003 were admitted to treatment programs. SAMHSA noted that there had been a 65% increase in the number of admissions of adolescents into substance abuse treatment since the preceding decade (Mark et al., 2006). Although it is true that most adolescents who use illicit drugs do not abuse them (Vaughn & Howard, 2004), these staggeringly high numbers indicate an increasing population of addicted teens.

The use of illicit substances by adolescents is often spurred on by a combination of many inter- and intrapersonal factors, including: low self-esteem, poor impulse control, genetic predispositions, low levels of family bonding, antisocial behavior, aggressiveness, academic failure, early peer rejection, parental drug use, peer drug use, alienation, and exposure to positive attitudes towards drugs (Mash & Barkley, 2003). Furthermore, substance abusers are at high risk for psychiatric disorders, including conduct disorder, depression, and separation anxiety disorder. Recent research estimates that 62% of youth entering substance abuse treatment have a co-occurring mental health problem (Ruiz, Stevens, McKnight, Godley, & Shane, 2005). Substance abusing teens are also more likely to take sexual risks and contract sexually transmitted diseases

(Etheridge, Smith, Rounds-Bryant, & Hubbard, 2001). Allowing these co-occurring disorders to persist untreated, will, for many, lead to devastating downturns in academic, social, and financial success. In addition, the trend for early substance using adolescents to develop more serious substance abuse problems in later years (Kandel & Davies, 1992; Wills et al., 2001) underscores the need for more research into understanding what leads to early onset and continual risk taking and behavior problems, so that we may intervene in this cycle.

Longitudinal studies routinely indicate that early temperament levels can predict substance use in adolescence and early adulthood (Lerner & Vicary, 1982; Wills & Dishion, 2004a; Windle, 1991). However, transactional theory argues that difficult temperament does not directly result in substance abuse problems among teenagers (e.g., Bronfenbrenner & Morris, 2006). Rather, a child's temperament interacts with the environment to make the child susceptible to the impact of experiences. Problem behaviors, like substance use, develop through this interplay between temperament and the context of development (Rothbart & Bates, 1998). A child's levels of temperamental dimensions, such as impulsivity and novelty seeking, differentiate the way they interact with their environment. Children high in these dimensions are likely to have more difficulties in school, coping with distress, and forming relationships with peers. This cycle of snowballing problems in turn can raise the risk for affiliation with deviant peer groups and subsequent drug use (King & Chassin, 2004).

Even early in life, temperament determines a person's overall expressiveness, which in turn has social and emotional development implications. Children who are

more expressive more easily engage others and communicate to them their emotional state and needs. This communication through expression presents more opportunities for people in the child's environment to provide feedback to the child and thereby enhance his/her emotional education and competence (Buck, 1991). Beyond communication, emotional expression also helps an individual internally regulate their feelings and behavior (Halberstadt, 1993).

Emotional expression is first learned at home, and positive associations between parent and child expressivity have been found from three months to young adulthood (Balswick & Avertt, 1977; Malatesta & Haviland, 1986). This connection between parent and child expressivity of emotion underscores the importance of understanding the family context from which risky adolescents have emerged and how that context interacts with an adolescent's innate characteristics of temperament. The following study underlines the importance of considering family emotional expression as an influential environmental factor that affects the relation between certain temperamental attributes and the developmental substance use problems. Specifically, three research questions will be addressed in this study: 1) What is the nature of the associations between the temperament dimensions of effortful control, negative affectivity, and surgency, and early adolescent substance use; 2) How does family emotional expression affect the relation between temperament and substance use; and 3) How do these associations differ by child gender?

## **Chapter 2: Background and Significance**

A great deal of research has emerged in the last twenty years examining the impact of social and emotional factors on developmental achievements or missteps. In particular, researchers have heavily examined the myriad factors that affect risk propensity in adolescents and young adults. This review will start with a description of the risky behavior of interest in this study, namely, drug use and abuse. Further sections will look at previous research into temperament as a predictor of later substance use, and into the construct of family emotional expression.

### **Drug Use and Abuse in Adolescence**

#### **Defining abuse.**

Although any use of illegal substances is of interest to criminal justice agencies, not all adolescents who experiment with substances are considered diagnosable with a substance-related disorder according to the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV; American Psychiatric Association, 1994). Many adolescents who experiment with substances do not develop regular patterns of use or addiction. In fact, of all teen users, less than 16% meet the DSM-IV criteria for alcohol abuse or dependence, whereas 7% use marijuana at diagnostically dependent or abusive levels (Wills & Dishion, 2004b). In the DSM-IV, the use of drugs is no longer considered

experimental when the behaviors show signs of abuse or dependence. Indications that a teen is abusing drugs may include his/her continued use even though it is causing social, familial, or academic problems, or using drugs even when it is putting him/her in physical or legal danger (e.g., driving while high).

### **The effects of drugs.**

Continued drug use relies on the neurological reward system, a collection of brain structures that control behavior through hedonic effects (Koob & Volkow, 2009).

Rewards are defined as objects or situations that induce positive feelings and therefore induce approach behaviors (Ernst & Spear, 2009). Drugs are a particularly dangerous form of reward because they lead to negative feelings after the pleasurable feelings have dissipated, including dysphoria, emotional distress, sleep disturbances, and painful withdrawal symptoms (Koob & Volkow, 2009). The biochemical changes associated with “coming down from a high” have negative consequences with regard to how a person interacts with his/her environment. For adolescents, these symptoms can disrupt academic performance and family functioning, which in turn can create additional stress and disengagement from family and school.

Addictive substances, when used chronically, increase tolerance to rewarding feelings; larger quantities (or more direct absorption) is required to feel the same level of pleasure as was felt during acute or early use (Mash & Barkley, 2003). Further, over the course of chronic use, neuroadaptations lead to increases in extracellular dopamine in limbic regions, and the originally impulsive drug taking morphs into compulsive, chronic,

and relapsing addiction (Koob & Volkow, 2009). The transformation from impulsive to compulsive use is due to psychomotor sensitization of activity in the mesolimbic dopamine system that grows over successive drug taking episodes (Robinson & Berridge, 1993). These brain systems are not sensitizing to the euphoric effects of drugs (*drug liking*) but instead mediate the motivation to take drugs (*drug wanting*). Therefore, it is a psychological process that is responsible for the drug-seeking and drug-taking behaviors that becomes compulsive. Continued drug use increases underlying sensitization of the neural structures and makes drug users vulnerable to long term addiction and relapse.

Continued use of drugs may lead to deleterious outcomes in adolescence that can last into adulthood. Exposure to alcohol and drugs during the adolescent years can critically alter the regions of the brain still under development, including significant damage to the executive functioning regions of the brain (Mash & Barkley, 2003). Even the so called 'soft drug,' marijuana, is linked to a variety of adolescent dispositions, including feelings of rebelliousness, inability to delay gratification, and de-emphasis on achievement (Block, Block, & Keyes, 1988). In time, substance use by adolescents can have significant ramifications; it has been estimated that over 60% of the youth involved with the juvenile justice system also need treatment for some level of substance use problem (Henderson et al., 2007).

### **Biological predispositions to drug use.**

Not only do drugs affect a developing adolescent's neurochemistry, but an adolescent's biology also affects his or her drug use. Neurological models indicate that

the reward system relies on the engagement of attention, emotion, and motivational systems in order to direct an individual to the stimulus, create the feeling of pleasure, and modulate the intensity of the drive to acquire the stimulus (Ernst & Spear, 2009). The triadic model, for example, explains the onset of risky behavior in adolescence by showing that the development of adaptive motivated behavior requires the integration of the underlying reward/approach system in the ventral striatum, the punishment/avoidance system in the amygdala, and the cognitive control processes seated in the prefrontal cortex (Ernst & Spear, 2009). Furthermore, this triadic model argues that adolescent decision making is focused on approach behavior that favors rewards over aversion (Ernst & Spear, 2009). Individual differences in neurochemistry predispose some children to greater susceptibility for seeking out alluring and novel sensations such as those provided by addictive substances.

Drug use by adolescents is of serious concern to not only individual families but also to school systems, public health officials, and politicians because of its significant impact on a teen's ability to live and learn and contribute to society into adulthood. The ramifications of drug use can be both social and neurological, and for many, chronic use leads to a cycle of failed treatment attempts and legal complications. The propensity to use drugs has been linked to several inter- and intrapersonal factors, including a teen's own neurochemistry, sensitivity to reward, and the social and familial environment in which he/she is developing. One of the most studied interpersonal factors predicting substance use, temperament, is discussed in the following section.

## **Temperament**

Across all definitions of temperament, it is commonly agreed to be a body of characteristic behaviors that are early appearing and are reasonably stable over time (Kagan & Fox, 2006; Rothbart, Ahadi, & Hershey, 1994; Thomas & Chess, 1986; Wills & Dishion, 2004a). Longitudinal studies have shown that the core characteristics of temperament are stable even though the way they are displayed, such as reactions to novel stimuli or ability to display socially appropriate behavior, may change as a child develops cognitively and socially (Wills & Dishion, 2004a; Williams et al., 2009). Developmental psychologists have long debated the number and breadth of temperament factors. Thomas and Chess proposed nine dimensions following their work with the New York Longitudinal Study (Thomas & Chess, 1986) and these temperament factors are still used by many researchers. However, questions about the overlap among the dimensions have led other researchers to seek empirically and theoretically based conceptual refinements.

Mary Rothbart and colleagues have argued for an overarching set of three temperamental components, and these have gained wide acceptance. These dimensions were identified during her research with 3 to 8-year olds in the U.S., China, and Japan, and map well onto other dimensional structures, including those by Thomas and Chess (1986) and Sanson and colleagues (Sanson, Hemphill, & Smart, 2004). Rothbart's three dimension structure includes negative affectivity, surgency, and effortful control (Rothbart & Bates, 1998). Negative affectivity describes a child's tendency to be uneasy or worried, in a negative mood, or frustrated (Rothbart et al., 1994). Effortful control, the



ability to inhibit a dominant response in order to respond with a subdominant one (Rothbart & Bates, 1998), is related to a child's ability to maintain his/her attentional focus and overall self control. Rothbart's final dimension, surgency, describes the tendency of a child to approach novel situations and people, or, conversely, to withdraw and be wary; additionally, it measures a child's tendency to display high intensity pleasure (Rothbart & Bates, 1998).

### **Temperament & substance use.**

Temperament plays an important role in affecting how a child interacts with his family, peers, and environment throughout childhood and into adulthood. One well-studied area of temperament is its connection to later problematic behaviors such as delinquency, aggression, and substance use and abuse. Temperament dimensions are often seen as either risk or protective factors in the development of substance use issues in adolescence and/or adulthood. Specifically, positive correlations have been found between substance abuse and several temperamental dimensions. These dimensions have been labeled with a variety of names depending on the researcher's measurement techniques and views of temperamental constructs, but all relate to a child's ability to control his/her behavior when interacting with the environment. Some of the temperament constructs measured in substance use research include: physical activity level, negative emotionality, task attentional orientation, positive emotionality (Wills et al., 2001), novelty seeking (Wills & Dishion, 2004a), behavioral undercontrol (King & Chassin, 2004), harm avoidance (Mâsse & Tremblay, 1997) and behavioral inhibition

(Caspi, Henry, McGee, Moffitt, & Silva, 1995).

Wills and Dishion (2004) described children who were both high on physical activity level measurements, meaning they moved about restlessly and had trouble sitting still, and who displayed negative emotionality, meaning they were often frustrated or irritated and became intensely upset when this happened. These children were more likely to develop substance use problems in adolescence. In another study, 3- and 5-year-olds displaying similar characteristics were labeled as having difficult temperament syndrome (Lerner & Vicary, 1982). Lerner and Vicary (1982) showed that when these children were interviewed in late adolescence, they were more likely to self-indicate an intense use of tobacco, alcohol, and marijuana. Masse and Tremblay (1997) used kindergarten teacher ratings and follow up interviews in adolescence to show that high rates of novelty seeking and lower levels of harm avoidance tendencies in early childhood predicted illicit drug use in mid-adolescence.

Effortful control, also referred to as behavioral control, behavioral inhibition, and impulsivity (Stice & Gonzales, 1998), is also frequently cited as a precursor to the development of problem behavior. Moffitt and colleagues (1996) studied a large cohort of children from age 3 to 18 and found that the children who showed less inhibited temperaments when toddlers were those who developed externalizing behavior problems, including substance use, in adolescence. In a study of interventions with first grade boys, Kellam et al. (2008) found that those displaying caution and shyness (or high behavior inhibition) were less likely to use drugs as frequently as their less inhibited peers (Kellam et al., 2008). Some have argued that for these more impulsive or less inhibited children,

illicit substance use may be more stimulating and provide a stronger reinforcement motivation (King & Chassin, 2004).

Other temperamental dimensions can serve to protect children from the draw of drugs. Although negative affectivity has not always been shown to correlate positively with substance use (Stice & Gonzales, 1998), high levels of positive emotionality can reduce the likelihood of substance use (Wills et al., 2001). Similarly, task attentional orientation in combination with positive emotionality can protect adolescents from problematic substance use issues (Wills et al., 2001).

Gender has also been shown to affect the association between temperament and substance use problems. Boys show greater stability of behavior disinhibition over time, and because of this are at greater risk for maladaptive outcomes, including substance use problems (Degnan & Fox, 2007). For girls, research suggests that their temperamental risk may be more responsive to buffering aspects of their family environment than boys. Boys who are less inhibited early in life are more likely to use drugs in adolescence regardless of parental and environmental characteristics (Block et al., 1988)

### **Intra-personal factors affecting temperament & substance use.**

A substantial amount of research has aimed to understand precursor temperamental dimensions that result in higher rates of substance use. The underlying goal behind these studies is to identify children at risk for later problem behaviors and somehow intervene in their development. However, although direct correlations have been found between temperament and substance use, these studies do not fully

acknowledge the role of the environment and the interplay between the child and the context in which he/she is developing in the emergence of substance use problems.

A transactional model of development underlines the importance of understanding the interaction between a child's characteristics and all aspects of his/her environment (Boyum & Parke, 1995). Therefore, all facets of a child's temperament, her cognitive capacities, physical health, and family contextual factors interconnect to explain a child's developmental over time. As Rothbart and Ahadi (1994) explained, if a child is temperamentally cheerful and affectionate, she will tend to be more rewarding to her parents and evoke from them a warmer relationship. Similarly, simply having a difficult temperament does not lead to risky behavior problems. Instead, such an outcome is the result of a child's difficultness in combination with his/her environment. This interaction between an individual's temperament and the expectations and resources of the environment was first described by Thomas and Chess (1977) as a 'goodness of fit.' Researchers, therefore, continue to look at the interplay between child and environment that yields the best fit, or the best developmental outcomes.

As the transactional literature illustrates, a child does not develop in isolation. Although a child's temperament greatly influences her developmental trajectory, as a child ages, her social interactions move progressively from being within the family to being within a peer group. All of these interpersonal interactions contribute to a child's development above and beyond his/her innate temperamental characteristics. Understandably, researchers, in their desire to comprehend how and why many

adolescents suffer from early onset substance use issues, have developed a host of explanatory models (Wills, Sandy, Yaeger, & Shinar, 2001a).

There are many facets of the family environment that play a role in the development of behavior problems, including: parental values, parental behavior, parenting styles, parenting quality, and the interactions between child characteristics and parental characteristics. Tarter and colleagues (1995) studied the interaction between family environment and temperament by examining the trajectory of substance use. They found that negative emotionality made children more reactive to family conflicts and other negative life events. In turn this left them more susceptible to parental modeling of illicit drug use and more likely to develop substance use problems themselves (Tarter, Moss, & Vanyukov, 1995).

Substance use by family members is one of the most commonly cited risk factor for adolescent drug use. Smoking and alcohol use in the home or within family history is correlated with use by children; however, the magnitude of these correlations is modest enough to indicate that children are not only imitating their parents, but there must also be other factors affecting the development of substance abuse (Wills & Yaeger, 2003). One such factor is the interaction between a child's temperament and family environment.

Parental substance use is correlated with difficult temperament in adolescents, and this in turn is implicated in risk of substance use (Wills & Yaeger, 2003). However, the influence of parental substance use does not equally affect all adolescents; the impact of substance use by parents is stronger in children who are temperamentally higher in

activity level and negative emotionality (Wills, Sandy, Yaeger, & Shinar, 2001b).

Conversely, children who are at risk because their parents use illicit substance are less likely to develop problematic use patterns if they are temperamentally high on attentional control and positive emotionality (Wills et al., 2001b). Wills and colleagues (Wills et al., 2001a) studied preadolescents and found that parental risk factors such as substance abuse or high levels of conflict have less of an impact on drug use in children who have high task attention and positive emotionality.

Following this finding, other research has indicated that for children who are temperamentally less at risk, poor parenting quality has a deleterious effect. Parenting appears to be most important for adolescents who are already at risk due to their own internal characteristics (Stice & Gonzales, 1998; Williams et al., 2009). Parental support, on the other hand, can serve as a buffer protecting less inhibited children from the risk of substance use (King & Chassin, 2004). Other studies have shown that ineffective parenting, including conflict and substance use, is least harmful for children who are temperamentally not at risk (Veenstra, Lindenberg, Oldehinkel, De Winter, & Ormel, 2006).

Studies such as those reviewed above, along with more complex transactional models, help to explain how temperamental dimensions in conjunction with the family environment can lead to the development of behavioral problems. This study will focus on a single aspect of the developmental environment: the frequency of family emotional expression.

## **Emotional Expression**

A child's family is the first context in which they can learn to recognize and communicate feelings. Parents and siblings bombard children with affective messages, and over the course of development, children are expected to interpret and respond to these messages with increasing skill and appropriateness (Boyum & Parke, 1995). Beyond these face-to-face interactions, children also use their parents as emotional role models and observe them to learn the expectations surrounding displays of emotion, handling emotional events, and talking about emotions (Denham, Salisch, Olthof, Kochanoff, & Caverly, 2002; Buck, 1991). Given the attention that children pay to their parents' use of emotion, it follows that how parents socialize their child's use of emotions is directly related to child's experiences, expressions, and regulation of emotion (Denham, Bassett, & Wyatt, 2006; Wong, McElwain, & Halberstadt, 2009).

One of the ways that this socialization process is measured is through an index of family emotional expression. Family expression is an indicator of the frequency of the expression of emotion over the course of every day interactions within a family (Halberstadt, 1986). Family emotional expression captures the emotional expressiveness of family members in order to understand the overall emotional environment in a home. An individual's emotional expressiveness refers to their overarching style of both verbal and non-verbal expression, and is typically discussed as having two valences, positive and negative (Halberstadt, Cassidy, Stifter, Parke, & Fox, 1995).

Following the emergence of theories emphasizing the functional importance of emotions, research has associated family expressiveness with a wealth of developmental

outcomes. In their review of emotional expression, Halberstadt, Crisp, and Eaton (1999) explained that family emotional expression is related to many characteristics of the child, including: emotionality, emotional comprehension, social competence, the quality of interpersonal relationships with adults and family members, self-esteem, and academic achievement. Similarly, Cassidy and colleagues (1992) tied family expressiveness to peer competence by showing that children from highly expressive homes were rated more highly on measures of social acceptance (Cassidy, Parke, Butkovsky, & Braungart, 1992).

The link between parental expressivity and that of the child has been demonstrated across contexts and ages. In children as young as three months old, Malatesta Haviland (1986) found significant similarities between mother and infant expressiveness. At the other age extreme, the expressivity of college students is also related to the parental levels of expression in their homes when they were growing up (Balswick & Avertt, 1977). However, the associations between parental and child expressiveness seems to be strongest when the children are either very young or closer to young adulthood (Boyum & Parke, 1995).

However, not all emotions are equal; the frequencies of positive and negative emotional expressions are differently related to children's outcomes. Children exposed to elevated negative emotion levels are less well accepted by their peers (Boyum & Parke, 1995). As an adolescent, exposure to higher levels of negative emotional expression puts these youth at risk of both internalizing and externalizing symptoms (Stocker, Richmond, Rhoades, & Kiang, 2007). It is possible that these children develop



adjustment problems as a result of the poor emotion regulation skills they learn when modeling their parents' negative expressions (Stocker et al., 2007). Furthermore, individuals from more negatively expressive homes report experiencing more incidents of intense and poorly controlled anger than those from less negatively expressive families (Burrowes & Halberstadt, 1987).

Family conflicts that result in negative emotional expression towards a child can result in significantly negative outcomes. Parent-child conflict is linked to the adolescent disengaging from the family and associating with more deviant peer groups (Wills et al., 2001a) which puts children at risk for early substance use (Wills, Windle, & Cleary, 1998). Similarly, a lack of positive interactions with family members is associated with poor self-control, which is precursor to problem behaviors such as risk taking and substance use (Wills & Dishion, 2004a; Wills et al., 2001a). Conversely, parental positive expression can be a protective factor and is negatively related to antisocial behavior, alcohol use, and illicit substance use (Stice & Gonzales, 1998; Wills & Yaeger, 2003).

### **Focus of the Present Study**

Despite the wealth of research conducted on the stability of temperament over the course of a child's development, the associations between early reactivity and inhibition and later behavioral problems are often fairly modest. Although the research has shown that some inhibited children develop serious internalizing problem behaviors in adolescence, many children do not. Limited research has been done to determine what is

distinguishing at-risk children who do not display problem behavior in adolescence from those who need early intervention to prevent such issues (Boyum & Parke, 1995). In this study, one such possible buffer will be explored. Specifically, this study aims to determine if, and to what extent, family emotional expressivity facilitates the association between temperament and risky behavior in adolescence. Unlike many public health concerns, substance use and its consequences are entirely preventable. This research will add to the desperately needed body of knowledge to help parents, interventionists, and policy makers understand the importance of supporting the family environment.

## **Chapter 3: Methods**

### **Participants and Procedures**

This study will use the longitudinal data collected as part of the Study of Early Child Care and Youth Development (SECCYD) supported by The Eunice Kennedy Shriver National Institute of Child Development (NICHD). As the title suggests, the original purpose of the study was to examine how variations in non-maternal care relate to cognitive, linguistic, social-emotional, and physical development (NICHD Early Child Care Research Network, 2005). Over the last decade and a half, researchers have conducted hundreds of observations and assessments with study participants and their families, from prenatal interviews to adolescent self-report surveys. These data are now available for secondary analysis through The Interuniversity Consortium for Political and Social Research (ICPSR).

Study children were all born in 1991 and were recruited from 24 hospitals around ten research sites including: Charlottesville, VA; Irvine, CA; Lawrence, KS; Little Rock, AR; Madison, WI; Morganton, NC; Philadelphia, PA; Pittsburgh, PA; Seattle, WA; and Wellesley, MA. The sample at the beginning of Phase I was made up of 1,364 families. The individual site samples were approximately equal in number.

Phase I of the study was conducted from 1991-1994 and followed the children from birth to age three years. Demographic information about study participants is presented in

Table 1. Study children were evenly representative by gender and were mostly Caucasian. At the time of Phase 1 reports, 68.7% of parents had completed at least high school. The sample was diverse in socioeconomic levels, family composition, and cultural backgrounds; 25% of the population was of an ethnic minority; the mean household income was just over \$37,000; and 18.8% of the sample was receiving public assistance (NICHD Early Child Care Research Network, 2005).

**Table 1: Sample Demographics at Phase 1 (N=1364)**

		N	%
Child Gender	Male	705	51.7
	Female	659	48.3
Ethnicity	American Indian	5	0.4
	Asian or Pacific Islander	22	1.6
	Black or African American	176	12.9
	White	1097	80.4
	Other	64	4.7
Mother's Education	Did not Complete High School	139	10.2
	High School Grad or GED	287	21.1
	Some College	455	33.4
	Bachelors Degree	284	20.8
	Advanced Coursework or Degree	198	14.5
Partner's Education	Did not Complete High School	105	8.4
	High School Grad or GED	284	22.7
	Some College	369	29.5
	Bachelors Degree	271	21.7
	Advanced Coursework or Degree	219	17.5

By Phase 3 the sample had changed slightly; over 70% of families in phase 3 were intact (both mother and father lived at home with child), whereas 12.8% were divorced. Only a quarter of the mothers in the sample were still not working by Phase 3, and although annual income had risen from Phase 1 ( $M=\$77,008$ ,  $SD= \$68,273$ ), 7% were still receiving public assistance. Phase IV, which was recently completed, followed over 1,000 of the original children through age 15.

The methodology used in this longitudinal study is extensive and complex. For over 1,000 participants in every phase, the researchers collected a wide variety of measures, both qualitative and quantitative, over multiple sessions every year. During each phase, research assistants from the ten data collection sites observed each child at home, in child care (if used), in school, and in a laboratory playroom. Telephone updates were completed every three months during Phase 1, every four months in Phase 2, and annually throughout Phase 3.

Even during study years for which school visits were not completed, researchers collected teacher questionnaires that covered school achievement and behavior. Assessments were made of the child and the parent(s), and the social and physical characteristics of the home, of the child-care (and after-school) environments, and the school. Children were observed interacting with a friend in the laboratory at four points from age three to sixth grade. Finally beginning in Phase 3, annual physicals assessed pubertal development and physical activity (NICHD, 2000).

## Measures

### Temperament.

A shortened version of the Child Behavior Questionnaire (CBQ), developed by Rothbart, Ahadi, and Hershey (1994), was administered in the lab to study mothers during Phase 2 of the SECCYD when the children were 54 months old. The CBQ is designed to gather parental report of temperament in children between the ages of 3 and 8 years old. The original instrument assesses 15 aspects of temperament by way of 196 items that ask parents to rate their child's reactions to a variety of situations. The items range in applicability from 1 (extremely untrue) to 7 (extremely true).

Rothbart's three broad dimensions of temperament are obtained as subscales in the CBQ. The *Surgency* subscale includes: approach, high intensity pleasure, smiling and laughter, activity level, impulsivity, and shyness. *Negative Affectivity* includes discomfort, fear, anger/frustration, sadness, and falling reactivity and soothability. *Effortful control* includes inhibitory control, attentional focusing, low intensity pleasure, and perceptual sensitivity.

Cronbach's alpha for the 15 subscales originally ranged from .67 to .94 (Rothbart et al., 1994). In determining the reliability of their measure, Rothbart and colleagues (1994) found that the three broad dimensions of temperament were associated with parent's reports of children's social behavior. Surgency was correlated with aggression ( $r = .54, p < .001$ ) and guilt ( $r = -.24, p < .05$ ). Negative affectivity was associated with aggression ( $r = .35, p < .01$ ), guilt ( $r = .22, p < .05$ ), help seeking ( $r = .36, p < .01$ ), and negativity ( $r = .56, p < .001$ ). Effortful control was correlated with aggression ( $r = -.38, p$

< .001), empathy ( $r = .48$ ,  $p < .001$ ), guilt ( $r = .36$ ,  $p < .01$ ), and negativity ( $r = -.36$ ,  $p < .01$ ).

In the NICHD SECCYD, mothers were asked to complete a modified version of the CBQ that only included 80 items. The subscales on the version used for these analyses include: Approach (10 of 13 items), Activity Level (10 of 13), and Shyness (10 of 13) from the Surgency dimension; Fear (10 of 13), Anger/Frustration (10 of 13), and Sadness (10 of 12) from the Negative Affectivity dimension; and Inhibitory Control (10 of 13) and Attentional Focusing (9 of 9) from the Effortful Control dimension; and one additional item about help seeking. In the SECCYD data, alphas for 8 subscales range from .60 to .85 for mother reports. The three larger temperament dimensions (effortful control, surgency, and negative affectivity) were recreated using the shortened subscales available in the NICHD analysis datasets and these three dimensions are used throughout the analyses described below.

### **Family emotional expression.**

The Family Emotion Expressiveness Questionnaire (FEQ) was completed by both mothers and fathers of study children at three different time points in Phase 3 of the study (3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> grades). Halberstadt and colleagues designed the questionnaire to assess perceptions of how much emotion is expressed in the study child's home (Halberstadt et al., 1995). The short form of the FEQ used in the SECCYD contains 24 items and yields subscales of positive, negative, and total family emotion expressiveness using five-point likert scales ranging from "rarely", 1, to "very often", 5. The positive expression

subscale ranged in reliability from .86 to .90 for mothers across the 3 time points, and from .88 to .90 for fathers. The negative expression subscale reliabilities ranged from .81 to .83 for mothers, and .83 to .84 for fathers. Total expressiveness reliability scores ranged from .83 to .85 for mothers and from .84 to .86 for fathers.

### **Adolescent substance use.**

At age 15, adolescent substance use was measured using the Youth Self Report, designed by Achenbach (1991). The YSR captures adolescent responses to a list of 119 items including a broad range of behavioral/ emotional problems and 16 socially desirable items. For each item, the adolescent was asked to determine how well that item described him or her currently or within the last six months: 0 = Not True, 1 = Somewhat or Sometimes True, and 2 = Very True or Often True. The YSR is designed to obtain self-reports from youths at ages 11 to 18 in a format similar to that of the Child Behavior Checklist (CBCL/4-18) completed by parents and the Teacher Report Form (TRF) completed by teachers (Achenbach, 1991). In modifying the instrument for the SECCYD, questions on employment, sports, hobbies, organizations, chores, friends, academic performance, illness, and narrative descriptions of concerns and self were not asked (Achenbach, 1991). Although the YSR is divided into eight subscales with internal consistency rates ranged from 0.71 to 0.95, only the three items about frequency of use of alcohol, tobacco, and other drugs, are included in these analyses.

Although there is always the possibility of underreporting drug use in self-report measures, the data from several studies indicates that there is limited self-report bias in



these types of instruments (Block et al., 1988; Haberman, Josphson, Zanes, & Elinson, 1972; Perry, Killen, Slinkard, & McAlister, 1980). The Center for Disease Control's (CDC) annual Youth Risk Behavior Survey (YRBS) also relies on self-reports of risky health behavior including substance use by middle and high school students (Brenner, Collins, Kann, Warren, & Williams, 1995). Upon comparing the self-report data to prevalence estimates, the CDC found that the Kappa statistics for the 53 survey items ranged from 14% to 91% with two-thirds of the items having Kappas between 60-100%. Self-report validity also appears to increase with age. In the YRBS, 7<sup>th</sup> graders were most likely to under-report their use of tobacco, alcohol, or drugs, high school students were more reliable in their answers. The SECCYD used an increasing number of self-report measures as the study children aged. Although additional laboratory measures of global risk taking (e.g. the Balloon Analogue Risk Task) were conducted with study children, this researcher feels that, in light of the reliability of self-reports discussed above, the aggregation of two separate self-reports of drug use will provide an accurate reflection of study subjects' substance use.

### **Data Analysis**

A structural equation modeling analysis of the association between temperament dimensions, family emotional expression, and adolescent substance use was conducted using the Analysis of Moment Structures (AMOS) statistical package (version 17) using full information maximum likelihood estimation. The statistical methodology of SEM was selected because of its known advantages over traditional regression modeling,

including: the flexibility of assumptions, its use of full information maximum likelihood handling of missing data, the availability of confirmatory factor analysis to reduce measurement error through the use of latent variables, enhanced model visualization, and the ability to compare alternative models to assess relative model fit.

Although many measures of model fit are available, each focusing on different components of fit, it is impractical to use all fit indices when assessing the models developed for this research. Therefore, three indices of model fit were considered when determining model quality: The model Chi-Square ( $\chi^2$ ), Comparative Fit Index (CFI), and the root mean square error of approximation (RMSEA). For the CFI index, values range from 0 to 1.0 and those of .90 are evidence of good fit (Bentler & Bonett, 1980).

Conversely, values of .05 or less on the RMSEA indicate good fit (Fan, Thompson, & Wang, 1999). The model chi square is the most common fit test and should not be significant if there is a good model fit. However, it is a very conservative test and makes it particularly difficult to achieve non-significance with large sample sizes because of the raised type II error (Bryne, 2001). For this reason, the CFI and FMIN are also used to determine support for the model.

## Chapter 4: Results

### Preliminary Findings

#### Temperament.

Overall, the three temperament dimensions were normally distributed (Shapiro-Wilks test of effortful control  $W(886)=.992, p <.01$ ; surgency  $W(886)=.996, p <.05$ ; negative affectivity  $W(886)=.993, p <.01$ ). Results from an Analysis of Variance (ANOVA) test, presented in Table 2, reveal gender differences in temperament ratings. Girls were rated higher on effortful control,  $F(1, 884) = 28.28, p <.01$ , and boys rated higher on surgency,  $F(1, 884) = 4.15, p <.05$ . No difference was found between boys and girls in their mother's rating of negative affectivity.

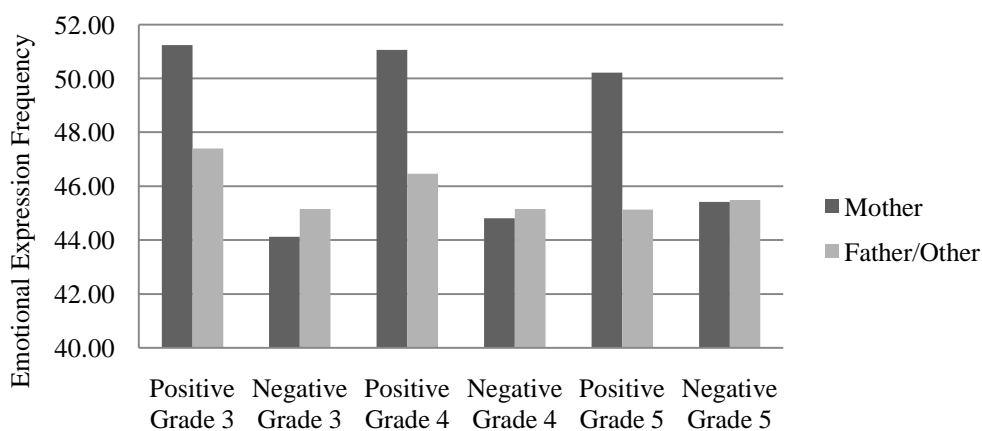
**Table 2: Analysis of Variance for Temperament Aggregates by Gender**

	Effortful Control	Negative Affectivity	Surgency
Overall Mean (SD)	4.69 (0.71)	4.29 (0.63)	4.47 (0.51)
Male (SD)	4.56 (0.74)	4.29 (0.60)	4.51 (0.53)
Female (SD)	4.81 (0.66)	4.29 (0.65)	4.44 (0.49)
Sum of Squares	13.89	0.00	1.09
<i>df</i>	1.00	1.00	1.00
<i>F</i>	28.28**	0.00	4.15*

\*\*  $p <.01$ , \* $p <.05$

### Emotional expression.

Across all three grades (3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup>), emotional expression was normally distributed with total expression values ranging from 66.33 to 111.33. Parents reported that positive emotion was expressed more frequently in homes than negative emotion. As is evident in Figure 1, maternal and paternal reports of emotional expression showed varying agreement depending on the valence of the emotion. Overall, mothers and fathers tended to agree on the frequency of negative emotional expression; paired sample t-tests of parents in the same year and same valence frequency ratings were not significantly different for 4<sup>th</sup> and 5<sup>th</sup> grade negative expression (4<sup>th</sup> grade  $t(623) = -.813, p = .42$ ; 5<sup>th</sup> grade  $t(687) = .016, p = .99$ ). However, for positive emotional expression frequency, maternal reports were significantly different from father/other reports across all three grades (3<sup>rd</sup> grade,  $t(666) = 13.27, p < .01$ ; 4<sup>th</sup> grade,  $t(625) = 15.14, p < .01$ ; 5<sup>th</sup> grade,  $t(689) = 16.97, p < .01$ ).



**Figure 1: Comparison of Mother and Father/Partner Reports of Emotional Expression across 3rd, 4th, and 5th Grades**

After examining these differences in expression reported by each set of parents, the decision was made to only use maternal reports in subsequent models. This decision was also affected by the lack of additional information in the SECCYD data regarding the relationships between mothers and the non-paternal partners. At each time point, between 13% and 16% of the reporters completing the Father/Other questionnaire were not the child's actual father. Instead, these reporters included the mother's partner (but not the child's father), a grandparent, other relative, or "other adult." Without knowing the relationship between the reporter and the study child, how much time the two spent together, or how frequently that adult was in the child's home, this researcher felt it inappropriate to use their accounts of emotional expression in the family.

### **Substance use.**

Alcohol, tobacco, and illicit drugs all showed very low use rates in the 15-year-old sample. Overall, 21.2 % of the sample indicated that it was either "sometimes or somewhat true" or "very true" that they had used at least one of the three substances at the time of the survey. All three YSR items asking youth to report their substance use behaviors were found to be extremely non-normal (Shapiro-Wilks test values are as follows: alcohol  $W(953)=.506$   $p <.01$ ; tobacco,  $W(953)=.232$   $p <.01$ ; drugs  $W(953)=.213$   $p <.01$ ). Therefore, in response to the extreme lack of normality, these items were dichotomized and subjects were labeled as either "Users" or "Non-Users" of each of the three substances. As Table 3 shows, alcohol was the most commonly used substance among the three and was the only substance that showed a significant gender difference.

The percentage of participants who reported using alcohol differed by gender  $\chi^2 (1, N=593) = 5.22, p < .01$ , with more girls drinking alcohol by age 15 than boys.

**Table 3: Chi Square of Gender Differences in Substance Use**

Gender	Use Alcohol	Use Tobacco	Use Drugs	Use Any of 3
Total Sample (N)	19.6% (187)	5.4% (52)	4.8% (46)	21.2% (202)
Male (N)	16.7% (79)	5.2% (25)	4.8% (23)	18.8% (89)
Female (N)	22.5% (108)	5.6% (27)	4.8% (23)	23.6% (113)
$X^2$	5.22**	0.73	0.00	-
$df$	1	1	1	-

\*\*  $p < .01$ , \* $p < .05$

### Modeling Expression as Prevention

Correlations among all measured variables are presented in Table 4 along with means and standard deviations. Of note in this table is the inter-correlation among all three temperament dimensions and, except for the association between effortful control and tobacco, the lack of significant correlations between temperament and substance use (yes or no). As expected, all three substance use variables were positively associated (range from  $r(953) = .36, p < .01$  to  $r(953) = .46, p < .01$ ). Same valence emotional expression was strongly related across grade years ranging from  $r(917) = .69, p < .01$  to  $r(917) = .55, p < .01$ . Additionally, there are several weak but significant positive correlations between positive and negative emotional expression frequencies as reported by mothers across all three grades, indicating that positive and negative expressiveness

tended to co-vary in the same direction. Cross variable correlations showed an unexpected negative relation between negative affectivity and all three reports of negative expression rates at home (3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> grades), indicating that children with high negative affectivity levels live in homes with lower levels of negative expression.

After a full exploration of the observed variables, models were constructed using SEM. Although models were tested using all combinations of temperament dimensions, maternal and paternal/other reports, and both valences of expression, as well as the total expression frequency, only models including effortful control, surgency, and maternal report of positive emotional expression converged properly and are reported below.

The measurement models contained two latent factors, FEE Level and FEE Slope. FEE Level is defined as the frequency of emotional expression at the first point of measurement (grade 3). FEE Slope is the change in the frequency of expression reported across all three grades (3<sup>rd</sup> through 5<sup>th</sup>). No latent variable was created for substance use due to the limited variability in the responses to these items. Additionally, each temperament dimension was entered in the model separately due to the failure of the model to converge when all three components were entered simultaneously.

As discussed above, paternal/other reports were significantly different from mothers regarding positive expression, and there was vague information available regarding the role these men and women played in the study children's lives. Additionally, negative affectivity, though related to the level of family negative expression, showed no direct or indirect associations with substance use or slope of

expression change. These models also showed poor fit with the data and are not reported here.

The models reported here are those which showed the best fit with the data, are most interpretable, and for which there seems to be sufficient theoretical support. Presented in Table 6 are the standardized parameter estimates for the first two models testing the direct and indirect relations between effortful control and surgency, FEE, and substance use. Schematic depictions of these models can be found in Figures 2 and 3 respectively and results are described below.

**Table 4: Correlations among variables in theoretical model**

	1	2	3	4	5	6	7	8	9	10	11	12
1. Effortful Ctrl	-	-.27**	-.33**	.25**	.18**	.24**	.13**	.19**	.16**	-.01	-.10**	-.02
2. Neg. Affect		-	.39**	-.05	-.20**	-.04**	-.19**	-.05	-.22**	-.03	.02	.02
3. Surgency			-	-.09*	-.09**	-.07	-.09**	-.07*	-.08*	-.02	.04	.01
4. Pos. 3 <sup>rd</sup> Grade				-	.09*	.69**	.12**	.65**	.12**	.01	.01	.04
5. Neg. 3 <sup>rd</sup> Grade					-	.10**	.63**	.07*	.55**	-.05	-.03	.00
6. Pos. 4 <sup>th</sup> Grade						-	.12**	.69**	.15**	-.00	-.00	-.02
7. Neg. 4 <sup>th</sup> Grade							-	.10**	.61**	-.03	-.04	-.04
8. Pos. 5 <sup>th</sup> Grade								-	.07*	-.03	-.03	-.02
9. Neg. 5 <sup>th</sup> Grade									-	.00	-.02	-.01
10. Alcohol Use										-	.38**	.36**
11. Tobacco Use											-	.46**
12. Drug Use												-
N	886	886	883	916	917	920	919	926	925	953	956	956
Minimum	2.33	2.10	1.60	22.00	18.00	16.00	22.00	28.00	17.00	.00	.00	.00
Maximum	6.54	6.50	5.97	60.00	60.00	60.00	60.00	60.00	60.00	1.00	1.00	1.00
Mean	4.69	4.29	4.47	51.24	44.12	51.06	44.82	50.21	45.42	.20	.05	.05
SD	.71	.63	.51	6.40	6.61	6.95	6.37	6.19	6.43	-	-	-

\*\* p < .01, \*p < .05



**Fee → substance use.**

Using the two latent variables of FEE slope and FEE Level described above, the relation between emotional expression and each of the dichotomous variables indicating substance use were modeled. Although there were no significant pathways between the 3<sup>rd</sup> grade levels of positive expression as reported by mothers and substance use, there is a negative association between the change in maternal report of positive expression and each of the three substance variables. This result signifies that it is the change over time in expression and not the initial level that is a significant predictor of whether or not a child experiments with drugs at an early age. The intercept value for the latent slope factor is positive (intercept = 1.00), indicating that the change is in a positive direction over time. Therefore, children who use drugs tend to live in homes with lower increases in positive expression from 3<sup>rd</sup> to 5<sup>th</sup> grade.

**Temperament → FEE → substance use.**

In Figure 2, effortful control is significantly related to both the mothers' reported level of positive expression in 3<sup>rd</sup> grade ( $\beta=.31$ ) and to the change in positive expression across 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> grades ( $\beta=-.68$ ). Children high on effortful control tend to live in homes with mothers who report higher positive emotional expression in 3<sup>rd</sup> grade but have lower levels of change from 3<sup>rd</sup> to 5<sup>th</sup> grades. The model shows an almost completely indirect relation between temperament and substance use, with only one direct pathway, between effortful control and tobacco use, approaching significance. This

finding is congruent with previous research on the importance of environment in the development of substance use behaviors (Tarter et al., 1995).

The model involving surgency (Table 6 and Figure 3) shows a negative association between this temperament dimension and mothers' ratings of positive emotional expression in 3<sup>rd</sup> grade ( $\beta = -.79, p < .05$ ) but not to the change in positive expression from 3<sup>rd</sup> to 5<sup>th</sup> grade (slope).

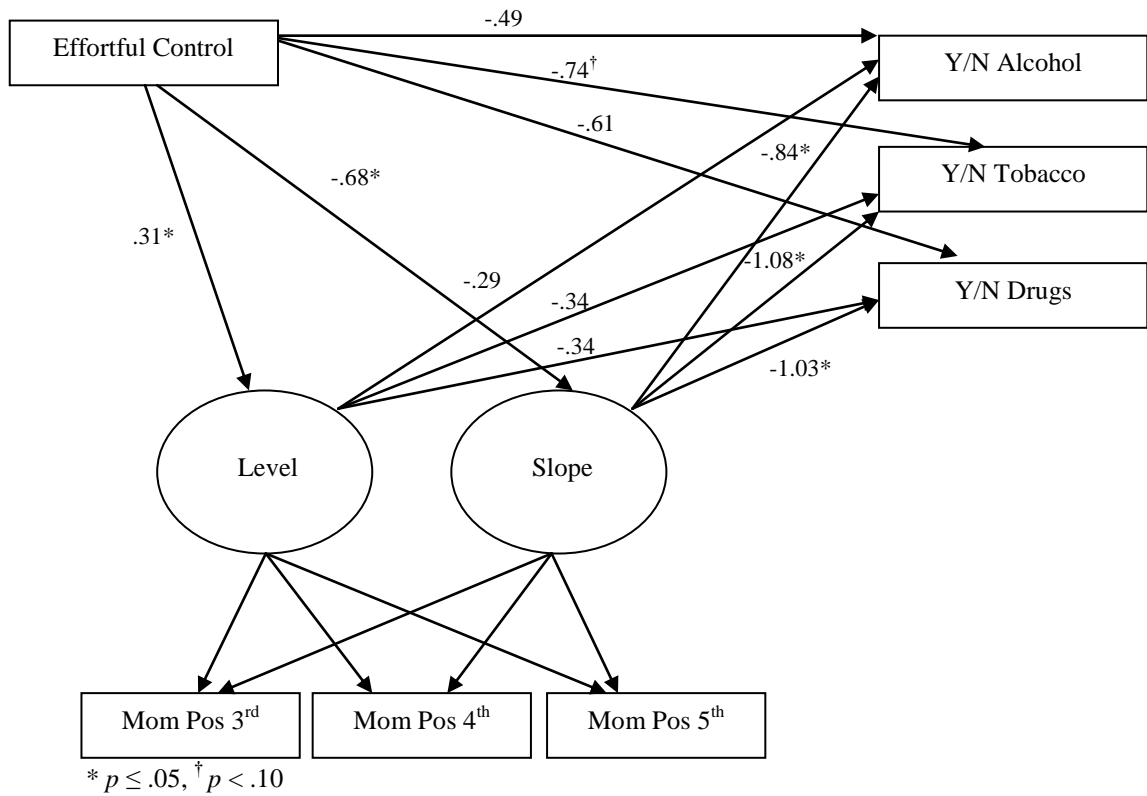
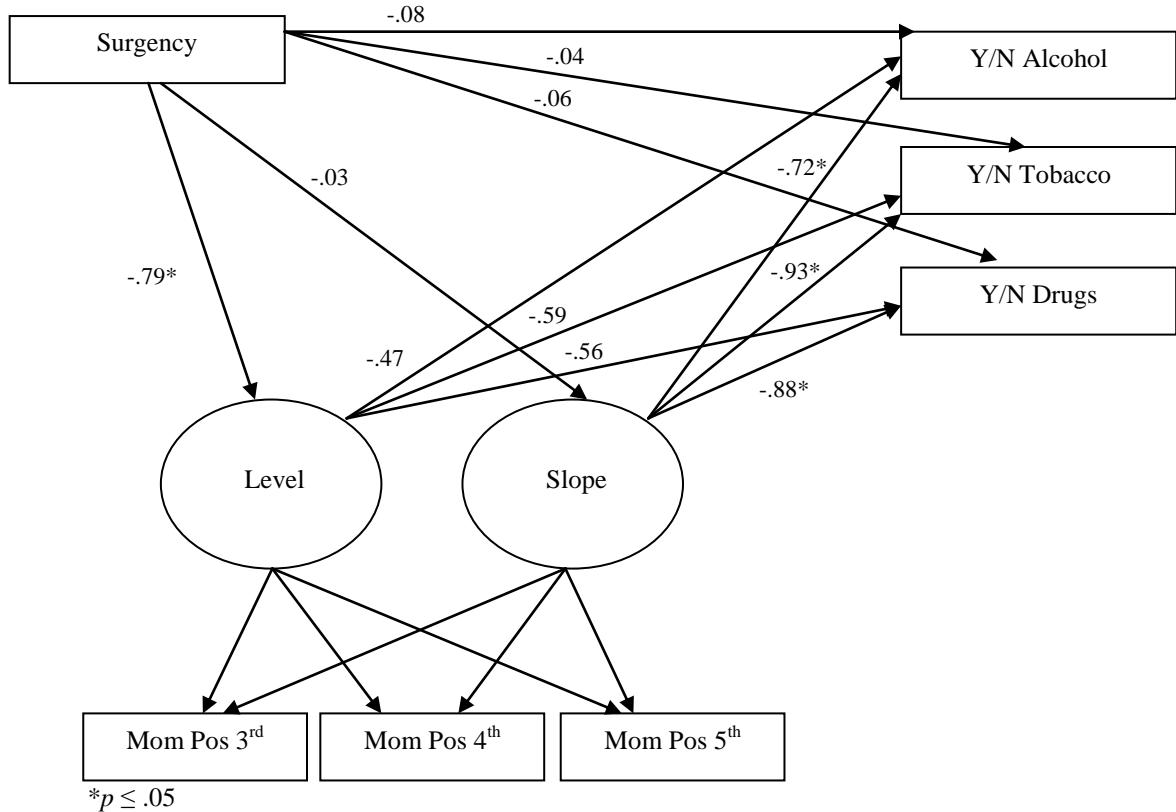


Figure 2: Effortful Control Model

This indicates that children who are rated as more outgoing or extroverted tend to have mothers who report less frequent positive emotional expression in 3<sup>rd</sup> grade. As explained above, the association between temperament and substance use is an indirect one carried by the rate of change in positive emotional expression in middle childhood. There are no significant direct paths from surgency to any of the three substances of use.



**Figure 3: Surgency Model**

### **Temperament X gender → FEE → substance use.**

The final model took into account the interaction between temperament and gender. Although multi-group analysis was attempted in AMOS, the model failed to converge. Instead, gender (coded as 1=boys, 0=girls) was entered as an interaction term with effortful control into the model (Figure 4). The interaction was tested without the main effect of gender and temperament on alcohol use because the model could not converge when all were included. As the original theoretical interest was in the interaction between temperament dimensions and gender on substance use, the model was run with only the interaction term entered. It should be noted, however, that the effects of gender and temperament were included through the family emotional expression variables. This model, therefore, accounts for the main effects indirectly because of the observed gender differences in both the temperament ratings (Table 3). This model was tested with alcohol as the sole outcome variable because it was the only variable with sufficient variability to allow for an interaction.

Both effortful control and surgency interactions with gender models converged properly and results are presented in Table 7. Only the path diagram for effortful control is presented (Figure 4) because it was the only one to show significant results. Still evident in this model is the significant association between effortful control and maternal report of FEE level in 3<sup>rd</sup> grade ( $\beta=.30$ ,  $p < .01$ ) but no additional significant paths were found between temperament or gender and the FEE measures. The remaining path of significance is between the interaction term and the dichotomous alcohol use variable ( $\beta=-.08$ ,  $p < .05$ ).

**Table 5: Standardized Parameter Estimates for Factor Loadings, Directive Structural Associations and Fit Statistics for Latent Growth Models**

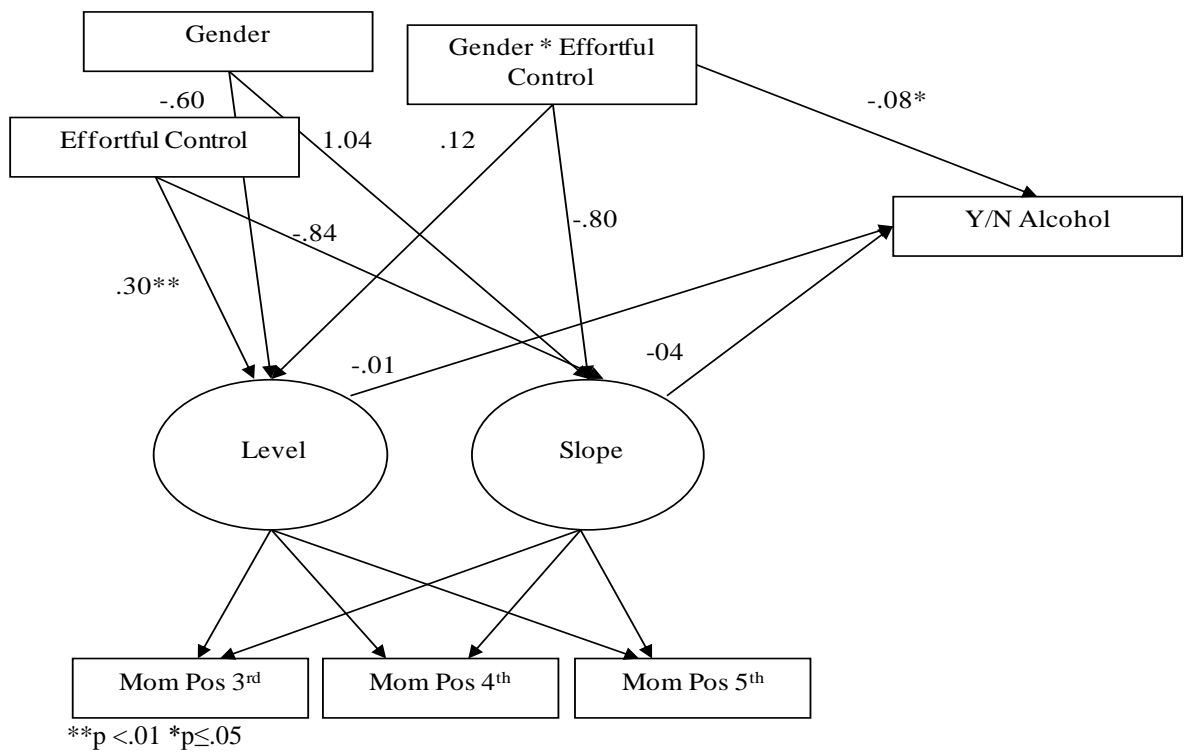
	<b>Effortful Control</b>	<b>Surgency</b>
<b>Factor Loadings</b>		
Positive FEE Level → Mom Grade 3	.83	.83
Positive FEE Level → Mom Grade 4	.85	.85
Positive FEE Level → Mom Grade 5	.87	.87
Positive FEE Slope → Mom Grade 3	.00	.00
Positive FEE Slope → Mom Grade 4	.05	.04
Positive FEE Slope → Mom Grade 5	.10	.08
<b>Directive Structural Associations</b>		
Temperament → Positive FEE Level	.31**	-.79*
Temperament → Positive FEE Slope	-.68*	-.03
Temperament → Alcohol Use	-.49	-.08
Temperament → Tobacco Use	-.74 <sup>†</sup>	-.04
Temperament → Drug Use	-.61	-.06
Positive FEE Level → Alcohol Use	-.29	-.47
Positive FEE Level → Tobacco Use	-.34	-.59
Positive FEE Level → Drug Use	-.34	-.56
Positive FEE Slope → Alcohol Use	-.84*	-.72*
Positive FEE Slope → Tobacco Use	-1.08*	-.93*
Positive FEE Slope → Drug Use	-1.03*	-.88*
<b>Fit Statistics</b>		
X <sup>2</sup>	31.75	30.91
df	10.00	10.00
CFI	.99	.99
RSMEA	.04	.04

\*\*p < .01 \*p ≤ .05 †p < .10

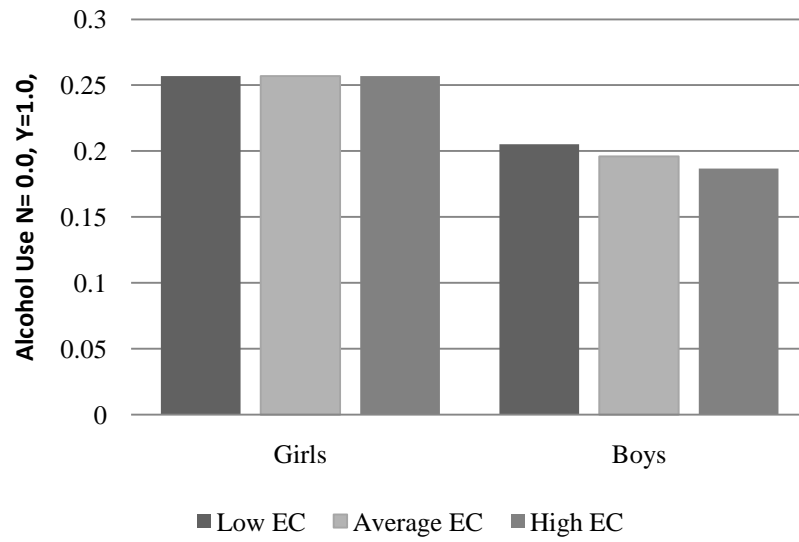
**Table 6: Standardized Parameter Estimates for Factor Loadings, Directive Structural Associations and Fit Statistics for Model Including Gender Interaction**

	Effortful Control	Surgency
Factor Loadings		
Positive FEE Level → Mom Grade 3	.83	.82
Positive FEE Level → Mom Grade 4	.83	.83
Positive FEE Level → Mom Grade 5	.84	.82
Positive FEE Slope → Mom Grade 3	.00	.00
Positive FEE Slope → Mom Grade 4	.03	.01
Positive FEE Slope → Mom Grade 5	.07	.02
Directive Structural Associations		
Temperament → Positive FEE Level	.30**	-.15*
Gender → Positive FEE Level	-.06	-.55
Sex X Temperament → FEE Level	.12	.57
Temperament → Positive FEE Slope	-.84	1.00
Gender → Positive FEE Slope	1.04	6.86
Sex X Temperament → FEE Slope	-1.06	-6.35
Positive FEE Level → Alcohol Use	-.01	-.01
Positive FEE Slope → Alcohol Use	.00	-.03
Gender X Temperament → Alcohol	-.07*	-.06
Fit Statistics		
X <sup>2</sup>	35.72	37.13
<i>df</i>	11.00	11.00
CFI	.99	.99
RMSEA	.04	.04

\*\*p < .01 \*p ≤ .05 †p < .10



**Figure 4: Gender Interaction with Effortful Control Model**



**Figure 5: Gender by Effortful Control Interaction Graph**

This finding demonstrates that the association between temperament and substance use differs by gender due to an interaction with the child’s effortful control level.

Specifically, as seen in the graph of the interaction, Figure 5, girls’ use of alcohol was not affected by their level of effortful control, whereas boys who were low on effortful control more often reported drinking than boys high on that temperament dimension.



## Chapter 5: Discussion

This study provides novel support for the consideration of the developmental environment in the fight to prevent early onset substance use. Using the longitudinal data collected as part of the Study of Early Child Care and Youth Development (SECCYD), three research aims were addressed: 1) examine the nature of the associations between the three temperament dimensions and early adolescent substance use; 2) understand how family emotional expression affects the relation between temperament and substance use; and 3) identify how these associations differ by child gender. Through these analyses, family emotional expression emerged as an influential environmental factor that affects the connections between certain temperamental attributes and the development of substance use problems in young adolescents.

Among the 15 year-olds who participated in the SECCYD, use of alcohol, tobacco, and illicit drugs was fairly limited. Less than a quarter of the sample reported using any substances. Alcohol was by far the most frequently used and more girls reported drinking than their male peers. Direct relations between temperament and substance use were limited in this sample. The only significant direct correlation found was the weak negative association between effortful control and tobacco use. No associations were found between either surgency or negative affectivity and the three categories of substance use. This finding is contrary to previous research indicating a

direct link between early temperamental characteristics and risky behavior tendencies in adolescence (Lerner & Vicary, 1982; Mâsse & Tremblay, 1997; Moffitt, Caspi, Dickson, Silva, & Stanton, 1996; Stice & Gonzales, 1998) In order to understand this contrary finding, study aim 2 sought to understand the possibility of indirect relations between temperament and substance use by way of the emotional environment at home.

Unlike temperament, a direct relation was found between family emotional expression and substance use; however, even this association was not as anticipated. Originally, it was expected that the frequency of negative expression to be positively related to substance use. Instead, findings indicate that it is the change in positive emotional expression in a home across middle childhood that is associated with an adolescent's use of alcohol, tobacco, or illicit drugs. Families who are able to steadily increase their positive expression raise children who report abstaining from substances in adolescence.

Families who either show no change or negative change have children who report early experimentation with drugs and alcohol. Families are dynamic changing environments, and this finding supports the notion that the way a family's behavior changes matters. Longitudinal research by Bronstein and colleagues (1996) into parenting behavior has demonstrated similar results. Positive supportive parenting during the transition to middle school is associated with improved adjustment socially, academically, and psychologically. Conversely, inattentive parenting not only predicted poor 5<sup>th</sup> grade outcomes but also declining adjustment over time (Bronstein et al., 1996). For families who are able to break through and improve their frequency of positive

expression, their efforts may be rewarded with better outcomes for their children in adolescence.

To understand the interconnection between family emotional expression, temperament, and substance use, each temperament dimensions was examined separately to better understand its contribution. Effortful control is related to a child's ability to maintain their attentional focus and overall self control. Rothbart and Bates (1998) have shown that children low on effortful control measures have more difficulty delaying gratification in preschool and are less able to handle stressful situations as teenagers. They also described these teenagers as more driven by novelty and more sensitive to associations with reward and punishment.

Individuals with lower levels of effortful control are particularly susceptible to substance use problems because they struggle to inhibit actions or sensations they desire. Kochanska and colleagues have also found evidence of effortful control contributing to children's internalization of moral principles and social values, which would impact an adolescent's decision to experiment with substances despite known social and physical consequences (Kochanska, Murray, Jacques, & Koenig, 1996).

In this study, children high on effortful control tended to live in homes with mothers who report higher positive emotional expression in 3<sup>rd</sup> grade but have lower levels of change from 3<sup>rd</sup> to 5<sup>th</sup> grades. This finding indicates that for children who are high in effortful control, the family's emotional expression is less critical to the prevention of substance use later in life. Children high on effortful control are better able to resist the temptation of drugs and shift their attention elsewhere. For those low on

effortful control, the valence of their emotional environment is an important intermediary that can help reduce a child's risk of early substance use. For children who are not as capable of regulating their attention and attraction to novelty, their parents' positive and supportive communication may serve as a social reward that is strong enough to supplant the chemical sense of reward available through drugs.

Children lower on effortful control, who are easily swayed by new stimuli and sensations, can be further protected from the temptation of alcohol, tobacco, and other drugs by their family's increasing expressions of positive emotions. As children approach pre-adolescence and early puberty in 5<sup>th</sup> grade, increases in positive expressions from the parents may reinforce communication pathways at home and strengthen the bond between parent and child just as the peer group begins to supplant the family in guiding the child's socialization. Similar findings have been demonstrated in younger children's development of compliance. Kochanska & Nazzari (1995) found that preschoolers who share positive affect with their parents were more amenable with parent instructions. The current study shows that continued positive expression in homes can have long reaching effects on children's compliance with parent expectations. This in turn may help teenagers feel more comfortable talking with parents about challenging situations at school or with peers. Likewise, feeling supported at home may help teenagers resist peer pressure to use drugs.

The other temperament dimension showing significant results in this study was surgency. Surgency, a factor described by Rothbart as high-energy activation, is derived from several scales including pleasure, activity level, and low levels of shyness (Putnam

& Rothbart, 2006). This factor showed a negative association with the level of emotional expression at home where children who are rated as more outgoing or extroverted tend to have mothers who report less frequent positive emotional expression in 3<sup>rd</sup> grade.

Children high on the surgency dimension have also been described as self-confident, competitive, and dominating in social situations. It is possible these parents spend more effort contending with their spirited children and less time expressing positive emotions at home.

Unlike effortful control, there was no association between surgency and the increase in positive expression over time. Additionally, surgency was not correlated with any of the substance use items. The lack of associations between surgency and substance use was not surprising given the limited support in the literature for such a relation. It is possible that extroverted teens feel less of a need for ‘social lubricants’ like alcohol and drugs to feel comfortable around peers. Conversely, children low in levels of surgency may be too shy to even enter social situations where drugs are available.

The final study aim sought to identify how the connection between temperament, family emotional expression, and substance use differed by gender. There were gender differences in effortful control, surgency, and alcohol consumption. Girls were more likely to be rated by their mothers as showing more self-control and less extraversion in preschool. In high school, girls in this sample more frequently reported that they used alcohol than boys. The interaction between gender and temperament was only a significant predictor of alcohol in the context of effortful control temperament, and not for surgency. Girls’ use of alcohol was not affected by their level of effortful control,

whereas boys who were low on effortful control more often reported drinking than boys high on that temperament dimension. Therefore, although the family environment seems to be important for all teenagers, it may be particularly critical that boys low in effortful control experience increasing positive expression at home through middle childhood in order to prevent early onset substance use problems.

This study sheds some light on the developmental precursors to early adolescent substance use, and it also reveals potential steps families can take that may help their children avoid the dangers of drugs. The findings of this study indicate that some children who have lower levels of control over their attention and attraction to novelty are more likely to experiment with drugs in early adolescence unless their families are able to increase the expression of positive emotions at home over time. This exception was especially true for boys and for children in families that showed lower levels of expression in 3<sup>rd</sup> grade. Families of such children may therefore be able to prevent substance use through an intervention designed to increase positive emotional expression. Through such an intervention, families could learn to increase positive expression of emotions and build a supportive environment that encourages communication, and may in turn help children resist pressure to use drugs. Interventions focused on emotional expression have been used with clinical populations to help reduce the burden on caregivers of family members with Alzheimer disease (Butcher, 1996) and to improve outcomes in breast cancer patients (Classin et. al, 2001), and to help families with children diagnosed with autism, anxiety, or conduct disorders (Salmon, Dadds, Allen, &

Hawes, 2009), but such an intervention to prevent adolescent substance use has not yet been developed.

### **Limitations**

The most notable limitation in this study was the lack of variability in the substance use measures collected at age 15. Although low variability indicates that fewer adolescents in this sample were experimenting with substances, there are many reasons why this data probably does not paint the whole picture of risky behavior. First, one of the primary concerns with the NICHD data is that some of the study children who are most susceptible to risky behavior in adolescence were not still participating by Phase IV. In an attempt to understand the attrition in this sample, children with missing data at the age 15 (Phase IV) administration of the YSR were compared on their rate of completion on other measures being used in this study. Comparisons of Phase IV participants to study drop outs indicated that the groups did not differ on any of the temperament dimensions or emotional expression scores. In fact, of all the children for whom both the CBQ and FEE were collected, only five dropped out by Phase IV. Although 400 participants whose families entered the SECCYD study in 1991 did not participate in Phase IV, it appears as though they were already not participating fully before the study child reached adolescence.

Additionally, despite many previous studies supporting the use of self-report measures of substance use because of limited bias, there is a strong possibility of under-reporting of use problems in this sample. Unlike surveys discussed above that are

conducted annually by agencies like the CDC (Brener et al., 1995), the SECCYD had frequent and increasingly personal interactions with study children. These children had met with researcher staff dozens of times before the age 15 laboratory visit. Self-report bias may be low in anonymous surveys, but the youth participating in the SECCYD may have responded in more socially desirable ways because of their long relationship with researchers. Finally, there may have been limited variability in drug use because of the fairly homogenous sample primarily made up of white children born to middle class families. Although drug use is on the rise in non-urban, non-minority populations, easy access to drugs for these children may still be more difficult than for children in higher-risk populations, and therefore this sample may not adequately reflect the level of drug use found in other populations.

The primary limitation of the FEQ is that it only taps the frequency of emotion, even though other aspects of emotional expression are also important. The FEQ does not capture the clarity, intensity, or appropriateness of emotional expression. Although adaptations have been made to the instrument in other studies to address some of these shortcomings (Boyum & Parke, 1995), these alterations were not made during the SECCYD. Understanding the emotional environment a child grows up in is more complicated than just knowing the frequency of positive and negative expressions. A more complete measure of emotional expression would also capture the context of expression, the intensity of the expression, and at which family members the expressions are directed.



An additional limitation to the generalization of these findings stems from the use of two maternal report questionnaires: the CBQ and the FEQ. Although the SECCYD also had study children's care givers complete the CBQ, the care givers version was shorter (only 48 items long) and measured fewer subscales. Additionally, as discussed above, the second adult completing the FEQ did not always have consistent relationships with the study children. Therefore, for these analyses, the two maternal reports provided the best picture of both the child's temperament and the frequency of family emotional expression.

Ideally, future research will be able to address these limitations through the use of more ethnically diverse samples and more comprehensive measures that assess more aspects of a family's emotional climate. In addition, it would be beneficial to include additional time points for assessing emotional expression to see how the family's behavior changes as the child enters high school and beyond. Overall, more longitudinal research is needed to see how these models fit older drug users and how the age of first use is affected by family environments.

## **Conclusion**

In sum, the findings of this study expand the understanding of the connections previously found between temperament and adolescent risky behavior by examining the role of family emotional expression. This study's analyses, which were specifically designed to look not just at the static family environment, showed that it was the increase in a family's emotional expression over time that was related to abstinence from drugs

and alcohol in adolescence. The ability for a family to grow and change as their child approaches middle school plays an important role in protecting children with poor effortful control from early onset substance use problems. The most heartening aspect of this study's findings is that it supports the use of interventions to improve emotional expression in homes throughout middle childhood. This study shows that not only can families improve their positive emotional expression, but by increasing it, they may also help their child avoid a damaging and debilitating addiction.

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## **Curriculum Vitae**

Katherine Marie Zinsser graduated from Smith College in Northampton, Massachusetts, in 2005 with a Bachelor of Arts degree in Psychology. After leaving Smith, she worked in adolescent substance abuse treatment at Second Nature Wilderness Program in Duchesne, Utah, and conducted research into criminal justice substance abuse treatment in the Administration of Justice Department at George Mason University in Fairfax, Virginia. Following the completion of her Master of Arts degree, Katherine will remain at George Mason to complete her doctorate in Applied Developmental Psychology.