Stability and changes in problem behavior during adolescence: multilevel predictors and moderators

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Stability and changes in problem behavior during adolescence:
Multilevel predictors and moderators

by

Dan Okello Nyaronga

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirement for the degree of
DOCTOR OF PHILOSOPHY

Major: Human Development and Family Studies (Life Span Studies)

Program of Study Committee:
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Ames, Iowa
2006

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This study predicted that community ethnic heterogeneity (controlling for community poverty), family adversity (i.e., family economic hardship and non-intact two-parent family/single parenthood), family social resources (i.e., parent-adolescent relationship, parental control, parental warmth, parental knowledge), and individual traits (i.e., racial minority status and gender) would influence adolescent problem behavior trajectories both additively and multiplicatively. In addition, the study predicted that there would be racial/ethnic and gender differences in problem behavior over time. An effective analysis of community influence on individual outcomes requires a multilevel analysis that includes community-level, family-level, and individual-level variables. This multilevel analysis used 15,170 adolescent data values from the National Longitudinal Study of Adolescent Health, Wave 1 (1995), Wave 2 (1996), Wave 3 (2001), and the 1990 U.S. Census. The findings demonstrate that there is: (a) change in adolescent problem behavior over time; (b) unique influences of family adversity, family social resources, and individual factors (i.e., race and gender) on adolescent problem behavior; (c) diminishing effects of community poverty over time; (d) diminishing effects of family social resources (i.e., family warmth and parent-adolescent relationship) producing stability and equality over time during late adolescence; and (c) contextual dissipation of the influences of some family social resources (i.e., parent-adolescent relationship) under high ethnic heterogeneous conditions.
CHAPTER 1: INTRODUCTION

Adolescent problem behaviors, such as school misbehavior, drug usage, and weapon carrying, are disturbing issues confronting adolescents, parents, and teachers. It is estimated that each day in the United States, 1,234 youths run away from home and 2,255 teenagers drop out of school. Every 5 minutes a youth is arrested for some type of violent crime, and every 2 hours a child is killed by a gun (Elderman, 1995).

Previous community researchers have demonstrated that youth problem behavior is associated with community adversity such as concentrated poverty, residential instability, and ethnic heterogeneity (Aneshenshel & Succoff, 1996; Duncan, Brooks-Gunn, & Klebanov, 1994; Elliot & Menard, 1996; Hoffman, 2002; Sampson & Groves, 1989; South & Crowder, 1999). In addition, previous family and developmental researchers have demonstrated that adolescent problem behavior is associated with family adversity (i.e., family economic hardship and non-intact two-parent family or being a single parent; Patterson, 1982; Smith & Krohn, 1995; Voydanoff, 1990), family social resources (i.e., parental control, parental knowledge, parent-child relationship, and parental warmth; Buehler, 2006; Crouter & Head, 2002; Fletcher, Steinberg, & Williams-Wheeler, 2004; Geisman & Wood, 1986; Smith & Krohn, 1995; Stattin & Kerr, 2000), and individual factors (i.e., adolescent gender and ethnicity/race, or minority status; Harrell, Hall, & Taliafero, 2003; Noh & Kaspar, 2003; Peters & Massey, 1983; Spencer, 2001).

Although a considerable body of empirical research has established the importance of family context, in particular the role of parenting for influencing adolescent problem behavior (Patterson, 1992), few studies have examined the unique influences of family and community factors and their multiplicative influences on adolescent problem behavior.
Cross-level processes refer to the multiplicative effect of community- and family-level factors on adolescents. By investigating cross-level processes, we are able to explore the differential influence of family social resources, given the various levels of community adversity experienced by adolescents and by the family. It is not possible to isolate families from community or individuals from family since individuals are nested within families and families are nested within communities (Bronfenbrenner, 1986; Leventhal & Brooks-Gunn, 2000).

We know little about the multiplicative effects of community- and family-level factors on adolescent development outcomes. No study has examined the unique influences of these multilevel factors on adolescent problem behavior trajectories. This study will use multilevel risk and resources, or protective factors, additively and multiplicatively, to assess their influences on adolescent problem behavior trajectories through cross-level processes. In the present study, family and the individual represent the same level of measurement. Some previous developmental studies exploring the association between family factors and adolescent developmental outcomes may have yielded spurious results, given the common influence of community factors. Also, the findings of some of the community studies may be attributed to the “ecological fallacy,” which involves the interpretation of aggregate level findings at the individual level (Bryk & Raudenbush, 1992; Robinson, 1950). Multilevel analyses can address problems associated with both spuriousness and ecological fallacy, thereby improving upon the previous work.

Problem behavior in adolescents can be manifested as either externalizing or internalizing behavior. In externalizing problem behavior, negative emotions are directed against others. They are manifested as anger, aggression, and frustration (Roeser, Eccles, &
Strobel, 1998). Children with externalizing problem behaviors have underdeveloped self-regulation skills, leading to undercontrolled behaviors (Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996). Internalizing behavior, by contrast, includes withdrawal, fearfulness, inhibition, and anxiety (Eisenberg et al., 2001; Roeser et al., 1998). In this type of problem behavior, negative emotions are directed at oneself rather than others (Roeser et al., 1998). This study will focus on adolescent externalizing problem behavior.

**Problem Behavior Theory**

Jessor, Donovan, and Costa (1991) defined problem behavior theory as a social-psychological framework that evolved from the value and expectations. Jessor and colleagues (1991) posited that the primary concern of problem behavior theory is the relationship within and between three major systems (i.e., personality systems, perceived environmental systems, and behavioral systems) that are presumed to be most directly influential on the occurrence and non-occurrence of problem behavior.

Problem behavior theory holds that whether or not young people accurately assess the risk inherent in any given behavior, the actual (or perceived) risks pale next to the developmental goals they advance. A second tenet of problem behavior theory is that there is substantial individual covariation in risk behaviors among adolescents. That is, there are common factors that link these often disparate behaviors (e.g., cigarette smoking and drug use). What underlies these behaviors is what Jessor (1992) referred to as “the web of causation”—biology and genetics, social environment, perceived environment, personality, and other behavior. Each of these domains has associated risks and protective factors (Blum, McNeely, & Nonnemaker, 2002). Thus, problem behavior is a system-level property referred
to as proneness, which is caused by instigators (i.e., risks) and controls (i.e., protective factors/resilient/or social resources).

Although family and community disadvantages increase a child’s risk for problem behavior, past research has paid little attention to cross-level and protective processes involving multilevel risk and protective variables (measured at community, family, and individual levels) that combine to influence adolescent problem behavior. More specifically, little attention has been paid to gender and racial/ethnic differences in problem behavior over time as predicted by ethnic heterogeneity, family social resources (i.e., parental control, parental knowledge, parental warmth, and parent-adolescent relationship), family adversity (i.e., family economic hardship and non-intact two-parent family or single parenthood), and individual (i.e., gender and minority status) variables. Thus, there is a need to examine how different types of risks and resources interrelate. Multilevel risk and resources (protective variables) can be used additively and multiplicatively to examine developmental outcomes through cross-level processes (Blum, Kelly, & Ireland, 2001). Thus, this study will test the relationships between risk and resilience (protective) variables in the individual, family, and community domains and problem behaviors across racial groups and gender.

Family socialization research suggests that an unsupportive parent-child relationship contributes to risks such as deviance-prone attitudes (Brody et al., 2001). On the other hand, a loving, warm, caring, and cohesive family environment with a positive parent-child relationship protects adolescents by reducing the chances of problem behavior (Simons, Johnson, Beaman, Conger, & Whitbeck, 1996).
Other Theories

The association between family socialization and adolescent problem behavior is also explained by other theories. For example, social bonding theory states that lack of bonding to prosocial individuals predicts deviant behavior. This theory postulates that the stronger the bonds, the more control, the weaker the bonds, the higher the probability of antisocial behavior (Agnew, 1993; Williams, Ayers, Abbott, Hawkins, & Catalano, 1999). Social learning theory hypothesizes that the acquisition and maintenance of conventional or deviant behavior depends on which behaviors are strengthened through rewards and punishments or weakened by adverse stimuli and loss of rewards (Akers, 1994; Akers, Krohn, Lanza-Kaduce, & Radoe, 1997; Bandura, 1962, 1979; Williams et al., 1999). Differential association theory posits that the learning of behaviors occurs within intimate groups (e.g., peers and siblings). Youths are more likely to be prosocial or antisocial depending on the behaviors of their intimate groups (Sutherland & Crossey, 1978). Social learning theory incorporates the principles of differential association theory by proposing that behavior is derived from interaction in or under the influence of those groups with which a person associates. These associations control the sources and patterns of reinforcement and define normative behavior as prosocial or antisocial (Akers, 1994; Williams et al., 1999).

Theoretical Integration

I contend that most of these developmental theories fit into the larger framework of risk and resources. According to the risk-resources perspective (Blum et al., 2001; Jessor, 1992), both contextual (family and community) and individual risk variables are instigators—conditions that are associated with higher likelihood of negative outcomes—that place youth at risk of negative outcomes (ethnic heterogeneity, minority status, family
economic hardship, and non-intact two-parent family, or single parenthood), and are associated with an increase in adolescent problem behavior (Blum et al., 2001). Resource or protective factors are controls that directly decrease the probability of negative outcomes (e.g., parental control decreases the probability of engaging in problem behavior or modifies the negative impact of the risk factor). This integration of different theories into a larger framework is summarized and presented in Table 1.

Table 1

**Integrating Theories/Perspectives into Risk-Resources Perspectives**

<table>
<thead>
<tr>
<th>Theory</th>
<th>Risk Factors</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Behavior Theory</td>
<td>Ethnic heterogeneity, family economic hardship, non-intact two-parent family or single-parent home, minority status, and deviant peers</td>
<td>Promoting conventional values (i.e., religious activities and church attendance) and improving family and community conditions (i.e., increase in individual and family income)</td>
</tr>
<tr>
<td>Social Learning Theory</td>
<td>Exposure to problem behavior by negative role models (i.e., alcoholic parents) and exposure to problem behavior</td>
<td>Exposure to positive role models (i.e., positive parental figure)</td>
</tr>
<tr>
<td>Social Bonding Theory</td>
<td>Lack of social bonds to prosocial individuals (i.e., lack of a strong social bond between a father and a son)</td>
<td>Strong social bonds between family members (i.e., a strong social bond between a father and a son)</td>
</tr>
<tr>
<td>Differential Association Theory</td>
<td>Negative behavior from intimate groups (i.e., peers and siblings)</td>
<td>Positive behavior from intimate groups (i.e., siblings and peer groups)</td>
</tr>
<tr>
<td>Developmental Perspectives</td>
<td>A lack of parental control and a lack of parental knowledge of adolescents’ whereabouts and activities</td>
<td>Parental control, parental knowledge of adolescents’ whereabouts and activities, parental warmth, and a strong parent-adolescent relationship</td>
</tr>
</tbody>
</table>
Although various studies have documented the association between adolescent problem behaviors and risk and resources (Bonger, Koot, Van Der Ende, & Verhulst, 2004; Dekovic, Buist, & Reitz, 2004; Jessor et al., 1991; Patterson, 1982, Patterson, Reid, & Dishion, 1992), very little empirical research has investigated the unique influences of these variables and the cross-level multiplicative effects of these factors on adolescent problem behavior. Even less research has looked at racial/ethnic differences in adolescent problem behavior as well as gender-moderating effects over time as predicted by the instigators (i.e., community ethnic heterogeneity, family economic hardship, being a racial minority, and non-intact two-parent family or single parenthood) and resilient resources (i.e., parent-child relationship, parental knowledge, parental control, and parental warmth). Thus, there is a pressing need to focus in this area using multilevel analysis to investigate how community ethnic heterogeneity, family adversity (i.e., family economic hardship and non-intact two-parent family or single parenthood), and individual factors (i.e., racial minority status and gender) uniquely as well as in combination (i.e., cross-level multiplicative effects) influence adolescent problem behavior (Simons et al., 1996; South & Crowder, 1999). In addition, there is a need to investigate changes in problem behaviors over time.

While most previous studies have explained the level of problem behavior of adolescents, with or without lagged controls, these studies did not explain the different facets of growth in problem behaviors (both level and rate of change/slope). Patterson, Capaldi, and Banks (1991) posited that there are two routes to problem behavior, one for late starters and another for early starters. Late starters are youths who experiment with delinquent acts during mid- to late adolescence, when such rebellious behavior is quite prevalent. Their participation in problem behavior is considered largely to be a function of the encouragement and support
provided by peers as a result of a decline in the quality of parenting. These disruptions facilitate drifting into association with deviant peers and experimentation with delinquent behavior (Simons, Wu, Conger, & Lorenz, 1994). In contrast, early starters are individuals who engage in problem behavior during early adolescence. Early starters are viewed as having serious deficits in social skills also as a result of inept parenting. Patterson and his colleagues (1991) contended that whereas late starters tend to continue their delinquency within a short period, early starters are at risk for chronic offending during adolescence and criminal careers as adults (Patterson et al., 1991, 1992; Patterson & Yoerger, 1993; Simons et al., 1994). These observations suggest that there are differences in both initial level and subsequent growth and decline of problem behavior, and these differences may vary across adolescents. In the present study, the focus will be on additive and multiplicative influences of community ethnic heterogeneity, gender, and racial/ethnic differences on stability and change in problem behavior over time.

**Family and Parenting Influences on Adolescents’ Problem Behaviors**

Much research has been published on the role of the family or parenting in adolescents’ problem behaviors (Simons et al., 2002). Of the many parenting variables, parenting styles have been among the most frequently investigated (Aunola & Nurmi, 2005; Simons et al., 2002; Steinberg, 2001; Wood, McLeod, Sigman, Hwang, & Chu, 2003). In the dimensional approach to parenting styles, the focus has been on the impact of affection (e.g., responsiveness, involvement, and supportiveness), which refers to parents’ connectedness to the child and their interactional warmth (Galambos, Barker, & Almeida, 2003; Wood et al., 2003), and behavioral control (e.g., maturity demands, monitoring, and limit setting), which consists of the regulation of the child’s behavior through firm and consistent discipline.
(Barber, 1996; Galambos, Barker, & Almeida, 2003; Simons et al., 2002). Each of these parenting style dimensions has been shown to be associated with adolescent problem behaviors (Aunola & Nurmi, 2005). For example, a high level of behavioral control is related to a low level of externalizing problems such as antisocial behavior and conduct disorders among adolescents (Barber & Olsen, 1997; Eccles, Early, Frasier, Belansky, & McCarthy, 1997; Pettit, Laird, Dodge, Bates, & Criss, 2001; Simons et al., 2002; Stice & Barrera, 1995).

Community Context of the Influence of Family Social Resources on Problem Behavior

Recent research suggests that the positive influence of family social resources, such as parent-child relationship, parental knowledge, parental control, and parental warmth begins to level off under highly diverse community conditions (Wickrama & Bryant, 2003; “ceiling effects”). For this reason, this study investigates whether family social resources continue to have positive effects on adolescent problem behavior even in highly diverse communities. In addition, this study will investigate and determine whether some of these factors can be identified as a more central influence than others and whether these factors exert differential influences on different growth parameters (i.e., stability and change in problem behavior). Using a risk-resources perspective, the present study will analyze individual, family, and community influences on adolescent problem behavior trajectories. The study will extend previous work by others, such as Fletcher et al. (2004), Moffit, Lynam, and Silva (1994), Patterson et al. (1992), Simons et al. (2002), and Stattin and Kerr (2000), by investigating not only family influences, but also moderating influences of race/ethnicity, gender, and community ethnic heterogeneity.

Although community ethnic heterogeneity has been documented as creating challenges and problems such as a lack of uniform behavioral standards, which consequently
leads to ineffective social control and problem behavior (Patterson, 1982), research also
documents that a high degree of ethnic heterogeneity has beneficial effects independent of
community poverty that vary from social resources, ideas, styles, vision, creativity,
innovation, and history (Wickrama, Noh, & Bryant, 2004). Thus, I contend that community
ethnic heterogeneity will have a varied influence on different ethnic/racial groups.

Data and Procedures

This study will use a nationally representative sample of 15,170 adolescents. The data
(ADDHEALTH). The study also used the growth curve (GC) technique with SAS PROC
MIXED to estimate the individual change parameters (level and slope) as well as their
variations across individuals. Research questions with regard to the nature of change require
researchers to view change as a continuous process using more than 2 time-points (Rogosa,
Brand, & Zimowski, 1982). Individual-specific growth parameters can capture different
facets of multifaceted process of change. These parameters include not only the severity
(level), but also the amount of growth or decline (rate of change) in problem behavior over
time (Karney & Bradbury, 1995). The traditional regression and MANOVA methods are not
flexible enough to include time-varying predictors while preserving their continuous nature.
The growth curve (GC) technique using PROC MIXED provides an estimation of individual
change parameters as well as their differences across individuals, and systematically relates
these differences to the differences in time-invariant and/or time-varying predictors and in
sequelae across individuals (Karney & Bradbury, 1995; Wickrama, Beiser, & Kaspar, 2002).

A developmental perspective on problem behavior implies that changes are related to
age in an orderly way (Patterson & Yoerger, 1993). There are several different ways to
conceptualize and operationalize stability in problem behavior. However, one important distinction is between absolute and relative stability (Holsen, Vollebergh, & Meeus, 2000; Loeber et al., 2000). Absolute stability refers to the consistency in a construct’s level when that construct is measured over time. Relative stability, on the other hand, refers to the consistency of an individual’s rank order within a group (Dekovic et al., 2004).

Using the proposed predictors, this study focuses on explaining the variation in problem behavior, that is, if both relative stability of problem behavior and absolute levels change over time and produce significant variation in the rate of change (slope). Thus, the study will turn to the conceptual model (see Figure 1) to examine the additive and multiplicative effects of multilevel risks and resources on problem behavior. In addition, the study will investigate the level and rate of change in adolescent problem behavior trajectories.

The Theoretical Model

Based on the path (labeled) in the theoretical model below, the present study will examine several important research questions:

(a) Does adolescent problem behavior change over time? (See for reference the growth factors in the right-hand side box.)

(b) Do risk factors (i.e., ethnic heterogeneity, family economic hardship, minority status, and non-intact two-parent family or single parenthood) contribute to or increase the level and rate of change (slope) in adolescent problem behavior? (Path 1)

(c) Do resources (i.e., parental control, parent knowledge, parental warmth, and adolescent-parent relationship) decrease the level and rate of change (slope) in adolescent problem behavior over time? (Path 2)
(d) Do resources (i.e., parental control, parent knowledge, parent-adolescent relationship, and parental warmth) buffer the influence of risk variables (i.e., ethnic heterogeneity, family economic hardship, minority status, and non-intact two-parent-family, or single parenthood) on problem behavior over time? (Path 3)

(e) Do risk factors (i.e., ethnic heterogeneity, family economic hardship, minority status, and non-intact two-parent family, or single parenthood) decrease the influence of resilient variables and resources on adolescent problem behavior over time? (Path 4).

---

**Figure 1.** The Conceptual Model
CHAPTER 2: LITERATURE REVIEW

In this chapter, I will revisit risk and resources, or resilience, perspectives, review the literature on problem behavior, and expound on community, racial/ethnic, and gender differences in problem behavior, as well as predictors of problem behavior.

Risk and Resources Perspectives and Problem Behavior

Research indicates that the level and amount of exposure to risk variables lead youths on a pathway to involvement in problem behaviors (Barnes & Welte, 1986; Carpenter, Lyons, & Miller, 1985; Newcomb, Maddahian, & Bentler, 1986). In addition, interpersonal risk variables that are influential in shaping behavior and setting values are often found in an adolescent’s environment (Hawkins, Catalano, & Miller, 1992; Newcomb, Maddahian, & Bentler, 1986). Such risk factors may include favorable attitudes toward problem behaviors, low bonding, low commitment to school, and academic failure (Brooks, Brook, Gordon, Whiteman, & Cohen, 1990; Catalano & Hawkins, 1996; Hawkins et al., 1992).

According to Moffit et al. (1994), problem behavior begins early in childhood because neuropsychological deficiencies disrupt normal development; it is these deficits that increase vulnerability to the criminogenic aspects of disadvantaged rearing environments. Such deficiencies evoke challenges to the parents by eliciting more physical punishment from caregivers, especially if the family is living in a disadvantaged or distressed environment (Moffit, 1997). Vulnerabilities may result from being reared in disadvantaged environments such as in substance-abusing families, family economic hardship, abusive or violent environments, being a minority, and being reared in a non-intact two-parent household or in single-parent families. Vulnerabilities also can result from individual characteristics such as an aggressive temperament (Blum et al., 2002). Vulnerability has been
defined as the interactive process between the social context in which a young person lives and a set of underlying variables that, when present, place the young person “at risk” for negative outcomes (Blum, 1998). Risk is thus defined as any influence that increases the likelihood of the onset of problems or maintains a problem state (Coie et al., 1993).

Counterbalancing such vulnerabilities are the resources (Patterson, McCubbin, & Warwick, 1990), assets (Benson, 1997), protective factors (Blum, 1998), and resilience variables (Masten et al., 1999) that arise likewise from the individual, familial, and social environments in which a young person lives.

Prevalent data suggests that risk factors differ by a variety of sociodemographic characteristics, such as gender, race/ethnicity, and the neighborhood’s socioeconomic conditions. For example, census data show that school dropout rates vary by race and ethnicity, with African American and Hispanic children living in poor neighborhoods being at a greater risk of dropping out of school than Caucasian students who live in rich neighborhoods (Richman & Bowen, 1997). In the same vein, data on delinquency and violence indicate that African American youths are more likely than Caucasian youths to be victimized and be involved in serious violent crime (Williams, 1994). A research study by Vega and colleagues (1993) on the risk factors for drug use among 6,760 sixth and seventh graders found that among Cubans, Hispanics, African Americans, and non-Hispanic White youths, risk patterns differed by race and ethnicity. Although the distribution of risk factors for all groups was not significantly different, the mean number of risk factors varied by race and ethnicity, with African American children having the highest mean number of risk factors (Fraser, Richman, & Galinsky, 1999).
As far as gender difference in problem behavior is concerned, conduct disorder consistently has been found to occur at a much higher rate among boys than girls (Robins, 1991). Several studies reviewed by Werner (1990) also indicated gender differences in child-rearing practices that differentially affect males and females. Werner (1990) posited that resilience in girls is promoted by parenting styles that place an emphasis on risk taking, independence, and stable emotional support. For boys, resilience is promoted by parenting styles that provide higher degrees of supervision and structure, the presence of a male role model, and support for the pressing emotions. Resilience implies resistance to threat, or change (Blum, 2002). Garmezy (1991) defines it as the individual’s capacity to recover and maintain adaptive behavior after insult. Although evidence is accumulating on gender, racial, and ethnic differences, it is sparse and inadequate. That is, very few studies contain adequate information on African Americans, Latinos, and other minority racial groups.

Consistent with risk and resources perspectives, this study will test relationships between risks in the individual and/or family domains and problem behaviors across communities, racial groups, and gender. This is important because many past research findings have not been generalized to minority families or gender. That is, past findings may not necessarily apply to all ethnicities/races and/or genders. In addition, very little research on ethnicities/race and gender has been done using longitudinal data. However, a longitudinal study is vital in identifying particular predictors that are more central in influencing problem behavior across time. Thus, risk factor variables studied include community ethnic heterogeneity, family economic hardship, single-parenthood, and minority status.
Ethnic Heterogeneity (Diversity) and Adolescent Problem Behavior

Previous community researchers have demonstrated that youth problem behavior is associated with community adversity, such as concentrated poverty, residential instability, and ethnic heterogeneity (Aneshenshel & Succoff, 1996; Duncan, Brooks-Gunn, & Klebanov, 1994; Elliot & Menard, 1996; Hoffman, 2002; Sampson & Groves, 1989; South & Crowder, 1999). In his theory of concentration effects, Wilson (1987) argued that social transformation of inner-city areas in the United States during the last three decades resulted in concentrations of poverty and racial segregation that led to delinquency and behavioral problems, with which Sampson (2001) concurred. The argument is that problem behavior is explained through the structural and cultural differences arising from the isolation of the racial minority (Wilson, 1987). According to this theory, segregation of racial minorities in poor neighborhoods contributes to inferior educational and employment opportunities, which in turn enhances the likelihood of adolescents engaging in problem behavior (Jarjoura, Triplett, & Brinker, 2002; Sampson, 2001).

Impoverished areas of the city that feature the cheapest rent attract not only the lowest income groups, but also a higher proportion of groups with different racial and ethnic backgrounds. The presence of multiple cultures in the neighborhood, each with a unique set of values and norms and speaking different languages, undermines communication between neighbors and the level of consensus achieved within the neighborhood about appropriate goals and standards of behavior (i.e., normlessness; Elliot et al., 1996). Consequently, this normlessness gives rise to delinquent gangs and illegitimate enterprises, such as gambling, prostitution, extortion, theft, and drug distribution networks in the neighborhoods (Elliot & Menard, 1996; Shaw & McKay, 1942). I contend that this influence of ethnic segregation on
adolescent problem behaviors is, at least in part, independent of the detrimental influence of the community’s poverty level.

Racial Minority Status and Adolescent Problem Behavior

Racial minority status is a distinct factor and different from ethnic heterogeneity. Whereas ethnic heterogeneity is a community characteristic, racial minority status is an individual characteristic. According to the research, racial minority status has a detrimental influence on adolescent problem behavior (Carroll, 1998; Meyer, 1995). The unique influence of race may be attributable to institutionalized practices in American society that result in the systematic subordination and devaluation of minority groups (Spencer, 2001). It also may be attributed to the day-to-day discrimination experienced by minorities (Spencer, 2001) that may not be captured fully by traditional family and community socioeconomic indicators. Indeed, systematic subordination and devaluation of African Americans, Hispanic Americans, or Native Americans is reflected by proxies indicating that racial minorities have higher employment instability, lower purchasing power, lower wealth, and fewer assets than do the majority of Caucasians who have comparable levels of family income (Wickrama et al., 2004). Constant racial discrimination in the broader society is a powerful daily stressor that can contribute to the emotional distress of minority racial groups through the internalization of racist beliefs, such as innate inferiority, negative self-evaluations, and subsequent development of behavioral problems (i.e., racial hatred and violence; Harrell et al., 2003; Noh & Kaspar, 2003; Williams, Neighbors, & Jackson, 2003).

Additional research has shown that family influences have components that distinguish African American youths, Native American youths, or Hispanic youths from Caucasian youths (Maguin & Loeber, 1996; Wallace & Bachman, 1991; Williams, 1994).
For example, earlier studies have found that racial differences in academic performance predict delinquency (Maguin & Loeber, 1996) and that the number of siblings involved in problem behavior and parental norms regarding problem behaviors differ across racial groups (Brooks, Gordon, Whiteman, & Brook, 1988; Williams et al., 1999).

Based on the literature review, I hypothesize that being a minority (i.e., African American, Native American, Asian American, or Hispanic American) will have a negative and detrimental effect, thereby increasing the level and slope of adolescent problem behavior across time.

*Family Economic Hardship and Adolescent Problem Behavior*

Previous research has documented that there is a link between family economic hardship and adolescent negative outcomes underlying problem behavior (Lempers, Clack-Lempers, & Simons, 1989; Voydanoff, 1990). Research indicates that adolescents from poor families resort to delinquent acts due to the stress exerted by family economic hardship (Lempers, Clack-Lempers, & Simons, 1989; Voydanoff, 1990). The research also points out that the lack of meeting family basic needs, overcrowding, utility shut-offs, inadequate heating, and other housing-quality problems create tension in a family and lead to adolescents’ frustration, which may be expressed through heavy drinking, violence, and drug use (McAdoo, 1986; Sherman, 1994). Furthermore, research has revealed that adolescents from poor families have no health insurance. For example, 25.2% of children from poor parents had no health insurance at all in 1998 (U. S. Bureau of the Census, 2000). This lack of addressing basic needs causes stress for adolescents and their families, because many doctors refuse Medicaid patients due to low reimbursement rates from the government,
notwithstanding the inability of most of these parents to pay even small fees for covered medical services (Sherman, 1994).

Based on the literature review, I hypothesize that the prevalence of family economic hardship will have negative and detrimental effects on (i.e., lead to an increase) the level and slope of adolescent problem behavior across time.

Non-Intact Two-Parent (Single-Parent) Family and Adolescent Problem Behavior

The dramatic shifts in American families over the past few decades have altered children’s family living arrangements considerably. Family structures are extremely varied today, not only due to the high rates of divorce and the proliferation of complex step-families, but also because of the increasing rates of non-marital childbearing and cohabitation (Demuth & Brown, 2004).

Studies have demonstrated consistently that children from non-intact two-parent (single-parent) families are more susceptible to problems than are children from intact two-parent (traditional) families (Simons et al., 1996). Likewise, adolescents from traditional (intact two-parent) families are less likely to report school problems than are children from non-intact two-parent (single-parent) families. More recent research has consistently revealed that children from broken homes are more delinquent than those from intact families (Demuth & Brown, 2004; Lamborn, Mounts, Steinberg, & Dornbusch, 1991). This is attributed to the economic pressure on female heads of families that contributes to long hours of work at low wages and being away from her children (Austin, 1992). Family research does suggest that when there is only one parent in the home, all other things being equal, parental capacities are stretched. Single-parent household heads find it hard to cope with work, run errands, and dedicate enough time to be with their children, let alone supervising their
activities and providing for their basic needs adequately. Lack of adequate parental supervision then may lead to adolescents relying on peers for advice, which in turn may lead to the bad influence of drug use, drinking, violence, and other behavioral problems (Simons et al., 1996).

This study, then, will investigate the effect of non-intact two-parent family status or single parenthood on adolescent problem behavior; furthermore, this study will improve on prior cross-sectional research studies (i.e., Demuth & Brown, 2004) that looked at parental absence. This study will use three waves of longitudinal data from an adolescent national data set. Such a strategy, therefore, will provide a more complete understanding of adolescent problem behavior as predicted by non-intact two-parent household or single parenthood. Based on the literature review, it is expected that adolescents from non-intact two-parent (single-parent) families will exhibit higher levels of behavioral problems compared to adolescents from two-parent intact families.

**Resources (Protective Variables) and Adolescent Problem Behavior**

Like risk factors, protective variables or resources predict future outcomes. Often perceived as conceptually distinct from risk factors, protective variables modify risk or compensate for risk by directly reducing a disorder or dysfunction through a compensatory mechanism (Coie et al., 1993). Sometimes they provide resistance to risk by moderating the relationships among risk factors and problems or disorders (Bryant, West, & Windle, 1997). The latter is usually called a “buffering” effect, because it buffers an individual against the full effect of risk, thus helping reduce involvement in problem behavior (Hawkins et al., 1992). Intervention and prevention strategies can seek to address risk by enhancing positive influences (Williams et al., 1999). Resources or protective family characteristics may include
a caring parent, an authoritative parenting style, parental control (Blum et al., 2002), parental warmth and supervision, or extra familial conditions such as having a network of supportive friends or regularly attending a place of worship (McLoyd, 1998; Runyan et al., 1998).

Resources or protective factors are important because they provide clues for designing more effective social programs or interventions. They identify influences that, if fostered by social programs, may directly affect a problem behavior or moderate risks associated with a problem behavior (Burt, Resnick, & Novick, 1998).

Consistent with risk-resources perspectives, this study will test relationships between resources or protective factors in the individual and family domains and problem behaviors across racial groups and gender. As stated above, many past research studies have not been extrapolated to minority families and gender. In addition, little research has been done using longitudinal data. I contend that longitudinal data are important in identifying predictors that are more central in influencing the development of problem behavior. The variables studied here include parenting variables such as the parent-adolescent relationship, parental control, parental knowledge, and parental warmth.

**Parent-Adolescent Relationships and Problem Behavior**

Studies that investigate the role of parenting constantly draw on two basic dimensions: affection and control (Claes et al., 2005). The first dimension is concerned with the quality of the relationship that binds parents and adolescents. Several studies indicate that emotional bonding and proximity with parents in the course of childhood and adolescence have beneficial effects on psychosocial development, thus providing an important protection against involvement in antisocial behavior (Barrera, Biglan, Ary, & Li, 2001; Loeber, 1990). These links are consistent across cultures and across different social groups (Barrera et al.,
However, an increasing amount of evidence indicates that emotional detachment or poor parent-adolescent relationships is associated with adolescent problem behavior (Rutter, Giller, & Hagel, 1998). Furthermore, many studies point out that parental relationships characterized by coercion, hostility, or the presence of conflicts can be a sign of family dysfunction (Patterson, 1982). Adolescents living in such a family context display personal difficulties and increased risks of developing deviant behaviors, such as aggression, vandalism, theft, alcohol and drug use (Duncan, Duncan, Biglan, & Ary, 1998; Patterson, 1992).

Based on the literature review, I hypothesize that a positive parent-adolescent relationship, as indicated by how well parents get along with the adolescents and trust one another, will have a beneficial effect and positive influence on the level and slope of adolescent problem behavior. That is, I expect such adolescents to exhibit fewer problem behaviors during adolescence as well as less growth in problem behavior. Therefore, the positive quality of interpersonal relationships is expected to reduce or inhibit the growth trajectories of behavioral problems across time.

*Parental Knowledge and Adolescent Problem Behavior*

Stattin and Kerr’s (2000) findings suggest that the strongest predictor of adolescent problem behavior is the extent to which parents are knowledgeable concerning their children’s activities. They indicate that parents may become knowledgeable about the adolescents’ activities through the use of *parental solicitation* (i.e., how much the parents actively seek information concerning their children’s whereabouts, activities, and associates either from the children themselves or from key others such as friends and friends’ parents). Solicitation is akin to what Crouter and Head (2002) refer to as *parental monitoring*. 
Parental monitoring seems to be one of the most consistently cited protective factors against delinquency, drug use, and aggression (Barber, Olsen, & Shagle, 1994; Barnes & Farrell, 1992; Brown, Mounts, Lanborn, & Steinberg, 1993a, 1993b). Research suggests that parents of delinquent youth have little knowledge of what their children are doing, where their children are, and with whom they are spending time (Patterson & Stouthamer-Loeber, 1984). Reports of poor parental knowledge are related cross-sectionally to higher levels of alcohol and drug use (Bahr, Maughan, Marcos, & Li, 1998; Dishion & Loeber, 1995), aggression, school misconduct (Barnes & Farrell, 1992; Brown et al., 1993a, 1993b), and vulnerability to peer pressure (Flannery, Vazsony, Torquati, & Friedrich, 1994). Longitudinal investigations also have established that low levels of parental knowledge and monitoring in childhood are related to future behavioral problems (Henry, Tolan, & Gorman-Smith, 2001). For instance, the level of parental knowledge and monitoring in middle childhood have been found to relate inversely to adolescent drug use (Chilcoat & Anthony, 1996). In addition, problem behavior is more likely among adolescents who spend a lot of time in unstructured and unsupervised activities (Richards, Miller, O’Donnell, Wasserman, & Colder, 2004). Parents also can be knowledgeable through adolescent disclosure. Stattin and Kerr (2000) defined disclosure as the extent to which children spontaneously disclose information about what they have done outside the direct supervision of their parents.

Based on the literature review, I hypothesize that parental knowledge, as indicated by the level of parental participation and supervision of adolescents’ activities, parental awareness of the adolescents’ friends, knowledge of adolescents’ whereabouts, and what and how the adolescents do in school, will positively influence the level and slope of adolescent problem behavior. Thus, parents’ participating, supervising, and being aware or
knowledgeable about their children’s activities are expected to decrease or inhibit the growth trajectories of behavioral problems across time.

*Parental Control and Adolescent Problem Behavior*

The family is seen as the key group to which adolescents are attached, and it therefore can exert a great deal of control over adolescents’ behavior. Fletcher et al. (2004) argued that it is not only the strength of parents’ knowledge that predict problem behavior in adolescents as suggested by Stattin and Kerr (2000), but also the strength of parental control that minimize various types of adolescents’ problem behavior. Therefore, Fletcher and colleagues’ findings indicate that the strongest predictor of adolescent involvement in problem behavior is the extent to which parents provide high levels of control over their children’s behavior, as opposed to just being knowledgeable about their activities and behavior (Fletcher et al., 2004). However, Stattin and Kerr (2000) conceptualized parental control as the extent to which parents require adolescents to seek permission from them (i.e., parents) before going out and insist on being informed about their children’s whereabouts, activities, and associates.

The distinction between control and solicitation is that of setting and communicating limits on behavior versus seeking information about adolescents’ whereabouts, associates, and activities (Fletcher et al., 2004). Parental controls call for a proactive role exerted by parents on their children. This parental practice is established to promote the respect of rules and social conventions, to assure the social integration and success of their children. This dimension also pertains to the establishment of rules and limits that will not be broken (Fletcher et al., 2004).
Various studies have assessed parental control through the concept of supervision, which refers to information that parents have about their adolescents’ daily life (Dishion & McMahon, 1998). Barrera et al. (2001) indicated that parental supervision constitutes a powerful protective factor against deviant behaviors, such as delinquency, alcohol use, and drug use. Some parents experience difficulties in adjusting to the occurring changes of adolescence and hence may establish inadequate patterns of supervision characterized by the absence of control and laxness. The absence of parental supervision, the presence of permissiveness, and the inability to establish limits have been identified as strong predictors of behavioral problems (Lamborn et al., 1991) and drug use (Loeber & Dishion, 1983).

Recent studies by Buehler (2006) and Galambos et al. (2003) explained the association between inadequate parental control and youth problem behavior. According to Buehler (2006), inadequate parental control includes inconsistent discipline (Patterson, 1982) and psychological intrusiveness (Barber, 1996). That is, inadequate parental control is associated with the idea that youth who affiliate with deviant peers do so because they have been rejected by more prosocial peers. Using coercion theoretical perspectives, Buehler (2006) suggested that parenting and parent-adolescent interactions influence youths’ friendship selections and peer group affiliations. The empirical support for this association includes Buehler’s recent research documenting the deleterious effects of initial levels and rate of change in inept parenting on increasing affiliation with deviant peers from ages 12 through 15 years (Brown et al., 1993a, 1993b; Buehler, 2006; Simons, Chao, Conger, & Elder, 2001). These findings, however, are not generalized to cover minority families or gender.
Based on the literature review, I hypothesize that parental control (as indicated by parental supervision, establishing limits, absence of permissiveness, and parents making many decisions in collaboration with adolescents) will have a beneficial effect by positively influencing the level and slope of adolescent problem behavior. Thus, it is expected that parental control will decrease or inhibit the growth trajectories of adolescent behavioral problems across time.

*Parental Warmth and Adolescent Problem Behavior*

A cohesive family environment with loving, warm, and caring parents reduces the chances of problem behavior in adolescents (Simons et al., 1996). In addition, Fletcher, et al. (2004) wrote that adolescents are less likely to engage in substance use when their parents are warm and involved in their lives, seek to obtain information concerning their children’s activities, and provide higher levels of control over their activities. In other words, warm and caring parents solidify the parent-child bond and allow parents to know what is going on in their children’s lives (e.g., with whom they are associating) and therefore monitor their children’s behavior more closely. Family warmth or warm parenting refers to the expressions of affection toward a child, responsiveness to his or her sensitivities, and adaptation to the child’s needs and desires (Schwartz & Knafo, 2003). Adolescents who have warm and sensitive parents are less likely to be involved in problem behavior, whereas those without parental warmth, caring, and supervision are more likely to engage in delinquency and problem behavior (Flannery, Williams, & Vazsony, 1999).

Based on the literature review, I hypothesize that parental warmth (as indicated by expressions of affection toward adolescents, responsiveness to their sensitivities, and
adaptation to their needs and desires) will have beneficial effects upon and will positively influence (decrease) the level and slope of adolescent problem behaviors across time.

**Moderating Influence of Racial Minority Status and Ethnic Heterogeneity**

Research suggests that by determining perceived social status within the social context, community composition may influence the psychological and behavioral adjustment of youth. This influence, however, may be different for minorities and Caucasians, reflecting a race-by-place interaction (Wickrama et al., 2004). For example, Caucasian families, even those who are poor, tend to live in communities where the majority of families are not poor. Many African American families, on the other hand, live in extremely disadvantaged communities (Simons et al., 2002). Not only are they poor, but most of their neighbors are as well (Wilson, 1987). Given these racial differences, community ethnic heterogeneity is more likely to be beneficial for African American than European American families (Simons et al., 2002). However, the incongruent fit between racial/ethnic identity and community context in their neighborhoods, schools, classes, workplaces, and peers may increase negative feelings such as powerlessness, subordination, and alienation; it may also decrease positive feelings such as social affection, self-acceptance, interpersonal competence, and feelings of belonging among both African American and Caucasian adolescents (Spencer, 2001; Wickrama et al., 2004). Carroll (1998) and Meyer (1995) referred to the above-described negative feelings as “minority stress.”

Research reveals that minority stress is caused by the stigma attached to being a racial minority (Carroll, 1998; Meyer, 1995). Minority stress generates depressive feelings such as powerlessness, hopelessness, and alienation that are expressed through heavy drinking, drug use, and gang violence (Carroll, 1998; Meyer, 1995). Although Blacks living in White-
dominant neighborhoods may be, in general, economically better off than their White neighbors, evidence still suggests that Black youth are disliked, disrespected, and subjected to hostility in these neighborhoods (Meyer, 1995). For adolescents, the task of exploring and developing their identities is much more daunting when they are living in stressful conditions. Empirical evidence suggests a multiplicative influence (an interaction) between racial and ethnic composition of the community on youth developmental outcomes. Despite this evidence, few longitudinal studies have been done to explore racial differences in the influences of multilevel risk factors over time.

This study will use longitudinal data to investigate both additive and multiplicative influences of race on adolescent problem behavior. This research takes into account the conditioning effect of ethnic heterogeneity because previous research has shown that in highly diverse communities, the beneficial effect of family social resources disappear and ethnic heterogeneity may positively influence developmental outcomes of minority adolescents (Krivo & Patterson, 2000; Wickrama et al., 2004). Perhaps this is due to parents being more protective of their children in what they consider as harsh environments. The negative environment in White-dominant neighborhoods may bind Black families together, with parental warmth and affection more pronounced despite adolescents’ problem behaviors. In addition, in Black-dominant communities, Blacks live in relatively supportive and empowered social environments despite community impoverishment (Korbin, 2001).

Based on the literature review, I expect to find moderation of the influence of race on adolescent problem behavior by extremely diverse community conditions. In addition, I expect race to moderate the detrimental influences of community ethnic heterogeneity (i.e., the joint effect of race and community ethnic heterogeneity, as noted earlier) over and above
community poverty level. Furthermore, I expect that the beneficial effects of family social resources (i.e., parent-child relationship, parental control, parental warmth, and parental knowledge) and community ethnic heterogeneity on adolescent problem behavior would level off under extremely diverse community conditions. Accordingly, there would be multiplicative influences between community ethnic heterogeneity and family social resources (or individual variables).
CHAPTER 3: MATERIALS AND METHODS

Participants

Data for this quantitative research is taken from the National Longitudinal Study of Adolescent Health, Wave 1 (1995), Wave 2 (1996), and Wave 3 (2001). The study used in-home interview data from adolescents and parents along with data from the 1990 U.S. Census. The Adolescent Health data comprises information collected from a nationally representative sample of high school students. This data focused on adolescents’ lives, particularly their health and health behavior.

Data collection was based on a complex cluster-sampling frame. Each case in the core sample was assigned a weight based on the sampling design so that the sample was nationally representative of U.S. adolescents in grades 7 through 12. Sample weights were normalized so that the weighted sample size was equal to the actual sample size and they were used to ensure national representativeness. The primary sampling frame included high schools in the United States that had an 11th grade and at least 30 students enrolled in the school. A systematic random sample of high schools was selected from this sampling frame. The sample was stratified by region, urban city, school type, ethnic mix, and size. The final sample included 134 schools. Schools varied in size from fewer than 100 to more than 2,000 students.

Using school rosters, a sample of adolescents was selected for in-home interviews. Minority adolescents were over-sampled and added to the core sample. The total sample size was 15,170 adolescents who completed 90-minute interviews during the first, second, and third waves of data collection in 1995, 1996, and 2001, respectively. During the more sensitive portions of the interview, adolescents listened to questions through earphones and
directly entered their responses into laptop computers, thereby greatly reducing any potential for interviewer or parental influences on their responses.

The adolescents’ ages at Wave 1 ranged from 13 to 19 years, at Wave 2 from 14 to 20 years, and at Wave 3 from 19 to 25 years. The final sample was 58% Caucasian, 22% African American, 9% Hispanic (Mexican American), 7% Asian American, and 4% Native American; 51.1% of the participants were male and 48.9% were female. Approximately 79% were from two-parent families and 24.4% of households were considered below the poverty line.

Extensive precautions were taken to maintain confidentiality and guard against deductive disclosure of participants’ identities. All protocols received Institutional Review Board approval (Goodman, 1999). This research does recognize the role played by the adolescent-peer relationships in adolescent developmental outcomes (Claes et al., 2005; Dishion, 2000; Dishion & Medici Skaggs, 2000; Elliot & Menard, 1996; Fuligni, Eccles, Barber, & Clement, 2001; Patterson, Dishion, & Yoerg, 2000; Simons et al., 1994). However, due to the data (ADDHEALTH) limitations (i.e., lack of information), the present study was unable to incorporate adolescent-peer relationships as predictors of adolescent problem behavior.

As children become adolescents and as those adolescents become more mobile, their social space expands beyond the neighborhood in which they live. The present study focuses on formal and informal community social context. The census block group area data (approximately 450 households on average) usually encompassed only the neighborhood in which the study participants live. On the other hand, the school district encompasses relatively large areas with, on average, about 100 block groups. I believe that the social
context influencing adolescents’ behavioral problems is larger than census block group areas and smaller than school districts. Thus, I considered the census tract area (approximately 2,000 communities), which consists of about 10 block groups, on average as the community in my analyses (Jencks & Mayer, 1990).

*The National Longitudinal Study of Adolescent Health (ADDHEALTH)*

According to J. R. Udry (1999), the principal investigator (PI) of the ADDHEALTH project, the mission of the ADDHEALTH project was to survey a nationally representative sample of adolescents regarding the behaviors that affect their current and future health and to make the data of interest and widely available to social, behavioral, and medical researchers. The data included the measures of adolescents’ current mental, physical, emotional, and sexual health status as well as health-affecting behaviors, like exercise, seat belt use, drug, tobacco, and alcohol use; family patterns of illness or disease; and measures of multiple levels of context including family interactions, peer influence, school policies, and access to community services. In many cases, those items or measures were proposed by the funding agencies and modified by the ADDHEALTH team.

ADDHEALTH was funded by Grant P01-HD31921 from the National Institute of Child Health and Human Development to the Carolina Population Center (University of North Carolina at Chapel Hill) with cooperative funding participation by the National Cancer Institute, the National Institute of Alcohol Abuse and Alcoholism, the National Institute on Drug Abuse, among other federal agencies (see Appendix II).

*Attrition Analysis*

Attrition has effects on both external and internal validity of a study. The threat of attrition to the external validity occurs when attrition processes systematically excludes
certain segments of the population to which one wishes to generalize the findings, limiting how broadly the findings may apply. The threat to the internal validity occurs when those who remain in the study are least likely to show changes regardless of the intervention being studied. The threat of attrition to the external validity can be assessed by testing for the mean difference between those who stayed (“stayers”) in the study and those who dropped out (“attriters”; Wickrama et al., 2006). In the current study, the attrition rate for the total sample was 27% across the 6-year period (i.e., 1995–2001). I performed an attrition analysis to determine possible differences between those who stayed in and those who dropped out of the study and analyzed the sample. Table 2 presents mean comparisons between stayers and attriters for problem behavior (Time 1 to Time 3), community variables (i.e., ethnic heterogeneity and community poverty), family adversity variables (i.e., family economic hardship and non-intact two-parent family), individual variables (i.e., gender, African American, Native American, Asian American, and Hispanic), and family social resource variables (parental control, parental knowledge, parent-adolescent relationship and parental warmth).

The attriters’ means for problem behavior Time 1 (i.e., 11.5962) was slightly lower than the stayers’ means at Time 1. On the other hand, stayers’ mean for problem behavior time 2 (i.e., 4.0188) was slightly lower than the attriters’ means at Time 2. However, the differences were not significant. Thus, the stayers’ sample can be adequately used as a representative sample for problem behavior in Wave 1, Wave 2, and Wave 3 (see Table 2).
Table 2

Comparisons in Study Variables in 2001 Between Respondents Who Dropped Out from the Sample (Attriters) and Respondents in the Analyzed Sample (Stayers) with Complete Data

<table>
<thead>
<tr>
<th>Variables</th>
<th>Stayers (N = 15,170) Mean</th>
<th>Attriters (N = 5,500) Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Behavior (Time1)</td>
<td>11.6242**</td>
<td>11.5962*</td>
</tr>
<tr>
<td>Problem Behavior (Time2)</td>
<td>4.0188</td>
<td>4.5459</td>
</tr>
<tr>
<td>Problem Behavior (Time3)</td>
<td>0.0000</td>
<td>2.6820</td>
</tr>
<tr>
<td>Ethnic Heterogeneity</td>
<td>0.3255***</td>
<td>0.3284**</td>
</tr>
<tr>
<td>Community Poverty</td>
<td>1.4957***</td>
<td>1.4954***</td>
</tr>
<tr>
<td>Gender (Being a Male)</td>
<td>0.50100</td>
<td>0.2316</td>
</tr>
<tr>
<td>Family Economic Hardship</td>
<td>0.2740</td>
<td>0.2707</td>
</tr>
<tr>
<td>Non-Intact Two-Parent Family</td>
<td>0.4231</td>
<td>0.4197</td>
</tr>
<tr>
<td>African American</td>
<td>0.2195</td>
<td>0.2230</td>
</tr>
<tr>
<td>Native American</td>
<td>0.0446</td>
<td>0.0431</td>
</tr>
<tr>
<td>Asian American</td>
<td>0.0769</td>
<td>0.0792</td>
</tr>
<tr>
<td>Hispanic American</td>
<td>0.1797</td>
<td>0.1833</td>
</tr>
<tr>
<td>Parental Control</td>
<td>1.5150***</td>
<td>1.5169***</td>
</tr>
<tr>
<td>Parental Knowledge</td>
<td>3.7533*</td>
<td>3.7619*</td>
</tr>
<tr>
<td>Parent-adolescent relationship</td>
<td>1.3921**</td>
<td>1.3929**</td>
</tr>
<tr>
<td>Parental Warmth</td>
<td>19.8779**</td>
<td>19.9111**</td>
</tr>
<tr>
<td>Age</td>
<td>16.1447***</td>
<td>16.1465***</td>
</tr>
</tbody>
</table>

*p < .05  **p < .01  ***p < .001
Missing Data

Missing data is a commonly occurring complication in many scientific investigations (Horton & Lipsitz, 2001) including the current study. Missing data or values means that the data contain various codes to indicate lack of response, such as “Don’t know,” “Refused,” “Unintelligible,” and so on (Schafer & Graham, 2002). There are three basic mechanisms that produce missing data.

**Missing Completely at Random (MCAR)**. This is the probability of a missing response being independent of all measured and unmeasured characteristics of the individuals under study. This situation exists when missing values are randomly distributed across all observations. The missing values are viewed as a simple random sample of all possible data values of the given variables, and it is assumed that no distinguishable difference exists between the cases with incomplete data and those with complete data sets. The set of cases with complete data are considered as a random sub-sample of the original set of observations (Little & Schenker, 1995), and hence no bias is deemed to reside in the results when the incomplete data set is discarded and only the cases with complete data are analyzed (Roth, 1994). MCAR can be confirmed by dividing respondents into those with and without missing data, then using $t$ tests of mean differences on key variables to establish that the two groups do not differ significantly. If data are MCAR, then the researcher may choose list-wise or pair-wise deletion of cases. If data are not MCAR, missing values should be imputed.

**Missing at Random (MAR)**. Missing a substantial amount of data in non-random patterns can cause a gap in the representations between the sample and the intended target population, and it can consequently threaten the validity of the study. MAR occurs when missingness does not depend on the values of the variables being measured, given that the
covariates are controlled (Allison, 2000). When data are MAR, missing values are considered as random samples of all possible values of the variable within each class of the covariate. MAR assumes that the probability of missing data is not related to the variable itself but related to the covariate, which differentiates between non-respondents and respondents. If the underlying relationship between the missing data and the influence variable is identifiable, the pattern of missing data is predictable (Little & Rubin, 1987). For instance, income may be the variable of interest, but often people who have a low education level tend not to report their income. Hence, the missing income values in this case will be MAR because missingness depends partly on the targets’ level of education.

Missing data are frequently deemed missing at random and simply discarded in practice. However, a large sample is one of the factors that increases statistical power (Trochim, 2001), and loss of considerable amounts of data decreases the power and accuracy of the data analysis, causing difficulty in detecting relationships in the data set and consequently influencing the validity of the research, hence producing bias in the analysis results. Alternatively, imputation of values is the best course of action; that is, using methods such as full information maximum likelihood (FIML) and multiple imputation (MI; Collins, 2006).

**Missing Not at Random (MNAR).** MNAR is also known as non-ignorable missingness and it is the most problematic form of missingness. It occurs when the probability of missing data is related to the unobserved value. It also assumes that values from the respondents and non-respondents systematically differ (Little & Rubin, 1987). That means the missing values are not randomly distributed across observations. In addition, the probability of the missingness cannot be predicted from the variables in the model. One approach to non-
ignorable missingness is to impute values based on data otherwise external to the research design (for instance, estimating race based on census block data associated with the address of the respondent).

The Full Maximum Likelihood (FIML) and Multiple Imputation of Missing Data (MI)

The full information maximum likelihood (FIML) and multiple imputation (MI) methods are theory-based approaches to the treatment of missing data, and they are preferred over traditional methods (i.e., list-wise deletion, pair-wise deletion, and mean substitution) that are not theory-based and exclude all cases with missing values or replace them with the mean of observed values. The FIML method uses all of the information in the observed data, including mean and variance for the missing portions of the variables, and assuming multivariate normality and MAR (Wothke, 1998).

SAS multiple imputation (MI) and MIANALYZE procedures, as proposed by Rubin (1987), provide useful strategies for dealing with data sets with missing values (Schafer & Graham, 2002). The procedure preserves the entire distribution of the data set rather than a point estimate (i.e., mean, variances, and standard errors), and thus has an advantage over other methods, in particular compared to the single imputation method (i.e., EM), which underestimates variability among the missing values and the traditional methods (i.e., list-wise deletion, pair-wise deletion, and mean substitution). The present study then assumed MAR and used MI and MIANALYZE procedures according to Rubin’s (1996) three-step process to impute data for missing values. The purpose was to preserve the entire distribution of the data set in 15,170 cases (i.e., stayers) who remained in the study in Wave 3 (see also Figure 2) rather than the entire sample size at Wave 1 ($N = 20,745$). That is, since the attrition analysis provided no evidence for significant differences in study characteristics
between attriters and stayers (see Table 2), I believe that there was no sufficient evidence of biasness due to attrition. Moreover, this is a very large sample; thus, I used the sample of 15,170 who stayed in the study in time 3. I also used SAS multiple imputation (MI) and MIANALYZE procedures to impute data for the missing values in this sample of 15,170 as follows. First, sets of plausible values for missing observations were created to reflect the uncertainty in the non-response model. Each of these sets of plausible values was used to “fill-in” the missing values and create a “completed” data set (i.e., missing data were filled in \( m \) times to generate \( m \) complete data sets). Second, each of these data sets was analyzed using complete-data methods (i.e., the \( m \) complete data sets were analyzed by using standard procedures). Finally, the results were combined, which allowed the uncertainty regarding the imputation to be taken into account (i.e., the results from the \( m \) complete data sets were combined for the inference).

**Non-Normality of Data**

According to Dunlap, Chen, and Greer (1994), skew reduces the test-retest reliability of otherwise normal data, and the greater the skew the greater the decrease in reliability. To address problems of non-normality, traditional approaches have included transformation of observed data (i.e., Table 3).

Since adolescent problem behavior variables were skewed substantially to the right, correcting the skewness problem was necessary. The measures of adolescent problem behavior at Time 1, Time 2, and Time 3, were log transformed and multiplied by 10 (a constant) to enlarge the scale.
Table 3

Common Transformations

<table>
<thead>
<tr>
<th>Transformation</th>
<th>Original Observed Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log_{10}(x)</td>
<td>Positive skew (substantial)</td>
</tr>
<tr>
<td>Log_{10}(x + c)</td>
<td>Positive skew (with zero)</td>
</tr>
<tr>
<td>1/x</td>
<td>Positive skew (severe)</td>
</tr>
</tbody>
</table>

The logarithm function squeezes together big data values (anything larger than 1), and the bigger the data value the more the squeezing. In addition, the logarithm stretches small values apart (i.e., values less than 1). The smaller the values, the more the stretching. This squeezing and stretching can correct skewed data and unequal variation. That is, the log transformation squeezes the groups with larger standard deviations more than it squeezes the groups with smaller standard deviations. This is especially effective when the size of the group’s standard deviation is directly proportional to the size of its mean. Furthermore, transforming skewed data helps in obtaining greater symmetry and thus improves the test-retest reliability of the resulting measure (Dunlap, Chen, & Greer, 1994).

Measures

Adolescent Behavioral Problems. A measure of adolescent problem behavior consisted of a subset of items drawn from the minor delinquency and violent behavior subscale (Fletcher et al., 2004; Wight, Botticello, & Aneshenshel, 2006). Adolescent problem behavior was operationalized as the number of times each adolescent reported engaging in one or more of the following seven negative behaviors: (a) stealing something worth more than $50, (b) deliberately damaging property that didn’t belong to them, (c) going into a
house or building to steal something, (d) threatening to use a weapon to get something from someone, (e) selling marijuana or other drugs, (f) stealing something worth less than $50, and (g) taking part in a fight where a group of their friends were against another group. The items ascertained the frequency of various delinquent activities and physically aggressive activities over the previous 12 months. The seven behavior items were rated on a range of 0 (never) to 3 (5 or more times). Higher scores reflected more problem behavior. These items were used consistently from Wave 1 to Wave 3. Factor analysis and reliability analysis led to the selection of these seven behaviors as being internally consistent with one another (Fletcher et al., 2004). Items were summed and coded such that higher scores reflected higher problem behavior (Cronbach’s alpha for Wave 1 = .65, Wave 2 = .73, and Wave 3 = .65).

Ethnic Heterogeneity. Ethnic heterogeneity was operationalized as the proportion of minority for each census tract, from 1990 U.S. Census data. This is the percentage of non-Caucasians (i.e., African Americans, Asian Americans, Native Americans, and Hispanic Americans) living in the community (Ennett, Flewelling, & Norton, 1997).

Community Poverty. Community poverty was included in the analysis as a control variable. A score representing the community poverty for each adolescent was generated by summing five indicators corresponding to his/her census-tract information from the 1990 U.S. Census (contextual data set): (a) the proportion of families with income that is below poverty level, (b) the proportion of single-parent families, (c) the proportion of adults employed in service occupations, (d) the proportion with households that receive public assistance income, and (e) the proportion of unemployed males. I computed and used census tract-level scores as the concentration of poverty measure for the community (Cronbach’s alpha = .88).
Family Economic Hardship. A measure of family economic hardship was generated by summing five hardship items reported by the respondent-parent. The family economic hardship items asked whether any member of the household received public assistance, social welfare benefits such as Social Security, Supplemental Security Income, Aid to Families with Dependent Children, Food Stamps, and/or any housing subsidy (as adopted from Wickrama & Bryant, 2003). The measure was represented by dichotomized variables coded 1 for “yes” and 0 for “no.” Higher scores in the scale reflected greater economic hardship (KR-20 = .71).

Racial Minority Status. Racial minority status was operationalized as ethnicity, and it was dummy coded 1 for minority (i.e., African American, Asian American, Hispanic American, and Native American) and 0 for non-minority (Caucasian).

Non-Intact Two-Parent Household. Non-intact two-parent household was operationalized as single parent household, and it was represented by a dummy variable coded 1 for single (including never been married, separated, divorced, and widowed) and 0 for non-single. (The analysis does not take into account stepparents because of inadequate information in the data.)

Gender. The gender of adolescents was included in the analysis as a control variable. It was dichotomized with a dummy variable coded 1 for females and 0 for males.

Parent–Adolescent Relationship. A measure of parent-adolescent relationship consisted of a subset of items drawn from the acceptance scale (Wickrama & Bryant, 2003). The three items assessed the relationship in terms of how much (or how often) the parents: (a) got along with the adolescent, (b) made decisions together with the adolescent, and (c) trusted the adolescent. Responses for the three items on the parent-adolescent relationship subscale were measured on a range from 1 (always) to 5 (never). Items were summed and
Parental Knowledge. A measure of parental knowledge consisted of a subset of items that assessed parental participation in adolescents’ activities to enhance their knowledge of adolescents. Specifically, items dealt with adolescents’ whereabouts, how they spent their time, how they did in school, and other activities adolescents were involved in (Fletcher et al., 2004). The scale consisted of 14 items that asked the adolescents to identify things their parents participated in or things they have done together with their parents in the past 4 weeks: “discuss personal problems,” “played a sport,” “talked about school work or grades,” and “attended religious services” (Brown et al., 1993a, 1993b; DeKovic, 1999; Simons et al., 1994). Responses to the 14 items on the parental knowledge subscale were dichotomized, with values coded 0 for “No” and 1 for “Yes.” Items were summed such that higher scores reflected greater parental knowledge and lower scores reflected less parental knowledge (KR-20 = .72).

Parental Control. Parental control was conceptualized as the extent to which decisions regarding a key set of areas of adolescents’ lives were made by parents or parents in collaboration with adolescents, instead of by adolescents themselves (adopted from Fletcher et al., 2004). Items asked adolescents whether they made their own decisions about: (a) the time they must be home on a weekend night, (b) the people they hang around with, (c) what they wear, (d) how much television they watch, (e) the television programs they watch, (f) what time they go to bed, and (g) what they eat. The response to each of the seven items on the parental control subscale was a dichotomized measure with values coded 0 for “No”
and 1 for “Yes.” Items were summed such that higher scores reflected less parental control and lower scores reflected higher parental control (KR-20 = .63).

**Parental Warmth.** A measure of parental warmth consisted of a subset of items drawn from the nurturant/involved parenting scale (Wickrama & Bryant, 2003). The scale assessed the quality of both mother’s and father’s parenting (separately) as reported by the adolescent. More specifically, the scale assessed parental love, warmth, and overall relationship with the adolescent by summing six items on warmth and caring. These items asked adolescents to indicate whether: (a) parents are warm and loving towards him/her, (b) he/she has a good relationship with parents, and (c) he/she has a good communication with parents. The ratings for all items for both mother and father were summed to create a score for parental warmth. The items each were rated on a range from 1 (strongly agree) to 5 (strongly disagree). The items were coded such that lower scores indicated greater parental warmth (Cronbach’s alpha = .85).

**Age.** Age was included in the analysis as a control variable. The adolescents’ age ranged from 13 to 19 years at the initial level (Time 1).

**Analytical Procedure**

Using multilevel models, the present research examined the influence of individual-, family-, and community-level predictors on the individual-level outcome variable of adolescent problem behavior. Data analysis was conducted as follows: (a) running descriptive statistics to determine the mean, standard deviation, minimum, and maximum for all of the study variables (Table 4); (b) estimating a correlation matrix to determine the relationships between all study variables and to identify predictors that have the highest or the lowest bivariate correlation with adolescent problem behavior (Table 5); (c) estimating
the multilevel models using the SAS PROC MIXED procedure; that is, running growth curve models (GC) with PROC MIXED (i.e., reporting means and variances of the initial level and slope, as well as the covariances between intercept and slope); (d) adding all predictors (i.e., stepwise; Model 2 = community factors; Model 3 = family adversity factors; Model 4 = individual factors; Model 5 = family social resources factors; and Model 6 = interactions) and reporting means and variances of the initial level and slope, as well as covariances between intercept and slope); and (e) identifying significant interaction variables to determine the dissipation or intensification of the influence of the significant variables on adolescent problem behavior.

The SAS PROC MIXED procedure was used because of the nested nature of the data, with individuals and families nested within communities; therefore, individual error terms may be correlated within communities, and ordinary least square estimates (standard errors in particular) may be biased. The PROC MIXED procedure permits efficient estimation for a much wider range of applications by posing hypotheses about relations occurring at each level and across levels and assesses the amount of variation at each level (Bryk & Raudenbush, 1992). SAS PROC MIXED uses restricted maximum likelihood estimates to estimate regression coefficients, as well as individual-level and cluster-level error variances. The output from SAS PROC MIXED presented several goodness-of-fit statistics. The indices can be used to evaluate this model and to compare it with other (nested) models. In addition, it indicates the number of observations, the actual REML log-likelihood, -2RLL, Akaike’s information criterion (AIC), and Schwart’s Bayesian Criterion (BIC; Singer & Willet, 2003). The indices are computed based on the log-likelihood penalized for estimated number of parameters; the smaller the index’s value, the better the model fit.
Growth curve analysis was used in PROC MIXED to examine the absolute and relative stability of problem behavior (see right-hand side of box in Figure 1 and illustrated in Figure 2). The focus is on adequately and parsimoniously modeling individual differences in growth; that is, identifying the statistical model that best describes growth of problem behavior using 3 time points. A 2-factor growth model (GM) is used to examine growth of problem behavior. The first factor (intercept factor—π₀) describes the initial level of problem behavior (intercept mean) and individual differences in the initial level (intercept variance).

Figure 2. Specification of problem behavior growth parameter-univariate growth curve (not a latent model).
The intercept is a constant for any given individual across times; therefore, the factor loadings for problem behavior measures are set at 1 for each Wave. The second factor in GM (the *slope factor*–\(\pi_1\)) describes the rate of change (slope mean) and individual differences in growth patterns (slope variance). Factor loading for a linear slope is fixed proportionately to time intervals.

\[
P_{Bi_t} = \pi_{0i} + \pi_{01} \text{(time)} + e_{it} \tag{1}
\]

Individual trajectories (Level–\(\pi_0\); and rate of change–\(\pi_1\)) are expected to be different from individual to individual. For a sample of \(n\) individuals, there will be as many as \(n\) different rates of change over time and \(n\) different levels over time. Although each individual trajectory varies in level and rate of change, they can be aggregated so that, for the whole sample, there is an average level (mean of \(\pi_0\)) with a variance, and an average rate of change (mean of \(\pi_1\)) also with a variance (Wickrama et al., 2002). These variances are explained by the proposed predictors as shown in Figure 3 and 4. Thus, *the second-level equations* (2A and 2B) can be written as:

\[
\begin{align*}
\pi_{0i} &= \gamma_{00} + \gamma_{01}(\text{Ehet}) + \gamma_{02}(\text{Pminority}) + \gamma_{03}(\text{Fahard}) + \gamma_{04}(\text{Single}) + \gamma_{05}(\text{African}) + \\
&\hspace{1em} \gamma_{06}(\text{Native}) + \gamma_{07}(\text{Asian}) + \gamma_{08}(\text{Hispanic}) + \gamma_{09}(\text{Gender}) + \gamma_{10}(\text{Pcont}) + \\
&\hspace{1em} \gamma_{10}(\text{Pknow}) + \gamma_{11}(\text{Pwarmth}) + \gamma_{12}(\text{Prelat}) + U_{0i} + U_{01} \tag{2A} \\
\pi_{1i} &= \gamma_{10} + \gamma_{11}(\text{Ehet}) + \gamma_{12}(\text{Pminority}) + \gamma_{13}(\text{Fahard}) + \gamma_{14}(\text{Singles}) + \gamma_{15}(\text{African}) + \\
&\hspace{1em} \gamma_{16}(\text{Native}) + \gamma_{17}(\text{Asian}) + \gamma_{18}(\text{Hispanic}) + \gamma_{19}(\text{Gender}) + \gamma_{20}(\text{Pcont}) + \\
&\hspace{1em} \gamma_{21}(\text{Pknow}) + \gamma_{22}(\text{Pwarmth}) + \gamma_{23}(\text{Prelat}) + U_{1i} \tag{2B}
\end{align*}
\]

*The combined equation* is:

\[
P_{Bi_t} = \gamma_{00} + \gamma_{01}(\text{Ehet}) + \gamma_{02}(\text{Cpoverty}) + \gamma_{02}(\text{Fadve}) + \gamma_{03}(\text{Singlepa}) + \gamma_{04}(\text{African}) + \\
\gamma_{05}(\text{Native}) + \gamma_{06}(\text{Asian}) + \gamma_{07}(\text{Hispanic}) + \gamma_{08}(\text{Gender}) + \gamma_{09}(\text{Pcont}) + \\
\gamma_{10}(\text{Pknow}) + \gamma_{11}(\text{Pwarmth}) + \gamma_{12}(\text{Prelat}) + U_{1i} \tag{2C}
\]
\[ \gamma_{010}(P_{\text{know}}) + \gamma_{011}(P_{\text{warmth}}) + \gamma_{012}(P_{\text{rel}}) + \gamma_{10}(\text{time}) + \gamma_{11}(\text{Ehet*Time}) + \gamma_{12}(\text{Cpoverty*Time}) + \gamma_{13}(\text{Fadve*Time}) + \gamma_{14}(\text{Singlepa*Time}) + \gamma_{15}(\text{African*Time}) + \gamma_{16}(\text{Native*Time}) + \gamma_{17}(\text{Asian*Time}) + \gamma_{18}(\text{Hispanic*Time}) + \gamma_{19}(\text{Pknow*Time}) + \gamma_{20}(\text{Pwarmth*Time}) + \gamma_{21}(\text{Prelat*Time}) + U_{0i} + U_{1i} \times \text{Time} + U_{1i} \]

Figure 3. Additive and multiplicative influences of multilevel risk and resources on problem behavior growth parameters.
Figure 4. Detailed additive and multiplicative influences of multilevel risk and resources on problem behavior growth parameters.
Age

Irrespective of the individual’s age, my initial findings suggest that there seems to be a general trend in the decrease of adolescent problem behavior over time from Wave1 (1995) to Wave3 (2001; see Figure 5). Figure 5 indicates that the 15 years olds have the highest incidences of problem behavior at Time 1 ($M = 1.208$) and at the same time point, the 14 year olds have the lowest incidences of problem behavior ($M = 1.076$). At time 2, the 14 year olds have the highest incidences of problem behavior ($M = 1.062$), whereas the 20 year olds score the lowest in terms of problem behavior ($M = 0.903$). The same cohort (i.e., 20 year olds), who turn 25 years at Time 3, remain with the lowest incidences of problem behavior ($M = 0.491$), whereas at the same time point, those who turn 24 years old have the highest incidences of problem behavior ($M = 0.586$). The 15 and 19 year old adolescents show the steepest decline in adolescent problem behavior from Wave 1 (1995) to Wave 3 (2001). The 17 and 18 year old adolescents show the lowest decline in adolescent problem behavior from Wave 1 (1995) to Wave 3 (2001).

Age differences however, seem not to play a significant role in terms of adolescent problem behavior change as indicated in Figure 5 (i.e., also indicated in the correlation Table 5, and in the multilevel models Table 6). Time differences on the other hand, seem to play a greater role in terms of problem behavior change. That is, data show that adolescents’ problem behaviors change with time, regardless of age. Thus, the present study, using growth curve analysis, will focus on problem behavior changes within three time points (i.e., 1995, 1996, and 2001).
Figure 5. Change in the mean of APB among different cohorts from 1995 to 2001.
Means, standard deviations, minimum, maximum, and skewness of all study variables are shown in Table 4. Skewness values for the study variables lie between –2 and +2 indicating acceptable distributions for all (continuous) variables. The average mean level of problem behavior [multiplied by 10 (constant to enlarge the scale); time1 = 11.62, time2 = 4.02, and time3 = 2.68] also indicates a decrease with time.

Table 4

*Descriptive Statistics of Study Variables (N = 15,170)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Skewness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Behavior (Time1)</td>
<td>11.62</td>
<td>5.13</td>
<td>6.93</td>
<td>29.44</td>
<td>0.92</td>
</tr>
<tr>
<td>Problem Behavior (Time2)</td>
<td>4.02</td>
<td>6.48</td>
<td>0.00</td>
<td>30.91</td>
<td>1.35</td>
</tr>
<tr>
<td>Problem Behavior (Time3)</td>
<td>2.68</td>
<td>5.41</td>
<td>0.00</td>
<td>30.91</td>
<td>2.00</td>
</tr>
<tr>
<td>Ethnic Heterogeneity</td>
<td>0.33</td>
<td>0.27</td>
<td>0.00</td>
<td>0.93</td>
<td>0.47</td>
</tr>
<tr>
<td>Community Poverty</td>
<td>1.50</td>
<td>0.07</td>
<td>0.00</td>
<td>2.59</td>
<td>-1.93</td>
</tr>
<tr>
<td>Gender (Being a Male)</td>
<td>0.50</td>
<td>0.42</td>
<td>0.00</td>
<td>1.00</td>
<td>1.28</td>
</tr>
<tr>
<td>Family Economic Hardship</td>
<td>0.27</td>
<td>0.49</td>
<td>0.00</td>
<td>1.95</td>
<td>1.54</td>
</tr>
<tr>
<td>Non-Intact Two-Parent Family</td>
<td>0.42</td>
<td>0.49</td>
<td>0.00</td>
<td>1.00</td>
<td>0.31</td>
</tr>
<tr>
<td>African American</td>
<td>0.22</td>
<td>0.42</td>
<td>0.00</td>
<td>1.00</td>
<td>1.33</td>
</tr>
<tr>
<td>Native American</td>
<td>0.04</td>
<td>0.20</td>
<td>0.00</td>
<td>1.00</td>
<td>4.50</td>
</tr>
<tr>
<td>Asian American</td>
<td>0.08</td>
<td>0.27</td>
<td>0.00</td>
<td>1.00</td>
<td>3.15</td>
</tr>
<tr>
<td>Hispanic American</td>
<td>0.18</td>
<td>0.39</td>
<td>0.00</td>
<td>1.00</td>
<td>1.64</td>
</tr>
<tr>
<td>Parental Control</td>
<td>1.52</td>
<td>0.31</td>
<td>1.10</td>
<td>2.30</td>
<td>0.30</td>
</tr>
<tr>
<td>Parental Knowledge</td>
<td>3.75</td>
<td>2.61</td>
<td>0.00</td>
<td>14.00</td>
<td>0.79</td>
</tr>
<tr>
<td>Parent-adolescent relationship</td>
<td>1.39</td>
<td>0.49</td>
<td>0.00</td>
<td>2.20</td>
<td>-1.28</td>
</tr>
<tr>
<td>Parental Warmth</td>
<td>19.88</td>
<td>6.94</td>
<td>3.00</td>
<td>30.00</td>
<td>-0.21</td>
</tr>
<tr>
<td>Age</td>
<td>16.14</td>
<td>1.70</td>
<td>13.00</td>
<td>19.00</td>
<td>-0.21</td>
</tr>
</tbody>
</table>
Table 5 shows zero-order correlations among all the study variables. The analytical results found that adolescent problem behaviors were significantly correlated among themselves from Time 1 to Time 3 ($p < .01$). That is, problem behavior at Time 1 was correlated with problem behavior at Time 2 ($p < .001$) and problem behavior at Time 3 ($p < .01$). In addition, problem behavior at Time 2 was correlated with problem behavior at Time 3 ($p < .001$). Furthermore, community adversity (community poverty and ethnic heterogeneity), family adversity (family economic hardship and non-intact two-parent family), family social resources (parental control, parent-adolescent relationship, parental knowledge, and parental warmth), and the control variables (being a male, being an African American, being a Native American, and being an Hispanic American) were all significantly correlated with adolescent problem behavior at Time 1 as to the expected direction ($p < .05$) to ($p < .001$). However, they were not correlated with problem behavior at Time 2 and at Time 3 (except for being a Native American; $p < .01$), suggesting diminishing influences of community, family, and individual-level variables on adolescent problem behavior over time.

The zero-order correlation between community poverty and ethnic diversity was $r = .50$. This moderately high correlation is evidence that the two items correlate differently. That is, community poverty and ethnic diversity can be treated as distinct community characteristics. Similarly, family warmth and being in a non-intact two-parent family (i.e., single parenthood) were also significantly correlated ($r = -.56$). However, community poverty and parental control were the highest correlated variables ($r = -.77$), indicating community influence on parenting predictors. In addition, community poverty and family economic hardship were positively and significantly correlated with all race/ethnicities of minority
Table 5

Zero-order Correlation Among Study Variables (N = 20,745)

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PBT1</td>
<td>--</td>
<td>.070***</td>
<td>.021**</td>
<td>.032***</td>
<td>.019**</td>
<td>.028***</td>
<td>.040***</td>
<td>.020**</td>
<td>.047***</td>
<td>.001</td>
<td>.041***</td>
<td>.016*</td>
<td>-.043***</td>
<td>-.173***</td>
<td>-.058***</td>
<td>-.128***</td>
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<td>2. PBT2</td>
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<td>.236***</td>
<td>.001</td>
<td>-.012</td>
<td>.003</td>
<td>-.007</td>
<td>.002</td>
<td>.020**</td>
<td>.004</td>
<td>.015</td>
<td>-.005</td>
<td>.001</td>
<td>.012</td>
<td>-.001</td>
<td>.013</td>
<td></td>
</tr>
<tr>
<td>3. PBT3</td>
<td>---</td>
<td>-.008</td>
<td>-.004</td>
<td>.011</td>
<td>-.011</td>
<td>.015</td>
<td>-.009</td>
<td>-.005</td>
<td>.005</td>
<td>-.008</td>
<td>.012</td>
<td>.001</td>
<td>.003</td>
<td>.010</td>
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<td></td>
</tr>
<tr>
<td>4. Ethnic</td>
<td>---</td>
<td>.501***</td>
<td>.120***</td>
<td>.129***</td>
<td>.218***</td>
<td>.060***</td>
<td>.260*</td>
<td>.299***</td>
<td>.095***</td>
<td>-.081***</td>
<td>-.039***</td>
<td>-.099***</td>
<td>-.094***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Poverty</td>
<td>---</td>
<td>.339***</td>
<td>.209***</td>
<td>.415***</td>
<td>.045***</td>
<td>-.098***</td>
<td>.081***</td>
<td>.018**</td>
<td>-.77***</td>
<td>-.019**</td>
<td>-.140***</td>
<td>-.187***</td>
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<tr>
<td>6. Hardship.</td>
<td>---</td>
<td>.355***</td>
<td>.212***</td>
<td>.034***</td>
<td>-.057***</td>
<td>.062***</td>
<td>-.026**</td>
<td>-.053***</td>
<td>-.046***</td>
<td>-.159***</td>
<td>-.278***</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>7. Single</td>
<td>---</td>
<td>.237***</td>
<td>.006</td>
<td>.020**</td>
<td>.020**</td>
<td>.424***</td>
<td>-.032***</td>
<td>-.053***</td>
<td>-.238***</td>
<td>-.561***</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8. African</td>
<td>---</td>
<td>-.008</td>
<td>-.141***</td>
<td>-.204***</td>
<td>.012</td>
<td>.046***</td>
<td>-.028***</td>
<td>-.110***</td>
<td>-.209***</td>
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<tr>
<td>9. Indian</td>
<td>---</td>
<td>-.036***</td>
<td>.053***</td>
<td>.017**</td>
<td>.008</td>
<td>-.004</td>
<td>-.009</td>
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<tr>
<td>10. Asian</td>
<td>---</td>
<td>-.089***</td>
<td>.129***</td>
<td>.010</td>
<td>.035***</td>
<td>-.024***</td>
<td>-.052***</td>
<td></td>
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</tr>
<tr>
<td>11. Hispanic</td>
<td>---</td>
<td>.025***</td>
<td>.042***</td>
<td>.071***</td>
<td>-.046***</td>
<td>-.030***</td>
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*p < .05. **p < .01. ***p < .001.
groups (African American, Native American, Hispanic American), but negatively and significantly correlated with being an Asian American ($p < .001$).

Community ethnic heterogeneity was positively and significantly correlated with all race/ethnicities of minority groups (i.e., African American, Asian American, Native American, and Hispanic American; $p < .05$ to $p < .001$). In addition, living in a non-intact two-parent family was significantly correlated with all minority racial groups (African American, Native American, Hispanic American; $p < .01$ to $p < .001$), except Asian American. Furthermore, family social resources (parental control, parental knowledge, parent-adolescent relationship, and parental warmth) were negatively and significantly correlated with community adversity (community poverty and community ethnic heterogeneity) and family adversity (family economic hardship and living in a non-intact two-parent family; $p < .01$ to $p < .001$). Family social resources were also significantly correlated with all racial/ethnicities of minority groups ($p < .001$), except Native Americans (see Table 5).

Table 6 is a presentation of the longitudinal data fitted on a three-level individual growth model (repeated measures nested in individual/family and individual/family nested in communities). In this model, the unstandardized regression coefficients predict adolescent problem behavior using three time points (see Table 6).

Model 1 estimates the univariate growth curve (fixed effects and variances) of adolescent problem behavior (with no predictors). In the first year, the average adolescent has a non-zero problem behavior score $\gamma_{00} = 9.204$ ($p \leq .001$). That is the average value of problem behavior (initial status or intercept across all occasions and individual adolescents) when time $= 0$. Rejection of its associated null hypothesis ($p \leq .001$) confirms that on average
Table 6

Results of Fitting a Taxonomy of Multilevel Models for Change to the Problem Behavior Data

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<tr>
<th>Parameter</th>
<th>Model 1</th>
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| Note. -2RLL = Deviance. AIC = Akaike’s information criteria. BIC = Schwart’s Bayesian criterion. Data are from Wave 1 to Wave 3 of the National Longitudinal Study of Adolescent Health. N = 15,170, Communities = 2000. *p < .05. **p < .01. ***p < .001.
adolescent problem behavior is non-zero in the population. Over time, this level declines linearly (on average) at the rate of $\gamma_{00} = 0.97$ per year, or per testing occasion, or per time point ($p \leq .001$), which is the average slope or estimated rate of change across individual adolescents. The variance components for level 1 (within-person, measurement level; temporal variation, $\sigma^2_{\epsilon ij} = 26.251$, $p \leq .001$) and for both initial status and rate of change, level 2 (individual level, $\tau_{00} = 15.156$, $\tau_{11} = .960$, $p \leq .001$) and level 3 (community level, $\tau_{00} = 0.203$, $\tau_{11} = 0.020$, $p \leq .01$) respectively, were statistically significant, indicating that there is inter-individual variation in both the intercepts and slopes at both levels (individual and community). Their variations could potentially be explained by level 2 (individual/family) and level 3 (community) covariates (see variance decomposition in Table 7), suggesting the wisdom of exploring the effects of community, family, and individual-specific predictors.

Model 1 (i.e., univariate growth curve) accounts for 1.3% of the variance between communities in the initial level [i.e., $0.203/(15.156 + 0.203)$], 2.04% of the variance between communities in the rate of change [i.e., $0.020/(0.960 + 0.020)$], 98.68% of the variance

| Table 7. |

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<th>Variance Decomposition for Univariate Growth Curve</th>
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between individuals in the initial level [i.e., 15.156/(15.156 + 0.203)], and 97.96 % of the variance between individuals in the rate of change [i.e., 0.960/(0.960 + 0.020)].

Influence of Community Adversity

Model 2 adds community ethnic heterogeneity and community poverty. The aim, according to the hypothesized model, was to find out the unique effects of community risk factors (i.e., community ethnic heterogeneity and community poverty) on adolescent problem behavior over time. The findings suggest that community poverty has an additive and detrimental effects on adolescent problem behavior \( (B = 1.100, p = .05) \). However, community ethnic heterogeneity was not significantly different from zero. Although previous studies (i.e., Aneshenshel & Succoff, 1996; Duncan et al., 1994; Elliot et al., 1996; Hoffman, 2002; Sampson & Groves, 1989; South & Crowder, 1999) using cross-sectional data may have suggested that community ethnic heterogeneity have an additive influence on adolescent problem behavior, for the first time, this influence is not significant for the multi-ethnic sample. Perhaps this is due to the differential influence of community factors for different race/ethnic groups (Wickrama et al., 2005).

The inclusion of community-level variables in the model reduced the intercept \( \gamma_{00} \) from 9.204 \( (p \leq .001) \) to 7.481 \( (p \leq .001) \). However, the declining rate of change \( \gamma_{10} \) remained the same as in Model 1 at the rate of 0.973 per year, or per testing occasion, or per time point \( (p \leq .001) \), even with the addition of all other subsequent models (i.e., Model 2 to Model 5). The inclusion of community-level variables did not help much in reducing the size of the variance components for the intercept. [That is, comparing these estimates to those from the unconditional Model 1, we see that the initial status \( \tau_{00} \) on both level 2 (individual level, \( \tau_{00} = 15.170, p < .001 \)) and level 3 (community level, \( \tau_{00} = 0.173, p \leq .01 \)) did not change.
significantly. Similarly, the variances of rate of change $\tau_{11}$ on level 2 ($\tau_{11} = 0.960, p \leq .001$) did not change significantly. In addition, an estimate for measurement errors component $\sigma^2$ also did not change significantly ($\sigma^2 = 26.156, p = .001$). However, the inclusion of community variables improved the goodness of fit. That is, there was improvement in the -2RLL statistics from 854294.0 to 853985.5, improvement in Akaike’s information criteria (AIC) from 854308.0 to 853999.5, and improvement in Schwartz’s Bayesian criterion (BIC) from 854345.2 to 854036.7. These indices were computed based on the log-likelihood penalized for estimated number of parameters. The smaller the index’s value, the better the model fit (Singer & Willet, 2003).

*Influence of Family Adversity*

Model 3 adds family adversity variables (i.e., family economic hardship and non-intact two-parent family/or single parenthood). The aim was to find out the unique effects of family adversity variables (family economic hardship and non-intact two-parent family/or single parenthood) on adolescent problem behavior after controlling for the effects of community variables (community ethnic heterogeneity and community poverty). In accordance with previous research, family economic hardship (Lempers et al., 1989; Voydanoff, 1990) and non-intact two-parent family (Demuth & Brown, 2004; Lamborn et al., 1991) had an additive and positive effect on adolescent problem behavior. Consistent with my expectations, both family economic hardship ($B = 0.154, p \leq .01$) and non-intact two-parent family ($B = 0.184, p \leq .01$) were significant. This means that family economic hardship and non-intact two-parent family or single parenthood have an independent linear positive effect on adolescent problem behavior (after controlling for the effects of community poverty and community ethnic heterogeneity). This suggests two different mechanisms
through which family economic hardship and non-intact two-parent family or single parenthood influence adolescent problem behavior. More importantly, the increase in the significance of community poverty in Model 3, probably a suppressed effect, suggests that at the same level of family adversity, one unit increase in community poverty results in an increase of $B = 1.614$ in adolescent problem behavior.

Although the rate of change $\gamma_{10}$ for Model 3 remained the same as the rate of change in Model 2, the inclusion of family adversity variables reduced the intercept $\gamma_{00}$ significantly from 7.481 ($p \leq .001$) in Model 2 to 6.602 ($p \leq .001$) in Model 3. In addition, the variance component’s size for the intercept was reduced. That is, comparing the Model 3 estimates to those of Model 2, we see that the initial status $\tau_{00}$ on both level 2 (individual level, $\tau_{00} = 15.149, p < .001$) and level 3 (community level, $\tau_{00} = 0.174, p < .01$) declined slightly.

Similarly, an estimate for measurement errors component $\sigma^2$ in Model 3 declined slightly ($\sigma^2 = 26.246, p \leq .001$) as compared to Model 2. However, the variances of rate of change $\tau_{11}$ on both level 2 (individual level, $\tau_{11} = 0.960, p \leq .001$) and level 3 (community level, $\tau_{11} = 0.020, p \leq .01$) were significant but did not change from the previous model.

The inclusion of family adversity variables (i.e., family economic hardship and non-intact two-parent family) also improved the goodness of fit. That is, comparing Model 3 to the previous model (i.e., Model 2), there were improvements in the -2RLL statistics from 853985.5 to 853977.0, improvement in AIC from 853999.5 to 853991.0, and improvement in BIC from 854036.7 to 854028.2.

Influence of Individual Characteristics (Race/Ethnicity and Gender)

Model 4 in Table 6 adds individual characteristics (i.e., being African American, being Native American, being Asian American, being Hispanic American, gender, and age)
to determine the unique effects of these variables and whether the observed community adversities (more in particular the community poverty) and family adversities (i.e., family economic hardship and non-intact two-parent family) effects are due to the adversities of the individuals who live in those neighborhoods. Being Hispanic American \( (B = 0.393, p \leq .001) \) was significant. That is, being Hispanic American had an independent linear positive effect on adolescent problem behavior (after controlling for the effects of family and community adversities). This suggests that minority disadvantage cannot be reduced to their lower socioeconomic status. It seems there are minority disadvantages which are not captured by traditional hardship measures.

Also due to individual variables (i.e., being African American, being Native American, being Asian American, being Hispanic American, and gender), the effect of family economic hardship on adolescent problem behavior was substantially reduced from 0.154 to 0.149, and that of non-intact two-parent family completely wiped out (non-significant). That seems to suggest that most of non-intact two-parent families are minorities and when we control for family adversity at the same level with minorities, minority status (i.e., being African American, being Native American, being Asian American) confounds with non-intact two-parent family or single parenthood. In other words, the effect of family adversities over time operates through race/ethnicity variables.

In addition, comparing Model 3 to Model 4, the inclusion of individual variables (i.e., being African American, being Native American, being Asian American, being Hispanic American, gender, and age) in the model reduced the intercept \( \gamma_{00} \) significantly from 6.602 \( (p \leq .001) \) to 6.289 \( (p \leq .001) \). The variance of initial status \( \tau_{00} \) on level 2 (individual level, \( \tau_{00} = 15.136, p < .001 \)) also declined slightly. However, an estimate for measurement errors
component $\sigma^2$ was significant but remained the same as in Model 3 (i.e., $\sigma^2 = 26.246, p = .001$). Similarly, the inclusion of individual variables did not improve the goodness of fit. That is, -2RLL statistics (i.e., 853977.0), AIC (i.e., 853991.0), and BIC (i.e., 854028.2) remained the same as in Model 3.

Influence of Family Social Resources

Model 5 added family social resource variables (i.e., parental control, parent-adolescent relationship, parental knowledge, and parental warmth) to examine their additive effects and also to determine whether adding the constructs would reduce the detrimental effects of the observed community and family/individual effects, more in particular the effects of community poverty, family economic hardship, and being Hispanic. Consistent with my expectations, family social resource variables exerted a significant influence on adolescent problem behavior ($B = -0.329, p \leq .01; B = -0.295, p \leq .001; \text{and } B = -0.018, p \leq .001$; for parental control, parent-adolescent relationship, and parental warmth, respectively), hence have beneficial effects on adolescent problem behavior over time. For instance, the resources reduce the detrimental effects of family economic hardship on adolescent problem behavior from $B = 0.149$ to $B = 0.135$. This suggests that the influence of family adversity partly operates through family social resources (Wickrama & Bryant, 2003).

The effect of family social resources is also consistent with previous findings, where family social resources such as parental control, parent-child relationship, and parental warmth are associated negatively with adolescent problem behavior (Buehler, 2006; Crouter & Head, 2002; Fletcher et al., 2004; Geisman & Wood, 1986; Patterson, 1992; Smith & Krohn, 1995; Stattin & Kerr, 2000). In addition, after controlling for the effects of family social resources, gender seems to be significant ($B = 0.199, p < .05$, or consistent with
previous research findings of Smith & Krohn, 1995). This suggests that, at the same level with family social resources, being an adolescent male rather than female result in 0.199 increases in adolescent problem behavior.

Furthermore, the inclusion of family social resource variables (i.e., parental control, parent-adolescent relationship, and parental warmth) in the model shows the greatest improvement in the linear model. Besides the slight decline of an estimate for measurement errors component $\sigma^2$ from 26.246 ($p < .001$) to 26.244 ($p < .001$), we also see a decline in variance of the initial status $\tau_{00}$ of both level 2 ($\tau_{00} = 14.981, p < .001$) and level 3 ($\tau_{00} = 0.161, p = < .01$) of the variance components. Overall, comparing the estimates in Model 5 to those in Model 4, the inclusion of family resource variables (parental control, parent-adolescent relationship, and parental warmth) helped in improving the goodness of fit. Thus, when comparing Model 4 to Model 5, there was improvement in Model 5’s -2RLL statistics from 853977.0 to 853938.1, AIC from 853991.0 to 853952.1, and BIC from 854028.2 to 853989.3.

**Multiplicative Influences**

First I tested interaction terms between time and all the independent variables (i.e., community, family, and individual variables), community poverty and all other independent variables (i.e., ethnic heterogeneity, family and individual variables), and community ethnic heterogeneity and all other independent variables (i.e., family and individual variables). These interaction terms were tested individually or each separately to ensure that there was co-linearity effect due to “time.” I then kept only the interaction terms that were significant or marginally significant, which were re-tested together and the results were essentially the same (see Model 6).
The interaction terms between time and family level factors (i.e., parent-adolescent relationship and parental warmth) was done to see whether the influences of these predictors on adolescent problem behavior changes over time. Tested separately, the interaction effects between time and parent-adolescent relationship ($B = 0.110, p \leq .001$) and time and parental warmth ($B = 0.008, p \leq .001$) were significant. When re-tested together in Model 6 with other predictors in the Model, the interaction effects between time and parent-adolescent-relationship ($B = 0.098, p \leq .001$) and time and parental warmth ($B = 0.008, p \leq .001$) were still significant, suggesting that although there is a general trend in the decrease of adolescent problem behavior over time, the rate of decrease in the slope is conditioned by the level of family social resources. The interaction terms between time and other family social resources (i.e., parental knowledge and parental control) were not significant even after being tested separately. In addition, the interaction terms between time and both family adversity (i.e., family economic hardship and non-intact two-parent family) and community adversity variables (i.e., community ethnic heterogeneity and community poverty) were not significant either, even after being tested separately, except for the interaction terms between time and community poverty. The interaction between time and community poverty ($B = .367, p \leq .05$) was significant when tested separately, and marginally significant ($B = -0.302, p \leq .05$) when put together with other predictors in the same model (i.e., Model 6). Furthermore, the interaction terms between community variables (i.e., community poverty and community ethnic heterogeneity) and family variables (i.e., family adversity and family social resources) and between community variables and individual variables (i.e., being African American, being Asian American, being Hispanic American, gender, and age) were not significant even after being tested separately. The only exception was the interaction terms between
community ethnic heterogeneity and parent-adolescent relationship, which was significant when tested separately ($B = .396, p \leq .05$), but not significant when included in the same model (i.e., Model 6) with other predictors. Also significant was the interaction terms between time and being an African American ($B = .069, p \leq .05$) and between time and being a Native American ($B = -0.161, p \leq .01$) tested separately. The re-test was still significant for the interaction terms between time and being an African American ($B = .096, p \leq .001$) and between time and being a Native American ($B = -0.164, p \leq .01$) when other predictors are added in the model (i.e., Model 6). The findings suggest that the level and the rate of change in adolescent problem behavior over time are also conditioned by race, such as being an African American or being a Native American, but not Asian American, or Hispanic American. Furthermore, this study separately tested the three way interaction between time, community variables (ethnic heterogeneity and community poverty), and family variables (family economic hardship and non-intact two-parent household), or individual variables (i.e., race, gender, and age); however, none of the interaction terms were found to be significant.

The inclusion of the interaction terms in Model 6 indicates a decrease in the variances of level 2 (individual level) and level 3 (community level). For instance, we see a significant decline in the initial status $\tau_{00}$ of both level 2 (individual level, $\tau_{00} = 14.932, p < .001$) and level 3 (community level, $\tau_{00} = 0.143, p \leq .05$) of the variance components. We also see a slight decline in the rate of change for level 2 (individual, $\tau_{11} = 0.951, p < .001$) and level 3 (community, $\tau_{11} = 0.018, p < .01$). Furthermore, comparing Model 6 to Model 5, there was improvement in Model 6’s -$2\text{RLL}$ statistics from 853938.1 to 853898.3, AIC from 853952.1 to 853912.3, and BIC from 853989.3 to 853949.5.
Although findings from Model 4 to Model 6 suggest a general trend in the decrease of adolescent problem behavior over time regardless of age, Model 7 represent the most parsimonious model after removing the non-significant predictors including age, non-intact two-parent household, parental knowledge, and being Asian American. Model 7 therefore includes predictors that have significant main effects or interaction effects. The findings from Model 7 indicate that interaction between parent-adolescent relationship and community ethnic heterogeneity was positive, significant ($B = 0.434, p \leq .05$), and consistent with my prediction that the influence of parent-adolescent relationship on adolescent problem behavior is conditioned by community ethnic heterogeneity. However, the influence of parent-adolescent relationship is more beneficial (effective) to adolescents who live in low ethnic heterogeneous communities and less beneficial (less effective) to those who live in high ethnic heterogeneous communities in terms of declines in adolescent problem behavior over time (not in terms of level of problem behavior). This interaction can be interpreted as a moderation of beneficial effects of parent-adolescent relationship on adolescent problem behavior by the level of community ethnic heterogeneity. That is, under high ethnic heterogeneous conditions, the beneficial influence of parent-adolescent relationship becomes less beneficial, or dissipates (see Figure 6).

Besides the interaction terms between parent-adolescent relationship and community ethnic heterogeneity, Model 7 also added (separately) interaction terms between time and family level factors (i.e., parent-adolescent relationship and parental warmth) to see whether the influences of these predictors on adolescent problem behavior change over time. All the interaction effects between the family level factors (i.e., parent-adolescent relationship and parental warmth) and time were positive and significant; that is, time and parent adolescent
Figure 6. The influence of parent-adolescent relationship on adolescent problem behavior as conditioned by the level of ethnic heterogeneity (the dissipation of the influence of parent-adolescent relationship on adolescent problem behavior at a high ethnic heterogeneous condition).

relationship ($B = 0.099, p \leq .001$) and time and parental warmth ($B = 0.008, p \leq .001$). These findings suggest that although there is a general trend in the decrease of adolescent problem behavior over time, the rate of decrease in the slope is conditioned by the level of family social resources. It seems that the rate of decrease in adolescent problem behavior is faster under a poor parent-child relationship, but also may be interpreted as a faster recovery. That is, although consistent with previous findings that parenting style dimensions are associated with adolescent problem behaviors (Aunola & Nurmi, 2005), these associations are different
for different growth parameters (level and slope). It seems that parents who have a good relationship with their adolescents and are warm towards them are able to keep adolescent problem behavior trajectories at a lower level compared to parents who don’t have a good relationship with the adolescents and rarely show warmth toward them (Fletcher et al., 2004; Hawkins et al., 1992; Patterson, 1982; Stattin & Kerr, 2000). However, the positive interactions between family social resources and time in the current study yield unique findings because we find a greater rate of decrease (i.e., recovery, especially between Time 1 and Time 2) in problem behavior over time among adolescents who launch their higher level of problem behavior trajectories, and at the same time have weaker relationship with their parents. On the other hand, their counterparts who begin their adolescent years with lower-level problem behavior trajectories and at the same time have a strong relationship with their parents, seem to have a lower rate of decrease in problem behavior over time although they consistently maintain lower levels of problem behavior overtime. These findings suggest that although high parent-adolescent relationships have a strong influence on the level of adolescent problem behavior trajectories during early adolescence, its influence diminishes over time and seems to be weaker during late adolescence. Therefore, there seems to be equalization or convergence of slope for adolescents who start with fewer problems \((M = 6.85)\) and those who start with more problems during early adolescence \((M = 7.17)\); see Figure 7.

The interaction between parental warmth and time also seems to yield similar results. That is, there is a greater rate of decrease in problem behavior for adolescents who begin their adolescent years with a high level of problem behavior and at the same time live with
Figure 7. The level and the rate of change in adolescent problem behavior over time as conditioned by family social resources (diminishing effects of parent-adolescent relationship over time, or recovering from adolescent problem behavior under low parent-adolescent relationship).

slope or rate of change for adolescents who begin adolescence with a low level of problem behavior and have parents who show greater love, warmth, and affection.

This interaction suggests that the beneficial influence of parental warmth decreases over time and seems to be weaker during late adolescence; hence, there is equalization or convergence of slope for adolescents who start with fewer problems ($M = 6.72$) and those who start with more problems ($M = 7.10$) during early adolescence (see Figure 8).
Figure 8. The level and the rate of change in adolescent problem behavior over time as conditioned by family social resources (diminishing effects of parental warmth over time, or recovering from adolescent problem behavior under low parental warmth).

Also added in Model 7 are the interaction terms for time and community poverty. This interaction effect was significant ($B = -0.363, p \leq .05$). The parameter estimate of -0.363 indicates that individual adolescents who differ by 1.0 with respect to community poverty have a growth rate that differs by -0.363. That is, with a one unit increase in community poverty, there is a 0.38 decrease in time for change in adolescent problem behavior. Thus, under high community poverty, the rate of change for adolescent problem behavior decreases at a faster rate compared to the decrease in the rate of change under low community poverty.
That means adolescents who live in the very poor neighborhoods drop the problem behavior faster compared to their counterparts who live in affluent neighborhoods (see Figure 9).

Therefore, there seems to be a diminishing effect of community poverty over time, but at a slower rate for adolescents in affluent neighborhoods compared to those in poor neighborhoods, again suggesting equalization or convergence of slope for adolescents who start with fewer problems (i.e., $M = 6.91$) and those who start with more problems (i.e., $M = 7.09$) during early adolescence.

**Figure 9.** The level and the rate of change in adolescent problem behavior over time as conditioned by the level of community poverty (diminishing effects of community poverty over time, or recovering from adolescent problem behavior under high community poverty).
Also added in Model 7 are the interaction terms between time and being an African American ($B = .073, p \leq .05$) and between time and being a Native American ($B = -0.189, p \leq .001$). The two are significant and the findings suggest that the level and the rate of change in adolescent problem behavior over time are also conditioned by race. That is, being a minority (i.e., African American) seems to have a detrimental effect on both level and slope of adolescent problem behavior trajectories (double jeopardy). For example, the general trend seems to suggest that there is a decrease of problem behavior over time; however, the decrease is slower for minority groups (i.e., African American; see Figure 10) as compared to the Caucasians.

These findings are consistent with previous research (Carroll, 1998; Meyer, 1995) that problem behavior is higher among the minority groups than among the Caucasians and maintains the same trend over to adult years. Although Native Americans have the highest initial level of problem behavior, their rate of change in problem behaviors seems faster compared to African Americans, who start at a lower level compared to the Native Americans and finish up at the top of all the ethnic groups with problem behavior stabilized between 1995 and 2001 (i.e., mean = 6.94). Overall, problem behavior among the Caucasian, Native Americans, and Hispanic Americans seems to decrease faster, especially between Time 1 and Time 2, as compared to the problem behavior decrease among African Americans or Asian Americans. Caucasians seems to have the lowest rate of problem behavior.

The inclusion of the interaction terms in Model 7 also indicates a decrease in the variances of level 2 (individual level) and level 3 (community level). For instance, we see a
significant decline in the initial status $\tau_{00}$ of both level 2 (individual level, $\tau_{00} = 14.808, p < .001$) and level 3 (community level, $\tau_{00} = 0.121, p \leq .05$) of the variance components. However, there is no much difference in the rate of change for level 2 (individual, $\tau_{11} = 0.956, p < .001$) and level 3 (community, $\tau_{11} = 0.009, p < .05$).

Figure 10. The level and the rate of change in adolescent problem behavior over time as conditioned by race.
Finally, comparing the variance components between Model 1 and Model 7 at level 2 (individual level), there is a 2.30% change in the variance of the initial level (intercept), $\tau_{00}$ [i.e., $(15.156-14.808)/15.156$] and a 0.42% change in the variance of the rate of change (slope), $\tau_{11}$ [i.e., $(0.960-0.956)/0.960$]. Similarly at level 3 (community level), there is a 40.39% change in the variance of the initial level (slope) $\tau_{00}$ [i.e., $(0.203-0.121)/0.203$] and a 55% change in the variance of the rate of change (slope), $\tau_{11}$ [i.e., $(0.020-0.009)/0.020$].

Overall, comparing the estimates in Model 7 to the rest of the models, the inclusion of interaction terms helped in improving the goodness of fit of Model 7. That is, comparing Model 7 to Model 6, for instance, there was improvement in Model 7’s -2RLL statistics from 853898.3 to 853465.7, AIC from 853912.3 to 853479.7, and BIC from 853949.5 to 853516.9. This suggests that more elaborate models with additional parameters fit better than the corresponding reduced model (Little, Miliken, Stroup, & Wolfinger, 1996), hence Model 7 is the most parsimonious model.
CHAPTER 5: CONCLUSION

Although a considerable body of empirical research has established the importance of family context, in particular the role of parenting influencing adolescent problem behavior (Patterson, 1992), few studies have examined the unique influences of family and community factors and their multiplicative influences on adolescent problem behavior (Simons et al., 2002). (In other words, no study has examined the unique influences of these multilevel factors on adolescent problem behavior trajectories.) The aim of this study was to unravel these complex multilevel processes by using multilevel risk and resources or protective factors, additively and multiplicatively, to assess multilevel influences on adolescent problem behavior trajectories through cross-level processes, and more specifically, to assess race/ethnic and gender differences in problem behavior over time.

The findings of the study generally supported the hypothesized model, which highlighted the various ways individual, family, and community characteristics influence adolescent problem behavior over time. According to the findings, there was an association between community level variables (community ethnic heterogeneity and community poverty) and adolescent problem behavior over time. Also as expected, community adversity (i.e., community poverty, net of the influence of family adversity), family adversities (i.e., family economic hardship, and non-intact two-parent family, net of the influence of community adversity), minority characteristics (i.e., being Hispanic and male, net of the influence of family and community factors), and family social resources (i.e., parental control, parent-adolescent relationship, and parental warmth) had significant influences on adolescent problem behavior over time.
In addition, and as expected, the study revealed that family adversities (family economic hardship and non-intact two-parent family) have linear and detrimental effects on adolescent problem behavior. However, and more importantly, the study revealed that the effects of family adversities over time operate through race/ethnicity variables. This is due to the fact that minority status, particularly in this data, confounds (i.e., collinear) with family adversity variables (i.e., family economic hardship and non-intact two-parent family).

Furthermore, the research demonstrates the beneficial effects of family social resources (i.e., parent-adolescent relationship, parental warmth, and parental control) on adolescent problem behavior over time. Some of these associations may not have been seen in the bivariate correlation. This may be attributed to the suppression by other variables (Wickrama & Bryant, 2003). However, the multiplicative effects unraveled the significance of such individual, family, and community variables. For example, analyses mainly from the interaction terms demonstrate the dissipation of the influence of parent-adolescent relationship on adolescent problem behavior at a high ethnic heterogeneous condition. In other words, the beneficial effects of family social resources are less pronounced under high ethnic heterogeneous conditions; or the parent-adolescent relationship may act as a buffering effect against adolescent problem behavior only in less diverse communities, but it may not be very effective as a protective factor against youth problem behavior in a more diverse community, even though the availability of family social resources in those communities may be comparable to those in less adverse communities. Theoretically, it implies that exposure to positive role models, as suggested in social learning theory and strong social bonds between family members as suggested in social bonding theory, are normative
processes that may not operate in certain conditions or as expected within an environment where social order does not exist.

In addition, the multiplicative effects demonstrate that the level and the rate of change in adolescent problem behavior over time are conditioned by race (i.e., being an African American and being a Native American). This is a very important finding and consistent with my prediction that there would be race/ethnic differences in adolescent problem behavior over time. Furthermore, the study revealed that the rate of change in problem behavior over time for minorities (except the Native American) is slower as compared to non-minorities, resulting chronically in high levels of problem behavior. It seems there are structural constraints or selection effects (i.e., minority status) operating as a risk factor among minority adolescents, keeping their anti-social lifestyle, or even nudging them to criminal behaviors.

Moreover, the multiplicative effects not only reveal that family social resources (i.e., parent-adolescent relationship and parental warmth) and the level of community poverty conditions change in adolescent problem behavior, but they also demonstrate that the effects of both family social resources and community poverty diminish over time and become weaker during late adolescence, hence there is equalization or convergence of slope for adolescents who start with fewer problems and those who start with more problems during early adolescence. This equality may be temporary and does not sustain for a long time. That is, the inequality may re-emerge during early/young adulthood, perhaps due to persistent or intergenerational influence of early adversities and more exposure to a stratified social environment (Warner & Hayward, 2006; West, 1997).
In general, my findings are consistent with the hypothesized model for additive and multiplicative influences. The findings explain the mechanisms by which community ethnic heterogeneity, family adversity, family social resources, and individual factors influence adolescent problem behavior. First, the findings support the hypothesized role of adolescent problem behavior change over time. Second, the findings provide evidence for the hypothesized role of community variables (i.e., community poverty and community ethnic heterogeneity) as to their unique and multiplicative influences on the level and slope of adolescent problem behavior trajectories. Third, the findings provide evidence for the hypothesized role of family adversity and more specifically, the role of family economic hardship and non-intact two-parent family as to their unique influence on adolescent problem behavior over time. Fourth, the findings provide evidence for the hypothesized role of being a minority (i.e., Hispanic, African American, and Native American) as to the unique and multiplicative influences on the level and slope of adolescent problem behavior trajectories over time. Fifth, the findings provide evidence for the hypothesized role of family social resources (i.e., parent-adolescent relationship, parental control, and parental warmth) to their unique and multiplicative influences on adolescent problem behavior over time.

Although community poverty, being African American, and being Native American did not have additive effects on adolescent problem behavior over time, the variables showed significance with multiplicative effects; that is, the joint effect either with time or family social resources (i.e., parent-adolescent relationship and ethnic heterogeneity). Hence, the findings supported the hypothesized moderating role of community and family factors on adolescent problem behavior and change over time. Being Asian American, age, and parental knowledge, however, did not show any additive or multiplicative (interaction) effect on
adolescent problem behavior over time. These findings, then, did not support their role to increase or decrease the level and slope of adolescent problem behavior trajectories. I therefore conclude that the results and discussion presented in this dissertation provide convincing evidence to support the importance of examining the multiplicative effects of multi-level factors simultaneously as well as the stability and change in developmental outcome. The study findings are supported by changes in the variance components, such as: (a) a consistent and systematic decrease in the initial level, $\tau_{00}$ (intercept) variances from Model 1 to Model 7, both at the individual level (level 2) by 2.30% and at the community level (level 3) by 30.39%, (b) a consistent and systematic decrease in the variance of the rate of change, $\tau_{11}$ (slope) from Model 1 to Model 7, both at the individual level (level 1) by 0.42% and at the community level (level 3) by 55%, and finally, (c) a consistent and systematic decrease in goodness of fit indices (i.e., -2RLL, AIC, and BIC) from Model 1 to Model 7. To summarize the results from the variance components, it is worth noting that community level differences in the level of trajectories and rate of change are well explained both at individual and community level predictors. On the other hand, individual level differences in the level of trajectories are also well explained by individual level predictors. However, individual level differences in the rate of change are not well explained. That is, they are same from Model 1 to Model 5. Nevertheless, the study demonstrates that stability and change in adolescent problem behavior is uniquely and multiplicatively attributed to individual, family, and community factors. This is important because of both unique influences and joint influences of these factors on youth outcome.

Although community poverty and ethnic heterogeneity are significantly correlated, these two community characteristics are distinct. Therefore, to capture the effects of ethnic
heterogeneity on adolescent problem behavior, I had to control for community poverty. Similarly, to determine whether race/ethnicity makes a difference in adolescent problem behavior, I tested for the interaction between being African American and time, and between being Native American and time. Thus, my findings show that in general, there is a decrease in adolescent problem behavior over time. However, the rate of change is contingent upon race. That is, for minority groups, the rate of decrease in problem behavior is slower compared to non-minority groups. As I mentioned earlier, there seems to be structural constraints or selection effects acting on minority adolescents that influence them in their anti-social lifestyle or even subtly push them to criminal behaviors.

These findings are thus substantially important to programs and policies that are time- and race-specific, since very little is now known about programs that take into account race and community composition. In contrast, however, this present study emerged as a result of incorporating community composition into the analysis as well as tracing the trajectories of adolescent development over time. Thus, future research aimed at capturing adolescent outcomes should not only trace an adolescent’s developmental outcome over time, but also should incorporate individual, family, and community factors (including individual, community-level variables, and cross-level multiplicative effects). As previously noted in this study, it is not possible to isolate a family from community or individuals from family given that individuals are nested within families and families are nested within communities (Bronfenbrenner, 1986). Rather, Leventhal and Brooks-Gunn (2000) as well as Wickrama and Bryant (2003) argued that family-focused models should be placed within communities.

In addition, the risk/resource theoretical model should be expanded to accommodate changes. This is important because the traditional risk/resource model is static and does not
accommodate changes, yet the study findings reveal that risk/resource changes over time. Similarly, the risk/resource theoretical model should be enlarged to accommodate contextual conditions. This is important because the study findings suggest that risk and resources are conditioned by the environmental context. Furthermore, risk and resource perspectives should be flexible and comprehensive enough to incorporate multiplicative influences. That is important because the current study suggests that risks multiply over time.

**Limitations**

In general, my findings are consistent with the hypothesized model, which includes both additive and multiplicative influences. My analyses used adolescents’ and parents’ reports from a large, nationally representative sample of adolescents together with census data. Despite the empirical support for my hypothesis, several limitations must be noted.

First, families with low levels of social resources and problem behavior individuals may have self-selected into adverse communities. Such selection’s effect contradicts the hypothesized community influences. Second, community or census-tract data as a unit of analysis may not be the appropriate unit with which to assess community characteristics. Thus, to increase people’s confidence in causal mechanisms and applicability of findings, these analyses must be replicated with improved measures using longitudinal data. Third, the report about social resources, as well as the subjective measures of community social resources, may be biased due to individual negative feelings. Fourth, the growth rates are measured using fewer waves (i.e., three data points); hence, the results may be considered less precise than those estimated from more waves. A more reliable assessment of growth rate parameters would require more measurement occasions (Willet, Ayoub, & Robinson, 1991; Willet & Sayer, 1994). Also, the time interval between Wave 2 (1996) and Wave 3
was very large and as such, it was hard to determine the shape of the trajectories between those two time points. Therefore, the study must be replicated using longitudinal data with a reduced time gap. Fifth, although peer influence is very important, it was not included due to data limitations that were beyond the study’s control. To ascertain peer influence then, this study must be replicated using a different sample. Finally, turning points and major life events (i.e., school drop outs, early marriages, and teenage pregnancy) were not taken into account; again, the study must be replicated to take turning points into consideration.

Although the present study examined only the quality of family interpersonal relationship and its impact in the life of adolescents, this does not suggest that these are the only factors that contribute to the development of problems during adolescence. Rather, the development of the problem behavior should be conceived as a result of a complex interplay of multiple factors at the biological level (e.g., genetic, neurobiological, neurophysiological), psychological level (e.g., affective, social cognitive, socioemotional), and social level (e.g., community, family, culture) that affect individuals over the life course (Circheti & Toth, 1998; Dekovic et al., 2004). Developmental theories are extremely vague about what produces change, and efforts to explain stability or to predict change in problem behavior have not been particularly successful (Patterson & Yoerger, 1993). Knowledge regarding the factors that predict not only the occurrence but also the course of development of problem behavior remains, however, of paramount importance for clinical practice. Understanding why in some adolescents problems persist or escalate in the course of adolescence, whereas in a vast majority of adolescents these problems tend to decrease, is likely to improve our
efforts to identify individuals who are at elevated risk and to design empirically informed interventions to prevent further escalations of problems.

*Important New Information*

Despite these limitations, this study provided important new information about (a) the change in adolescent problem behavior over time; (b) the unique influences of family adversity, family social resources, and individual factors on adolescent problem behavior; (c) the diminishing effects of community poverty over time; (d) the diminishing effects of family social resources (i.e., family warmth and parent-adolescent relationship) producing stability and equality over time during late adolescence; and (c) the contextual dissipation of the influences of some family social resources (i.e., parent-adolescent relationship) under high ethnic heterogeneous conditions. More importantly, the proximal influence of family social resources on adolescent problem behavior emphasizes the need for grassroots family intervention programs to improve parental practices, mostly at the early adolescence period, particularly among disadvantaged parents in minority ethnic/racial groups.

In summary, by understanding the multilevel, social, and familial processes through which the community, family, and individual influence trajectories of adolescent problem behavior, we will be able to design and implement effective prevention and intervention policies and programs at different levels (community, family, and individual) and for age-specific adolescents, hence reducing adolescent behavioral problems in a timely manner.
APPENDIX I: MEASUREMENTS

Adolescent Behavioral Problems Scale:
(A) “In the past 12 months, how often did you steal something worth more than $50?”
(B) “In the past 12 months, how often did you deliberately damage property that didn’t belong to you?”
(C) “In the past 12 months, how often did you go into a house or building to steal something?”
(D) “How often did you use, or threaten to use, a weapon to get something from someone?”
(E) “How often did you sell marijuana or other drugs?”
(F) “In the past 12 months, how often did you take part in a fight where a group of your friends was against another group?”
(G) “In the past 12 months, how often did you steal something worth less than $50?”

Items were rated on a range of 0 (never) to 3 (5 or more times). Higher scores reflected more problem behavior. These items were used consistently from Wave 1 to Wave 3. (Cronbach’s alpha for Wave 1 = .65, Wave 2 = .73, and Wave 3 = .65).

Community Poverty Scale: Census-tract information from the 1990 U.S. Census (Contextual data set):
(A) The proportion of families living in poverty.
(B) The proportion of single-parent families.
(C) The proportion of adults employed in service occupations.
(D) The proportion of unemployed males.

I computed and used Census tract-level scores as the concentration of poverty measure for the community (Cronbach’s alpha = .88).

Family Economic Hardship Scale: The family economic hardship items asked, “Last month, did you or any members of your household receive:
(A) Social Security or Railroad Retirement?
(B) Supplemental Security Income (SSI)?
(C) Aid to Families with Dependent Children (AFDC)?
(D) Food Stamps?
(E) Public assistance?
(F) Housing subsidy or public housing?”

The scale was represented by dichotomized variables coded 1 for “Yes” and 0 for “No.” Higher scale scores reflected greater economic hardship (Cronbach’s alpha = .71).

Parental Knowledge: The items asked adolescents to identify listed items or things they have done with their parents (both mom and dad):
(A) Went shopping.
(B) Played sport.
(C) Gone to a religious service or church-related event.
(D) Talked about someone you are dating or a party you went to.
(E) Gone to a movie, play, museum, concert, or sports event.
(F) Had a talk about a personal problem you were having.
(G) Had a serious argument about your behavior.
(H) Talked about your school work or grades.
(I) Worked on a project for school.
(J) Talked about other things you are doing in school.

Responses for the 10 items on the parental knowledge subscale were dichotomized measures with variables coded 0 for “No” and 1 for “Yes.” Items were summed such that higher scores reflected higher parental knowledge and lower scores reflected lower parental knowledge (Cronbach’s alpha = .95).

**Parent-Adolescent Relationship:** The items asked parents: “How often would it be true for you to make each of the following statements about {NAME}?”
(A) You get along well with (him/her).
(B) {NAME} and you make decisions about (his/her) life together.
(C) You just do not understand (him/her).
(D) You feel you can really trust (him/her).

Responses for the 4 items on the parent-adolescent relationship subscale were measured on a range from 1 (always) to 5 (never). Items were summed and coded such that lower scores reflected a stronger parent-adolescent relationship (Cronbach’s alpha = .61).

**Parental Control:** The items, as listed below, asked adolescents whether their parents let them make their own decisions about:
(A) The time you must be home on weekend nights?
(B) The people you hang around with?
(C) What you wear?
(D) How much television you watch?
(E) Which television programs you watch?
(F) What time you go to bed on week nights?
(G) What you eat?

The responses to the 7 items on the parental control subscale were dichotomized measures coded 0 for “No” and 1 for “Yes.” Items were summed such that higher scores reflected less parental control and lower scores reflected higher parental control (Cronbach’s alpha = .63).

**Parental Warmth:** Parental warmth items asked adolescents to indicate whether they agree or disagree that:
(A) “Most of the time, your mother is warm and loving toward you.”
(B) “You are satisfied with the way your mother and you communicate with each other.”
(C) “Overall, you are satisfied with your relationship with your mother.”
(D) “Most of the time, your father is warm and loving toward you.”
(E) “You are satisfied with the way your father and you communicate with each other.”
(F) “Overall, you are satisfied with your relationship with your father.”

The items were rated on a range of 1 (strongly agree) to 5 (strongly disagree). The items were coded such that lower scores indicated greater warmth (Cronbach’s alpha = .85).
APPENDIX II: ADDHEALTH FUNDING, FIELD WORK, AND DATA FILES

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Wave 1 and Wave 2 field work was conducted by the National Opinion Research Center of the University of Chicago. Wave III field work was conducted by the Research Triangle Institute of Chapel Hill, North Carolina. Persons interested in obtaining data files from The National Longitudinal Study of Adolescent Health can contact Add Health Project, Carolina Population Center, 123 West Franklin Street, Chapel Hill, NC 27516-3997 (email: addhealth@unc.edu). One can also obtain copies of the publications listed on the ADDHEALTH website (http://www.cpc.unc.edu/projects/addhealth/pubs) by contacting the
authors. This searchable database includes approximately 1700 publications, presentations, unpublished manuscripts, and dissertations by Add Health researchers.
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