Testing Thornberry's interactional theory: The reciprocal relations

by

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ABSTRACT

Thornberry's interactional model (1987) suggested that the process of delinquency could be explained by the reciprocal relations between social control variables and social learning variables over developmental stages. However, previous studies for testing interactional model (Thornberry et al., 1991, 1994) had some limitations. They did not adequately include theoretically significant measures of both social control and social learning variables. They did not fully cover the transition throughout adolescence. They also did not adequately examine the variation of social category and individual criminal propensity. This study selects family attachment as social control and deviant peer association as social learning variable. This study tests the reciprocal relationships among family attachment, delinquent peers, and delinquency across the full adolescence and early adulthood. In addition, this study hypothesizes that causal processes vary by gender and the early and late onset group. Data to test for these hypotheses are from 1977, 1980, 1983, and 1987 of the National Youth Survey. This study found that deviant peer association is more reciprocally related to delinquency than family attachment. The findings also suggest that gender and criminal propensity are important to determine deviant behavior processes. The effect of family attachment on delinquency is stronger for females than males. The effect of deviant peers on delinquency is stronger for males than females. Female delinquency has stronger negative effect on family relations than male delinquency. The early onset group has more stable levels of delinquency than the late onset group. The delinquency of the early onset group is primarily influenced by family attachment and deviant peers and their relationships are reciprocal, whereas the delinquency of late starters is mainly influenced by deviant peers and their relationships are unidirectional. This study suggests that delinquent processes

vary by age, gender and different types of offending.

CHAPTER I. INTRODUCTION

The purpose of this study is to examine causal processes leading to delinquency. These processes may be contingent on developmental stage, social category, and behavior group. Thornberry's interactional model provides theoretical guidance and a point of departure for the study. As in the interactional theory, a reciprocal process, whereby social relations influence delinquent behaviors and in turn affect social relations, is the focus of this study. First, this study examines the relationships between family, delinquent peers, and delinquency across the developmental stages of adolescence. Developmental theories propose that age is important to understanding delinquency. The causes of delinquency are different at different points in the individual life course (Loeber and LeBlanc, 1990; Nagin and Land, 1993; Patterson and Yoerger, 1993). Second, we examine how causal processes vary by gender. A number of studies on delinquency and crime have demonstrated significant gender differences (Gottfredson and Hirschi, 1990; Adler, 1975; Simon, 1975; Hagan, 1989). Gender differences affect the relations among family, deviant peer influences and delinquency. Empirical tests of these influences that neglect gender do so at the risk of misspecification. Third, we investigate causal patterns by offender type. Several studies (Patterson et al., 1992; Moffitt, 1993; Simons et al., 1994) have argued that the delinquent population contains two fundamentally different types of offenders and that disaggregation by these types is necessary to better understand the processes contributing to delinquency and crime. One type, herein called early starters, begins offending early and exhibits great stability in offending patterns over long portions of the life-course. The second type, herein called late starters, has both a late onset and an early termination of their delinquent careers. Different causal explanations explain the

delinquency and crime of these different types of offenders (Paternoster and Brame, 1997; Paternoster et al., 1997).

Recent theories of delinquency and crime have emphasized development of the outcomes over time. Developmental theories have several advantages over static theories of delinquency (Thornberry, 1987, 1997). Developmental theories emphasize the dynamic process of delinquency. Static theories of delinquency focus on how social forces and the learning process influence delinquent behavior at one point in time or by altering the offenders' minds in ways that have lasting and stable effects on their decisions (Agnew, 1992; Akers, 1998; Hirschi, 1969; Sutherland and Cressey, 1970). Static theories rely on unidirectional causal structures that influence delinquency. Developmental theories suggest that the reciprocal process in which delinquent behavior is learned and reinforced is critical (Elliott et al., 1985; Thornberry, 1987). Static theories show little interest in age-varying effects on delinquency. As a result, they do an adequate job of explaining the increase of delinquency in early adolescence, but fail to account for the decrease in late adolescence. The age-crime curve, showing that delinquency rates rise sharply in teenage years and then decline significantly, has always been of great interest to developmental theorists and, in fact, initially inspired developmental studies of crime (Farrington, 1992; Moffitt, 1993; Sampson and Laub, 1993).

Developmental theorists maintain that the precursors and consequences of delinquency may change significantly over time and as a criminal career develops. For example, they often contend that delinquency has developmental roots in early childhood marked by involvement in precursor behaviors such as conduct disorder and antisocial behaviors (Farrington, 1991; Loeber, 1991; Loeber and LeBlanc, 1990; Patterson et al., 1992; Robins, 1978; White et al., 1990). Many developmental theorists also assert that involvement in delinquency has consequences for other aspects of a person's

development. Serious involvement in delinquency is likely to adversely influence social relations with family and peers, belief system, and transitions to roles throughout the life course (Thornberry, 1987; Newcomb and Bentler, 1988; Patterson et al., 1992).

Thornberry (1987) suggested that delinquent behavior occurs in social interaction and can be explained by models that focus on interactive processes. His theory integrates elements from learning and control perspectives emphasizing their place in childhood to young adult development. Reciprocal relations among social control variables and social learning variables explain delinquency. Thornberry argued that these variables are part of an amplifying loop. Low social control increases the likelihood of association with delinquent peers and of delinquent behavior. In turn, delinquent behavior leads to further reduction in social control. For most adolescents, this amplifying loop is interrupted by the transition to adulthood, and therefore the processes should be studied among youth and young adults. This study tests a model based on Thornberry's interaction theory.

Chapter I introduces interaction theory and developmental perspectives that are used to guide the analysis. Chapter II examines reciprocal causality and proposes a model. First, I describe Thornberry's interaction theory. Second, I review literature on three theoretically central factors contributing to adolescent delinquency: family attachment, deviant peer association, and delinquent behavior and the reciprocal relations among them. Third, I examine the dynamic process of delinquent behavior and how it differs by gender, type of delinquent, and age. Fourth, I present a model and hypothesis. Chapter III describes the data, the measurement and methods. A test of reciprocal relations by developmental changes requires longitudinal data. I use the National Youth Survey, a nationally representative, longitudinal study of delinquency and drug use (Elliott, 1983). Chapter IV presents results. Chapter V provides the discussion of results including conclusions, limitations and implications for future research.

CHAPTER II. LITERATURE REVIEW

1. Thornberry's interactional theory

Thornberry's interactional theory is based on the premise that human behavior occurs in social interaction and can be explained by models that focus on interactive processes (Thornberry, 1987:864). Delinquent behavior is formed by the relationships with other people and social institutions over time. That is, delinquent behavior is explained as a causal network not only affected by social factors but also affecting the development of those social factors. From this premise, he combined social control theory and social learning theory into a developmental framework.

A. Origins of interactional theory

The interactional models are based on social control elements drawn from Hirschi's (1969) social control theory, social learning elements drawn from Akers' (1985) social learning theory, and combine two elements drawn from Elliott et al.'s (1983, 1985) integrated models. Hirschi (1969)'s social control or social bond theory suggested that delinquent behavior results when an individual's bond to society is weak or broken. He proposed that four elements of social bonds are important to prevent delinquent behavior (Hirschi, 1969:16-26): 1) Attachment refers to a person's sensitivity to opinions of others 2) Commitment refers to the degree to the importance of a person's stake in conforming behavior; that is, person invests time, energy, and effort in conventional actions such as getting an education 3) Involvement refers to participation in conventional or legitimate activities 4) Belief refers to the extent of the acceptance of a conventional value system.

Social control elements of interactional models consist of 'attachment to parents', 'commitment to school', and 'belief in conventional values'.

Akers' (1985) social learning theory suggested that delinquent behaviors are the results of social learning processes. There are four major concepts in the theory (Akers, 1999:63-67): 1) Differential association refers to the process whereby one is exposed to normative definitions favorable or unfavorable to illegal or law-abiding behavior 2) Definitions are one's own attitudes or meanings that one attaches to given behavior 3) Differential reinforcement refers to the balance of anticipated or actual rewards and punishments that follow or are consequences of behavior 4) Imitation refers to the engagement in behavior after the observation of similar behavior in others. Social learning elements of interactional models consist of deviant peer association and delinquent values.

Social control theory and social learning theory have different assumptions. Social control theory assumes that all human beings have the potential of committing delinquent behavior or crime since it is attractive (Hirschi, 1969). Without control mechanisms, such as attachment to societal bonds and parental control, delinquent behavior is more likely to occur. On the other hand, social learning theory assumes that there is no natural impulse toward delinquency or crime. Delinquent behavior results from socialization of deviant norms, values, and delinquent behavior (Akers, 1985). In spite of the contrasting assumptions of two theories, they can be integrated into a more comprehensive explanation of delinquent behavior. Elliott (1985) argued that the causes of crime and deviance are complex and it will be necessary to combine different theories to capture the entire range of relevant causal variables. Elliott et al., (1985) suggested that weak conventional bonds lead some youths to reject conventional values and adolescents to

seek out deviant peer groups, which provide role models for delinquent behavior. In turn, association with these groups leads to delinquent behavior.

Drawing from this integrated approach, Thornberry's interactional models emphasize the reciprocal relations between social control theory and social learning theory. Weak social bonds facilitate exposure to delinquent environments, which in turn weakens conventional social bonds. Interactional models suggest that both social control elements, attachment to parents, belief in conventional values, and commitment to school and social learning elements, associations with delinquent peers and adaptation of delinquent values are reciprocally related with adolescent delinquency.

Thornberry (1987) suggested that delinquent behavior occurs in social interaction and can be explained by models that focus on interactive processes. He argued that the process of delinquency could be explained by the reciprocal relations between social control variables and social learning variables. These variables are involved in an amplifying loop, such that low social control increases the likelihood of association with delinquent peers and of delinquent behavior, which in turn leads to a further reduction in social control. For most adolescents, this amplifying loop is interrupted by the transition to adulthood. Thornberry's interactional models also suggest the integrated social control and social learning theories into a single developmental perspective.

B. Interactional models

Thornberry's interactional models are outlined in Figure 1. The models are divided into three developmental stages. The basic model is represented in the early adolescence period. It consists of six concepts, combining social control elements and social learning elements: attachment to parents, commitment to school, belief in conventional values, association with delinquent peers, delinquent values and delinquent

Figure 1. Thornberry's (1987) interactional models
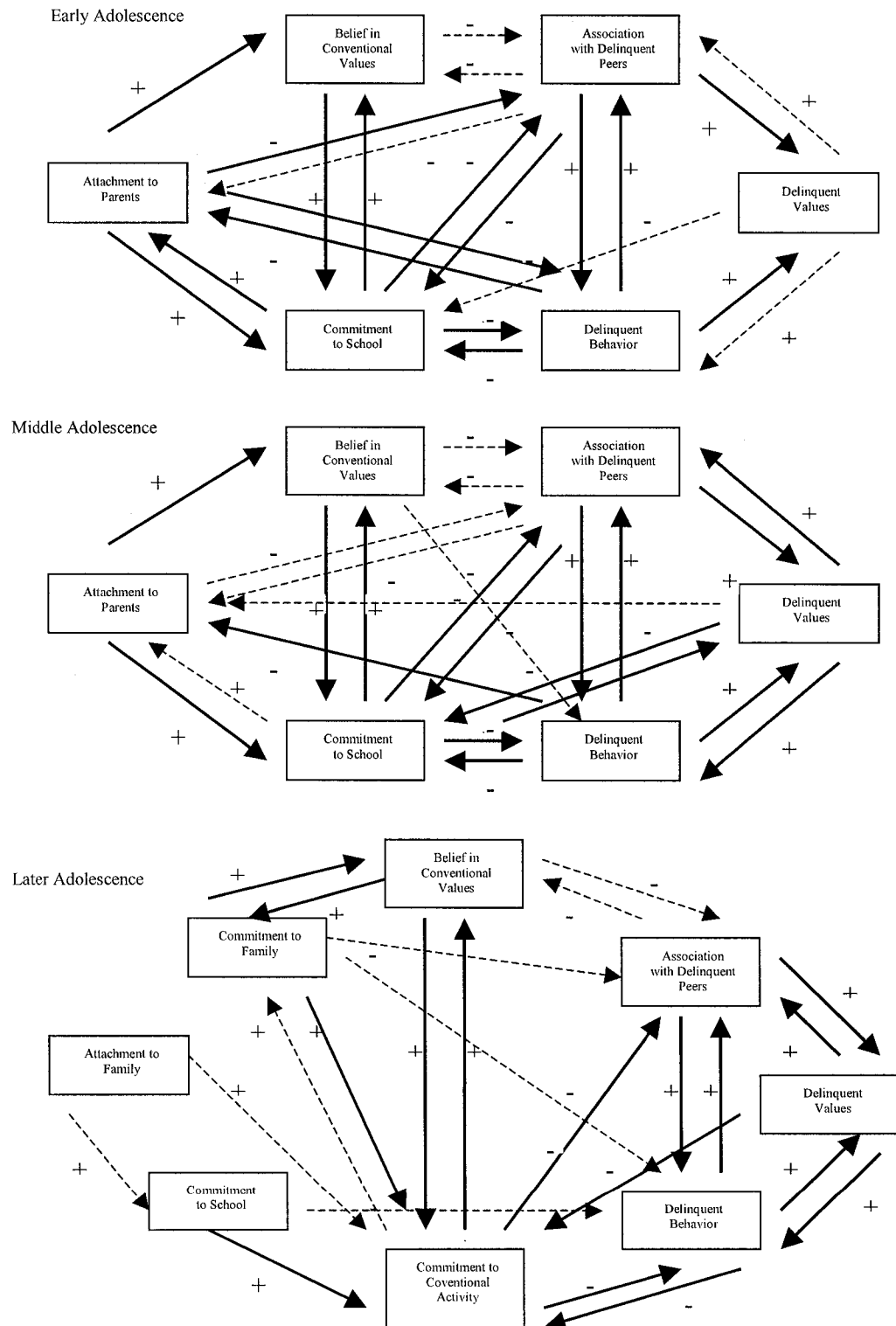
Note: Solid lines represent stronger effects; dashed lines represent weaker effects.

behavior. The causal effects and directions of variables vary by developmental stage. Furthermore, new variables occur in the late adolescence.[1]

In the basic model, attachment to parents is the initial causal variable in the model. It relates both directly and indirectly to delinquent behavior. Attachment to parents reciprocally relates to delinquent behavior. In addition, attachment to parents indirectly relates to delinquent behavior through association with delinquent peers. Attachment to parents affects association with delinquent peers and in turn is affected by association with delinquent peers. Attachment to parents relates to commitment to school in the same pattern as in the association with delinquent peers. Belief in conventional values indirectly affects and is affected by delinquent behavior as two different paths: 1) belief in conventional values reciprocally relates to commitment to school, which is also reciprocally related to delinquent behavior 2) belief in conventional values reciprocally relates to delinquent behavior through association with delinquent peers. Commitment to school also directly and indirectly relates to delinquent behavior. Commitment to school reciprocally relates to delinquent behavior and through association with delinquent peers. Social learning elements, association with delinquent peers and delinquent values reciprocally relate to delinquent behavior. Association with delinquent peers directly influences and is influenced by delinquent behavior. In addition, association with delinquent peers reciprocally relates to deviant values and also affects and is affected by delinquent behavior. Interactional theory does not view delinquency merely as an outcome or consequence of a social process. It views delinquent behavior as an active

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[1] The change of life circumstance leads persons to encounter new social relations in later adolescence and early adulthood. It includes conventional activities, such as employment, attending college and military service, and marriage and commitment their own family, such as marriage, and child rearing (Thornberry, 1997: 234-236).

part of the developmental process, interacting with other social factors over time to determine the person's ultimate behavior and social position.

The interactional models hypothesize that interactive processes develop over the person's life cycle and also specify the explanatory strength of each component by age. Early adolescence refers to the period from about age 11 to 13. This stage is the beginning of delinquent careers and prior to the period at which delinquency reaches it apex. During early adolescence, the family is the most influential factor in bonding the youth to conventional society and reducing delinquency. Middle adolescence is the period when the youth are approximately 15 or 16 years of age. This period normally represents the highest rates of involvement in delinquency and is often the reference period in studies. During this stage, attachment to parents begins to weaken, and the most salient social variables involved in delinquency are likely to be associated with the youth's activities in school and peer networks. As youth mature through middle adolescence, the world of friends becomes a more dominant influence. Late adolescence is the period of transition from adolescence to adulthood, ages 18 to 20. As a person enters this stage, commitment to adult conventional activities and to family offer a number of new ways to reshape the bond to society and subsequently influence participation in delinquency.

C. Empirical support for interactional theory

Thornberry et al. (1991) tested interactional theory using reciprocal relations of three variables, attachment to parents, commitment to school, and delinquent behavior with three waves of data for the Rochester Youth Development Study. They found some reciprocal effects[2] among the three variables. They concluded that weakened bonds to

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2 Thornberry et al. (1991) provided the instantaneous effects of variables in same waves and the cross-lagged effects across the waves. They found the significant interaction paths as follows: Attachment to

family and school cause delinquent behavior, which in turn weakens the strength of the bonds to family and school. In one study, Thornberry et al. (1994) also tested a theory with 4 variables, delinquent peers, peer reactions, delinquent behavior, and delinquent beliefs using the same data set. They found a reciprocal relationship between delinquent peers and delinquent behavior. Association with delinquent peers increases delinquency, but its effect is mediated through perceptions of reinforcement. In turn, delinquency affects association with delinquent peers. They also found reciprocal effects between delinquent belief and delinquent behavior. Delinquent beliefs tend to increase delinquent behavior, which in turn consolidate a delinquent belief structure. They concluded that the model better fits for reciprocal relations than for only unidirectional relations.

As mentioned above, interactional theory has been tested using selected variables from Thornberry's theoretical models, since the entire theoretical models are difficult to test. Thornberry et al. (1991) tested models focused on social control variables, parental attachment, commitment to school, and delinquent behavior. Another study (Thornberry, et al., 1994) focused on social learning variables, delinquent peers, peer reactions, delinquent beliefs, and delinquent behavior. Previous studies did not adequately model key social control and social learning variables theoretically.

Thornberry (1987) suggested that the interactive processes develop over the person's life cycle. The reciprocal relations change in each stage of adolescence. However, previous studies (Thornberry et al., 1991, 1994) did not sufficiently test models covering the full range of adolescent age. The sample of both studies is seventh and

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parents in wave 1 influences delinquent behavior in wave 2, which in turn affects attachment to parents in wave 2. Commitment to school in wave1 has an effect on commitment to school in wave two through delinquent behavior in wave 2. Delinquent behavior in wave 1 influences delinquent behavior in wave 3 mediated by commitment school in wave 2. Commitment to school in wave 2 has an effect on commitment to school in wave 3 through delinquent behavior in wave 3. Delinquent behavior in wave 2 influences delinquent behavior in wave 3 through commitment school in wave 2.

eighth grade students and analysis uses three waves of six month interval.[3] The age range of both studies is early adolescence or the transition from early to middle adolescence.

2. Etiology of adolescent delinquent behavior

Criminologists have investigated the relationships of many etiological factors to onset, continuation, and cessation of delinquent behavior. The most common mentioned factors are prior delinquent behavior, such as antisocial behavior or conduct problems (Farrington, 1989; Caspi et al., 1990; Loeber and LeBlanc, 1990), parental or family factors (Glueck, 1950; Hirschi, 1969; McCord and McCord, 1959; Nye, 1958; Patterson, 1989; Gottfredson and Hirschi, 1990), deviant peer association (Sutherland and Cressey, 1970; Elliott et al., 1989; Akers, 1998), deviant attitudes or beliefs (Krohn et al, 1985; Huzinga et al., 1991), and school factors, such as low school achievement (Hirschi, 1969). Thornberry's interactional models include most of these etiological factors. His models include family and school factors as control elements, deviant peer association and deviant values as learning elements, and prior delinquent behavior as developmental elements.

This study uses variables most commonly representing each element. Family attachment is the social control element[4]. Deviant peer association is the social learning

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3 One study (Thornberry et al., 1991) was analyzed using wave 1, wave 2, and wave 3 RYDS data and another study (Thornberry et al., 1994) was analyzed using wave 2, wave 3, and wave 4 RYDS data.
4 School commitment is not included since it is not always concurred in person's life span, which means that some adolescents, especially committing delinquency might drop out school and everybody does not participate in college in adulthood.

element[5]. Thus, three etiological factors are selected: family attachment, deviant peer association, and delinquent behavior.

A. Family influence

Interactional theory focuses on interactional relations between parents or other family members and children. Thornberry (1987: 866) defined family attachment as "the affective relationship between parents and child, communication patterns, parenting skills such as monitoring and discipline, parents-child conflict, and the like." This section describes why family factors are important determinants of delinquent behavior and the relations between family attachment and delinquent behavior.

Thornberry (1987) suggested that a fundamental cause of delinquency lies in the weakening of social constraints tied to family relationships. Weakening of controls allow for a much wider array of behavior, including continued conventional action, failure as indicated by school dropout and sporadic employment histories, alcoholism, mental illness, delinquent and criminal careers, or some combination of these outcomes.

Criminological studies have shown that several family factors[6], such as a lack of parental monitoring, weak parent-child involvement, inept parental discipline, and deviance by parents or other family members are powerful predictors of adolescent delinquency (Glueck and Glueck, 1950; Hirschi, 1969; McCord and McCord, 1959; Nye, 1958; Patterson, 1989; Gottfredson and Hirschi, 1990). The effects of family factors on

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5 One of social learning elements, deviant values, is not included since delinquent values are less strongly related to delinquency than peer associations and it is not consistently found that deviant attitudes is related to deviant behavior (Warr and Stafford, 1991; Agnew, 1991).

6 Loeber and Stouthamer-Loeber (1986) suggested four dimensions of family functioning to organize the understanding of child conduct problems. These include the neglect paradigm, which examines parent-child and child-parent involvement and parental supervision; the conflict paradigm, which analyzes discipline practices and parent-child and child-parent rejection; the deviant behaviors and attitudes paradigm, which focuses on parental criminality and deviant attitudes among parents; and the disruption paradigm, which looks at marital conflict and parental absence (Sampson and Laub, 1993: 65).

delinquency are summarized by two perspectives: the protective perspective and the risk perspective (Catlano and Hawkins, 1996). First, family members can control adolescents' delinquent behavior and serve as a protective factor (Hirschi, 1969; Kornhouser, 1978; Sampson and Laub, 1990). Social bond theory suggests that individuals are prevented from engaging in delinquency and crime by their bond to society and conventional institutions (Hirschi, 1969). Since the social bond may tie individuals to societal institutions, the risk of crime and delinquency is increased when it is loosened. The most important element of the bond to society is the individual's attachment to persons. Affective ties between parents and child are an important source of social control, motivating children to control, themselves through their need to avoid social disapproval from parents. The emotional bond between parents and children provides the bridge across which pass conventional ideals and expectations. That is, the internalization of prosocial attitude and behavior depends on the individual's attachment to persons and attachment to persons favors the acceptance of societal constraints.

Second, family can facilitate development of deviant attitudes and behaviors. Relationships in the family are the mechanism of early socialization and can be an important risk factor. Social learning theories suggest that family members may directly train the child to perform antisocial behaviors (Forehand, et al., 1975; Patterson, 1982; Snyder, 1977; Wahler and Dumas, 1984). When parents or other family members engage in deviant or criminal behavior, then the family's effectiveness in conventional socialization is undermined, and differential association, modeling, and reinforcement of delinquent tendencies are more likely to occur. Parents can directly socialize and reinforce their children to engage in deviant behavior and may serve as the first influence in long cycle of learning of delinquent behavior (Adler and Adler, 1978; Bandura and Walters, 1963).

Akers (1998) suggests that the family can provide anticriminal definitions, conforming models, and reinforcement for conformity through parental discipline. Parents who do not apply consistent or effective discipline fail to produce conforming social skills and to extinguish troublesome behaviors. Patterson et al. (1989, 1992) also argued that family members can directly train the child to commit delinquency. They suggested that less skilled parents inadvertently reinforce their children's antisocial behavior and fail to provide effective punishments for transgression. The child learns to use aggressive behavior to deal with aggressive intrusions by parents. As coercive training continues, the child and parents escalate the intensity of their coercive behaviors, which in turn leads to aggression. Thus, the coercive behaviors are negatively reinforced by parents. In this process, the child learns to control parents with coercive means and eventually the child exhibits antisocial behavior in other settings.

As reviewed above, family factors are important predictors of delinquent behaviors. Family is the major agency of early socialization and can function to inhibit or facilitate delinquent behavior. Most parents have typically prosocial and conventional attitudes to inhibit their children's delinquent behavior, but parents and other family members can directly socialize and reinforce their children to engage in delinquent behavior.

The effects of family attachment are empirically tested using different paths in previous studies. First, family attachment directly affects delinquent behavior. Social bond theorists suggest that the lack of attachment to parents implies poor bonding to parents and the lack of internal control, which directly causes delinquent behavior (Hirschi, 1969). However, most longitudinal studies find that family attachment has a weak or insignificant direct effect on delinquency (Agnew, 1985, 1991; Elliott et al., 1985; Paternoster, 1988). Second, family attachment can indirectly affect delinquent

behavior through social learning variables (Elliott et al., 1985). Paternoster (1988) found that effects of parental supervision are significant after social learning variables, such as peer attitude, behavior, and deviant beliefs are controlled. Third, family attachment is reciprocally related to delinquent behavior (Thornberry, 1987). Liska and Reed (1985) tested the reciprocal effect between family attachment and delinquent behavior. They found that family attachment affects delinquency but delinquency does not affect family attachment. Previous studies show that the direct effect of family attachment is weak and does not always occurs in the reciprocal fashion suggested by theory. However, most previous studies do not adequately control for the developmental stages of samples. Thornberry (1991) argued that the relations between family attachment and delinquent behavior are developmentally specific: attachment to parents and delinquency are reciprocally related in early adolescence, but later there is a negative unidirectional effect from delinquency to attachment to parents. Therefore, it is necessary to investigate the effects of family attachment in different developmental stages.

B. Deviant peer association

Traditionally, criminologists have viewed adolescent delinquency primarily as a group phenomenon (Cohen, 1955; Sutherland and Cressey, 1970). Association with delinquent peers is a primary cause of delinquency (Elliott et al., 1989; Akers, 1998). Moreover, those who commit delinquency are more likely to have delinquent peers (Farrington, 1990). Thornberry (1987) argues that adolescents who associate with delinquent peers are likely to commit delinquent behaviors and that those who commit delinquent behaviors are likely to continue associating with delinquent peers. Thus, deviant peers and delinquent behavior is strongly correlated in adolescence.

There are multiple mechanisms whereby deviant peer association may cause delinquent behavior. Adolescents may learn delinquent attitudes and behavior from their close friends. Differential association theory accounts for the effects of delinquent peers on delinquent behavior (Sutherland and Cressey, 1970). Differential association theorists argue that delinquent behavior results from normative conflict, which is determined by specific peer group relationships. An individual's normative conflict results from associations with delinquents that provide delinquent definitions and behaviors. Sutherland and Cressey (1970:75-77) suggest several principles of differential association. Delinquent behavior is learned as a byproduct of interacting with intimate personal groups. Learning delinquent behavior includes delinquent motives and techniques. A person becomes a delinquent when he or she perceives more favorable than unfavorable consequences to violating the law. Differential associations may vary in frequency, duration, priority and intensity. Differential association theory asserts that delinquency results from learning an excess of definitions favorable to crime, which is likely to occur in association with delinquent groups and isolation from conventional groups. The causality and the vagueness of terminology "definition favorable toward criminality," are often criticized, but studies have consistently shown that deviant peer association is related to delinquent behavior (Matsueda and Heimer, 1987; Warr, 1993).

Social learning theorists suggest that except for one's own prior deviant behavior, the best single predictor of the onset, continuance, or desistance of delinquency is differential association with deviant peers (Akers, 1998). Frequent and close associations with deviant peers are strongly predictive of one's own delinquent behavior. The influence of deviant peer on delinquency operates through modeling and reinforcing process according to social learning theory.

There is theoretical debate about the nature of causal relations between deviant peer association and delinquency. This debate is best summarized by three positions. The first position proposes that the relation is spurious because it is tautological. Critics suggest that delinquent peer association and behavior are different measures of the same thing (Farrington, 1986b; Gottfredson and Hirschi, 1987). Delinquency could be defined as underlying and unobservable individual potential (Farrington, 1988). Deviant peer association and delinquent behavior might be regarded as indicators of latent traits. Gottfredson and Hirschi (1987) argued that self-reported peer delinquency is just another measure of self-reported delinquency. The second proposition is that delinquent behavior leads to contact with delinquent peers. Social control theories suggest the flocking hypothesis, which means that antisocial characteristics and delinquency lead adolescents to associate with deviant peers and the delinquent behavior is amplified (Glueck and Glueck, 1950; Hirschi, 1969; Gottfredson and Hirschi, 1990). Glueck and Glueck (1950) argued delinquents had typically committed delinquent acts before the age at which boys usually join gangs. Thus, the social selection of delinquent peer groups was a fundamental fact in any analysis of the causes of juvenile crime than differential association. Delinquents are likely to have delinquent friends and non-delinquents are unlikely to have delinquent friends (Hirschi, 1969). Gottfredson and Hirschi (1990) also suggested that individuals with low self-control do not tend to make good friends and they are more likely to develop ties with people with similar characteristics. The individuals in such groups will therefore tend to be delinquent, as will the group itself. The third position is that delinquent peer association leads to delinquency. Social learning theories suggest the feathering hypothesis, which means that the exposure of delinquent peers precedes delinquent behavior (Sutherland, 1947; Burgess and Akers, 1966; Elliott et al., 1985; Patterson, 1991). Delinquent peers can have direct and indirect effects on

delinquent behavior (Heimer and Matsueda, 1994; Matsueda, 1992). Elliott et al. (1985, 1989) suggested that environmentally disadvantaged groups face a risk of perceiving strain, which in turn lead to weakened bonds with conventional groups. Weak conventional bonds and high levels of perceived strain can lead youth to reject conventional social values and affiliate with deviant peer groups. Deviant peer groups provide role models and positive reinforcement for antisocial behavior.

As mentioned above, the relations between deviant peer association and delinquent behavior are causally complicated. Kandel (1978) argued that both social selection and social causation effects are important. Adolescents who share certain prior attributes in common tend to associate with each other and tend to influence each other as the result of continued association (Kandel, 1978: 435). To solve the complicated causal relations, longitudinal studies are required. Elliott and Menard (1996) examined the causal order between the two variables using six waves of the National Youth Survey. They found that there are reciprocal effects between deviant peer association and delinquent behavior. The influence of deviant peer associations is pronounced at initiation stages. After that, the relationship between deviant peer association and delinquent behavior is more reciprocally related. Delinquent careers are maintained by the amplification process.

C. Prior delinquency

Developmental studies have consistently shown that past behavior relates to current behavior, which in turn influences future behavior (Farrington, 1989; Caspi et al., 1990; Loeber and LeBlanc, 1990). Thornberry (1987) also suggested that delinquent behavior is not merely an outcome or consequence of a social process. It is an active part of the developmental process, interacting with other social factors over time to determine

the person's ultimate behavioral repertoire. That is, delinquent behavior is also an important predictor variable to determine future delinquent behavior. Furthermore, delinquent behavior has its own developmental stages. Most serious delinquents develop from minor to more serious acts (Elliott and Menard, 1996). The following section describes how delinquent behavior is initiated, developed and sustained by age and introduces theoretical arguments about the continuity of delinquent behavior.

Delinquent behavior may be a consequence of prior delinquent or antisocial behaviors. Loeber (1990) suggested that a developmental ordering of problematic behaviors from early childhood to late adolescence. He argued that there are developmental sequences in problem behavior; that is, problem behavior varies with age. One manifestation of problem behavior is difficult temperament, which refers to a child's style of responding to the environment, such as rhythmicity, adaptability, and quality of mood (Loeber, 1996). The second stage is hyperactivity, which is associated with impulsivity and attention problems. The symptoms of hyperactivity occur after 3 or 4. After that, aggression or overt conduct problem occurs. Loeber et al. (1993) suggested three different developmental trajectories, which take account of the sequence from minor problem behavior to serious delinquency. First is the overt pathway, which represents an escalation from minor aggression (annoying others and bullying) to physical fighting, and eventually to violence (predatory). Second is the covert pathway, which consists of minor covert acts (shoplifting and frequent lying), then property damage (fire setting, vandalism), and then more serious forms of theft (burglary). Third is the authority conflict pathway, which starts with stubborn behavior, followed by serious disobedience and defiance, and finally by authority avoidance such as truancy and running away. Loeber (1996) argued that youth in multiple pathways, for instance, those in the overt and covert

pathways, those in covert and authority conflict pathways, and those in all pathways subsequently had significantly higher rates of delinquency than those in single pathways.

Criminological studies have been concerned with the characteristics of early behavior and traits before juvenile delinquency for decades (Gottfredson and Hirschi, 1990; Caspi et al., 1987; Farrington, 1991; Loeber, 1990). Some scholars have used the clinical terminology to describe early misbehavior. The term conduct disorder is widely used. Conduct disorder is defined as "a repetitive and persistent pattern of behavior in which either the basic rights of others or major age-appropriate societal norms or rules are violated" (DSM IV, 1994). Even though the expression of conduct disorder varies in terms of severity and persistence over time, the main components include aggression toward peers and adults, destruction and theft of property, chronic defiance and frequent lying and deception (Farrington, 1991). In its most severe forms, conduct disorder has been referred to as antisocial behavior (Kazdin and Esveldt-Dawson, 1986). Antisocial behavior persists beyond childhood and beyond early adolescence. It contains cruelty, forced sex, stealing, and destruction of property (Farrington, 1991).

Delinquent behavior is sustained by the interactional process. There are two kinds of the process: cumulative continuity and interactional continuity (Caspi et al., 1987). Cumulative continuity is generated by negative structural consequences of delinquency for life chances. Sampson and Laub (1993) argued that delinquent behavior has a systematic attenuating effect on the social and institutional bonds to society. Juvenile incarceration may spark failure in school, unemployment, and weak community bonds, leading in turn to increasing adult crime. Interactional continuity refers to how social interaction may reinforce personal behavior style. It occurs when a child with antisocial traits provokes hostile reaction in parents, which in turn feeds back to trigger further antisocial behavior by child (Sampson and Laub, 1993).

Previous delinquent behavior can manifest in future delinquent behavior in different ways. There are two kinds of continuity of antisocial behavior: homotypic continuity and heterotypic continuity (Caspi and Bem, 1990: 553). Homotypic continuity refers to the continuity of similar behavior or phenotypic attributes over time (Caspi and Bem, 1990:553). Heterotypic continuity is defined as the continuity of an inferred genotypic attribute presumed to underlie diverse phenotypic behaviors (Caspi and Bem, 1990:553). Heterotypic continuity means that individual characteristics in childhood will not only appear across time but will be manifested in a number of diverse situations. In particular, a specific antisocial behavior in childhood might not predict phenotypically similar behavior in later adulthood but may still be associated with behaviors that are conceptually consistent with that earlier behavior (Caspi and Moffitt, 1992).

It is clear that prior delinquency is positively related to future delinquency. The precise nature of the relationship is currently debated (Nagin and Paternoster, 1991; Nagin and Farrington, 1992a; Nagin and Farrington, 1992b). Nagin and Farrington (1992a; 1992b) suggest two processes accounting for the strong positive correlation between past and future offending. One process implicates differences between individuals in their latent tendency to commit crime. These individual differences of criminal propensity are due to personality traits (Wilson and Herrnstein, 1985) or lasting effects of ineffective socialization (Gottfredson and Hirschi, 1990). People in this category begin offending early in life, exhibit great versatility in offending, and are more likely to offend throughout life, resulting in a positive correlation between past and future problem behavior. According to this view, repeated offending among crime-prone individuals is simply a series of continuing realizations of a relatively stable underlying crime producing process. For instance, Nagin and Farrington (1992a) discovered heterogeneity effects in the Cambridge Study in Delinquent Development data. They

concluded that persistent individual differences were the predominant cause of variation in future offending behavior.

Other views argue that past offending behavior is causally linked with future crime because of social learning, labeling, and other effects of initial crimes. These views suggest that the commission of criminal acts reduces inhibition and/or strengthens motivations to commit crime (Sampson and Laub, 1993). There are a number of specific mechanisms that can account for this state dependent effect (Paternoster et al., 1997). For instance, the commission of crimes with impunity may weaken a persons' perceptions of the certainty of punishment, weaken their bond to conventional others or their commitments to conventional roles, strengthen their affiliation with deviant others leading to increased social reinforcement for crime and more criminal opportunities, or result in labeling and one's exclusion from the normal routines of life.

As mentioned above, delinquent behavior is often initiated in early childhood. In addition, prior antisocial behavior or delinquency is one of the best predictors of future delinquency. The stability of delinquent behavior can be explained by different theoretical approaches; most studies look to interactional relationships between personal traits and social processes. Thornberry's interactional model can specify the effects of personal traits and social processes.

3. Interaction process by three categories

Thornberry (1987: 884) argues that social structural variables should be incorporated in the interactional model. Class, gender, minority-group status, and residential characteristics affect the initial values of the interactive variables as well as behavioral trajectories. For example, youths from socially disadvantaged backgrounds

may begin the process least bonded to conventional society and most exposed to delinquency. Youths from middle-class families are more likely to enter a trajectory which is strongly oriented toward conformity and away from delinquency. However, previous studies of interactional models did not sufficiently consider structural factors. Even, gender, one of the most important structural factors is sometimes overlooked. This study investigates gender effects on interactional model.

Developmental studies have suggested that there are distinctive delinquent groups with different trajectories of delinquency in the delinquent population (Patterson et al., 1992; Moffitt, 1993). The onset of delinquent behavior is an important determinant of the process leading to delinquent behaviors. The interactional models did not consider initial variation in delinquency, which is known to be stable and thought by some to be a trait. This study will consider the relations among three etiological factors based on different offending types.

Thornberry (1987) suggested that age is an important factor for understanding the development of delinquent behavior. He argued that social control variables, social learning variables, and delinquency are reciprocally related over the person's life cycle. These reciprocal relations can be conceptualized developmentally with different variables in various age periods. As already mentioned, previous studies (Thornberry et al., 1991, 1994) did not sufficiently test models covering the full range of adolescent age. This study will attempt to investigate age effects and to cover a broader range of adolescent periods. This chapter details how the relations among three predictors of delinquent behavior vary by gender, different type of offending, and age.

A. Gender and delinquent behavior

Males are more involved in delinquent and criminal activities (Wilson and Herrnstein, 1985; Steffensmeier and Allan 1995). Gender differences in delinquency are found in official statistics, self reported studies, and victimization studies (Hindelang, 1979; Hindelang, et al., 1979; Wilson and Herrnstein, 1985; Steffensmeier and Allan 1995). Gottfredson and Hirschi (1990:145) suggested that gender differences appear to be invariant over time and space. Men are always and everywhere more likely than women to commit criminal acts.

Interactional theory suggests that social structure may differently shape the delinquent process. Reciprocal relations among social control elements, social learning elements, and delinquency may vary by gender. Thornberry did not sufficiently theorize and test gender differences in his model. This section examines theoretical expectations for gender difference, drawn from previous research, and suggests three perspectives relevant to family attachment, deviant peer association, and delinquent behavior.

Trait perspectives suggest that the gender difference in delinquency is due to the difference of physical and mental traits. The classic trait perspective has been criticized as biological, psychological and physiological determinism. However, the modern trait perspective suggests that biological and psychological traits interact with social environments. Some theories suggest that hormonal differences can explain the gender gap in delinquency. Booth and Osgood (1993) argued that androgen, a male sex hormone, accounts for the male trait antisocial behaviors, such as aggression, sensation seeking, impulsivity, dominance, and lesser verbal skill. Ellis (1989) also found that females with naturally low androgen levels are less aggressive than males, whereas those who have higher levels have male traits such as aggression. Physical maturation is also related to delinquency. Glueck and Glueck (1934) suggested that girls who experience the early

onset of physical maturity are more likely to engage in antisocial behavior. This early physical maturation is also related to exposure to delinquent groups. Girls reaching puberty early increased the exposure to older adolescent boys, and in turn exhibited more antisocial behaviors (Caspi et al., 1993). Some theories mention differences in inborn aggressive traits. Males are more likely to be aggressive and they present aggression in early life (Maccoby and Jacklin, 1974).

Family structure perspectives argue that the gender difference is due to the gendered socialization processes in family. Control theories (Glueck and Glueck, 1934; Hirschi, 1969) argued that girls are less delinquent than boys because they are supervised more closely. And, girls have stronger emotional bonds to families, and thus are less free to break the law (Hagan et al., 1985; Jensen and Eve, 1976; Singer and Levine, 1988). Similarly, role theorists suggest that feminine roles restrain law violation, whereas masculine roles can encourage offending (Adler, 1975; Harris, 1977; Harris and Hill, 1982; Shover and Norland, 1978). Females traditionally are relegated to uniquely "feminine" roles that kept them at home, and are more closely supervised at school and work. Therefore, they are less likely to engage in "drinking, stealing, gang activity and fighting" (Adler, 1975:95) because they have fewer opportunities to do so. This explanation suggests that female crime arises from the same mechanisms as male crime. Thus, this perspective predicts that as females gain greater freedom and wider social participation, their involvement in crime increases and converges with that of males (Adler, 1975; Simon, 1975). However, recent studies suggest that a trend toward equality in crime is not occurring (Steffensmeier, 1978; 1980; 1989).

Social process perspectives suggest that the gender difference comes from different exposure to delinquent environments and different societal reactions. Differential association may be a critical factor in explaining gender differences in

delinquency. Sutherland and Cressey (1970) suggested that girls are less delinquent because they are less exposed to the social and situational causes of delinquency. Smith and Paternoster (1987) argued that males and females differ in their rates of delinquency because they are differentially exposed to the same delinquent conditions. In addition, males and females are differentially affected by exposure to the same conditions (Johnson, 1979). Mears et al. (1998) found that males are substantially more likely than females to have delinquent friends and males appear to be more strongly affected by delinquent peers than females.

Other explanations focus on the social reaction process by gender. Chesney-Lind (1988) suggests that girls are treated more harshly for minor offenses than boys. Girls may be more stigmatized for and more severely punished for status offenses. The delinquent label, in turn, influences self-images of youth who come to view himself or herself from standpoint of others as delinquent which increases the likelihood of future delinquency. This result is a self-fulfilling prophecy, in which the process of deviance amplification or secondary deviance creates a disproportionate number of delinquents among those disadvantaged by labeling.

As mentioned above, there are several potential explanations of gender difference. Probably, a single perspective cannot fully explain gender differences. Males and females have different delinquent or criminal traits, different socialization process, different opportunities and different societal reactions. Gottfredson and Hirschi (1990:147-149) argued that gender differences are due to difference propensity integrating with different socialization and opportunity.

Gender differences in the interactional model might be explained by a number of perspectives. All imply that male and female adolescents have different interactional trajectories. Reciprocal relations among family attachment, deviant peer association, and

delinquency vary by gender. The effects of family attachment may differ by gender. According to the family structural perspective, it is assumed that female adolescents are more likely to be influenced by family structure. According to social reaction theory, it is also assumed that delinquency of female adolescents is more likely to negatively affect family relations. Considering the relations between deviant peer association and delinquency, a male adolescent is more likely to contact deviant peers. According to trait theory, male adolescents have more delinquent or criminal potential. Thus, it is assumed male adolescents with delinquent trait or prior delinquent behavior are more likely to associate with deviant peers.

B. Two different types of offenders

Life-course studies suggest that there are at least two distinct offending groups and two distinct causal processes that explain their behavior (Patterson et al., 1992; Moffitt, 1993). One group of offenders initiates antisocial conduct early in life and persists in offending throughout life, Patterson's "early starter" and Moffitt's "life-course-persistent" offender. A second, comparatively larger group begins offending only in adolescence and desists upon entering the early adult years, Patterson's "late starter" and Moffitt's "adolescence-limited" offender. This suggests that the interactional model may vary by two different types of offenders. This study specifies the relations among social control variables, social learning variables, and delinquent behavior by group. In other words, this distinction implies that the two groups differently interact with family, deviant peer association, and delinquent behaviors. This section describes the theoretical background of Patterson's and Moffitt's theory and its implication for the interactional model.

In explaining early starter/life-course-persistent offending, both Patterson and Moffitt argue that a fundamental factor is poor or infective socialization. Patterson and his colleagues (1989; 1992) focused on the parent-child interaction sequences in the early starter process. Poor parental management practices, particularly unskilled discipline, often serve to strengthen the child's coercive behaviors. In dysfunctional families, children often initiate early problem behavior, such as fighting, temper tantrums, disobedience and stealing around ages 4 to 9. Children learn how to manipulate parental reactions to their misbehavior for short-term advantage. As a result, the behaviors of such children soon exceed the control and discipline of their overwrought parents. This negative reinforcement process develops the child's antisocial behavior. Snyder and Patterson (1986) showed that negative reinforcement processes significantly strengthen coercive child behaviors. As the training in coercion progresses, the child's performance escalates from coercive behaviors of little significance, such as noncompliance, whining and talking back to more intense amplitude behavior, temper tantrums, and hitting. In addition, children starting antisocial behaviors early have a lack of social skill due to coercive exchange with parents and poor interpersonal skills. The children are rejected by normal peer groups and they fail in school. Patterson and Yoerger (1993) found that the child who receives antisocial training from the family during the preschool and elementary years is likely to be denied access to positive socialization in peer groups and school. Patterson's coercive model explains the sequences of each stage for the early starters. Poor parenting causes early antisocial problems; this process results in weak bonding to the family. Ineffective socialization in the family leads to social maladapation, rejection from normal peer groups and failure in school. As children pass through each stage, they are placed at increased risk of continuing to the next one and, at each stage,

there is an increase both in the spectrum of antisocial behaviors and in accompanying skill deficits (Patterson et al., 1991).

Moffitt's (1993) model is similar to Patterson's. Moffitt's (1993) theory emphasizes the interaction between personal traits and environmental reactions to them. Etiological factors begin with variation of personal traits, neuropsychological functions[7]. Moffitt (1993) described several empirical findings showing that infant brain function disruption is linked to antisocial outcomes. This neuropsychological impairment is caused by several sources, such as the ontogenesis of the fetal brain, maternal drug abuses, poor nutrition, prenatal or postnatal exposure to toxic agents, and neonatal deprivation of nutrition, stimulation, and affection. Moffitt also suggests that neuropsychological impairment is usually expressed in two forms: verbal deficits and executive deficits, which are referred to as learning disabilities. Moffitt (1990) found that poor verbal and executive functions are associated with antisocial behaviors. Children with neuropsychological problems affect parents' disciplinary strategies and subsequent interactions. Parents and children resemble each other on temperament, personality and cognitive ability. These characteristics of parents and children are correlated. Parents of children with behavioral and temperamental problems are difficult to manage often lack the psychological and physical resources to cope with a difficult children (Synder and Patterson, 1987). The patterns of interaction between persons and their social environment promote antisocial continuity across time and across life domains (Caspi and Moffitt, 1995). When poorly socialized children enter schools, they are unable to contend with the demands of either their new academic or social lives. As a result, they confront

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7 By combining neuro with psychological, she refers to the extent to which anatomical structures and physiological processes within the nervous system influence psychological characteristics such as temperament, behavioral development, cognitive abilities, or all three (Moffitt, 1993: 681).

failure and social rejection. In other words, difficult young children are likely to be difficult older children and difficult adults.

In explaining late starter/adolescence-limited offending, Patterson and Moffitt have a similar explanation. Patterson (1992) believes that peer influence is a key factor initiating offending. Late starters imitate delinquency in middle to late adolescence. Unlike early starters, they lack early antisocial training and have not experienced the dual failures: academic failure and peer rejection. If adolescents experience family disruption, such as conflict with parents, change of residence, and parental unemployment, they are temporarily freed from supervision, and come into greater contact with delinquent peers. Under the influence of delinquent peers, they begin a short period of experimental delinquency. Patterson and Yoerger (1993) found that the direct cause for the ensuing delinquency is the deviant peer group for late starters. Simons et al., (1994) also found that the late starter model identifies peer influence as a significant predictor of delinquent behavior. In addition, disrupted parenting was found to be contributed indirectly to late starters' delinquency by encouraging affiliation with deviant peers.

Moffitt (1993) argued that adolescence-limited offending is normative within the general adolescent population. Adolescence limited types have more temporary involvement in antisocial behavior. Moffitt suggested that contemporary adolescents experience a maturity gap and during their teen years are chronological hostages of a time warp between biological age and social age. As adolescents begin to feel the discomfort of a strain inducing maturity gap, they desire independence from parent and school authorities. The dissonance created by the maturity gap can be relieved by acts of rebellion and assertions of independence. These acts lead adolescents to further contact with delinquent peer groups. They are motivated, mimic, and are reinforced by life course persistent youth. However, when they exit the maturity gap, they gradually experience the

loss of motivation for delinquency. Moreover, they decide to discontinue delinquency as they increasingly perceive the negative consequences of antisocial behavior.

There are common and different points in both Patterson and Moffitt's theories (Paternoster and Brame, 1997). In both, poor or ineffective socialization produces a time-stable propensity to commit delinquency. In addition, early starter/life-course-persistent has little opportunities to acquire and practice prosocial alternatives. Thus, cumulative negative consequences increase the probability of future delinquency. In Moffitt's theory, peers have no influence on the delinquent behavior of life-course-persistent offenders. Their antisocial propensities are sufficient to explain their early and continuous involvement in delinquency. However, Patterson suggests that delinquent peers have a direct causal effect on the delinquent behavior of even the most poorly socialized youth by providing already undersocialized children with the attitudes, motivations, and rationalizations to support antisocial behavior (Patterson et al., 1989). Both theories also provide similar accounts of adolescence-limited offenders/late-starters. They are adequately socialized in early adolescence and don't experience social and conventional rejection. When they exit adolescence, they gradually discontinue delinquency.

As mentioned above, the onset of delinquent behavior is an important determinant of the delinquent process. Even though both theories have focused on the transition from childhood to adolescence, they have implications for interactional models that focus on adolescence. According to both theories, adolescents who initiate early antisocial behavior have poor socialization processes in the family. Early behavior problems and poor interpersonal skills lead adolescents to have weak social bonds to their families. Moffitt (1993) argues that ineffective socialization is not likely to be modified by successful socialization later. Thus, for early starters, poor socialization and weak family bonds could be stable over time. Unlike early starters, late starters are well

socialized. They may have contemporarily weak or relatively good relations with families in adolescence. Thus, it is assumed that early starters have lower family attachment than late starters and deviant behavior of early starters is more negatively related to family attachment than to late starters. The influence of deviant peers is another important risk factor related to deviant behavior in both groups. Moffitt suggests that for life-course-persistent, antisocial propensity is more important than influence of deviant peers, but Patterson et al. (1991) suggests that both deviant peers and antisocial propensity explain early starters' delinquency. For adolescence-limited offenders/late-starters, both theories suggest that the primary cause of deviant behavior is interaction with deviant peers. Thus, it is assumed that deviant peers affect deviant behavior for both early and late starters. Interactional models focus on the dynamic process between risk factors and deviant behavior. According to both theories, interaction processes which refer to cumulative negative consequences in continued interaction with environments are more relevant for the early onset group. For the early onset group, it is assumed family and peer is more reciprocally related with delinquent behavior and that delinquent behavior is more stable. By contrast, for as late starter group, it is assumed that peer influence is the primary cause of delinquency and is not reciprocally related to delinquent behavior.

C. Age and delinquent behavior

Most studies do not devote adequate attention to age-varying effects on delinquency. By focusing on a limited teenage period, they fail to explain how delinquent behavior is initiated, continued, and interrupted across the life span. Until recently, sociological studies neglected the relations between age and delinquent behavior (Robins, 1966; McCord, 1979; Caspi et al., 1989; Farrington, 1989; Gottfredson and Hirschi, 1990; Loeber and LeBlanc, 1990; Sampson and Laub, 1993). Developmental studies propose

that age is important to understanding delinquent behavior. Considering onset, continuity, and desistence in delinquent behavior, they emphasize the importance of childhood characteristics and the link between early childhood behaviors and adult outcome. The causes of delinquent behavior differ among individuals who participate in delinquent behavior and differ over the life course (Blumstein and Cohen, 1987; Farrington, 1986a; Loeber and LeBlanc, 1990; Moffitt, 1993; Nagin and Land, 1993; Patterson and Yoerger, 1993; Sampson and Laub, 1993). This section provides theoretical background of age influence, theoretical debates about age effects, and empirical findings about age effects in the interaction model.

Crime rates rise rapidly in the teenage years to a peak at about age 16 and 18 and then decline sharply across the personal life span (Hirschi and Gottfredson, 1983; Farrington, 1986a). Even for the most persistent delinquents, however, there seems to be a "burn out" that slowly sets in by around age 30 (Arboleda-Florez and Holley, 1991). This age-crime distribution is found in self-report studies as well as official data (Elliott, et al., 1989). Hirschi and Gottfredson (1990) suggested that this pattern is invariant over different times, places, crime types, and demographic subgroups.

There are two different perspectives on the age effect. First, the age effect may be explained by the changes in a person's social situations as they get older. Matza (1964) suggested that delinquent behaviors are reduced as adolescents mature. Even the most committed delinquents or criminals are not always involved in criminality. They drift back and forth between delinquent and conventional behavior. Adolescents can commit delinquency due to the uncertainties about roles and misinformation about the attitudes of peers, but they drift back into conventional behavior as they mature. Trasler (1980) also suggested that most adolescents spontaneously desist from delinquency. As they grow older, the young discontinue delinquency because they gain access to other resources of

achievement and social satisfaction, such as a job, girl friends, a wife, a home, and children. Adult life patterns are inconsistent with delinquent activities. In addition, Sampson and Laub (1993) argued that job stability and marital attachment in adulthood were significantly related to changes in adult crime. The stronger adult ties to work and family, the less crime and deviance occurring.

Second, the age effect is thought by some to be invariant across social and cultural conditions. Hirschi and Gottfredson (1990) argued that the age-crime curve is invariant over different times, places, crime types, and demographic subgroups. They suggest that crime everywhere declines with ages while differences in crime tendency across individuals remain relatively stable over the life course. Thus, they suggested that age has a direct effect on crime that cannot be explained by social factors.

Developmental studies focus on how age is interrelated with social environment. Thornberry (1987) argued that the interactive process among social control variables, social learning variables, and delinquent behavior, develops over the person's life cycle. During early adolescence, the family is the most influential factor in bonding the adolescent to conventional society and reducing delinquency. In middle adolescence, peer group and school environment become dominant influences on delinquent behavior. In adulthood, new social environments, such as commitment to conventional activities and to family, offer a number of new ways to reshape the person's bond to society and participation in delinquency.

Thornberry (1987) argued that attachment to parents has a stronger influence on life during early adolescence, but the strength of parental influences get weaker as the adolescent grows. As predicted, Thornberry et al. (1991) found that the effects of attachment to parents on delinquency decreased. Jang and Krohn (1995) also suggested that the effects of parental supervision tend to peak during early adolescence, remain

significant, but become nonsignificant in late adolescence. Thornberry (1987) also suggested the effect of peer influence on delinquency is significant at early adolescence, continues to middle adolescence, and then declines gradually. Jang (1999) found that the effects of delinquent peer association increase from early adolescence until they reach a peak at the age of middle adolescence and then decline.

4. Hypothesis and Model construction

Family attachment, deviant peer association, and prior delinquent behavior are hypothesized to influence delinquency. Interaction theory suggests that three these factors are interrelated and embedded in a causal loop, each reinforcementing the others over time (Thornberry, 1987).

This study follows a four-step modeling sequence to examine interactional theory and its relationship to other developmental literature. First, this study will test Thornberry's interaction theory. The interaction model suggests that the fundamental cause of delinquency is weakening of the social bond. Attachment to parents directly effects delinquent behavior (Hirschi, 1969) and interrelates to the other factors. Weakening attachment to parents may facilitate deviant peer association, which in turn influences delinquency directly and indirectly (Elliott et al., 1985). Deviant peer association directly causes delinquent behavior, called a social causation hypothesis (Sutherland, 1947; Burgess and Akers, 1966; Elliott et al., 1985; Patterson, 1991). Deviant peer association also interrelates with family factors. Deviant peer association may deteriorate the social bond. Prior delinquent behavior influences future delinquent behavior (Farrington, 1989; Caspi et al., 1990; Loeber and LeBlanc, 1990). Prior delinquency also reciprocally relates to the other two factors. Prior delinquent behavior

can weaken the social bond (Agnew, 1985). Furthermore, delinquent behavior leads to deviant peer association through the social selection process (Glueck and Glueck, 1950; Hirschi, 1969; Gottfredson and Hirschi, 1990). Based on the most important assertion of the interactional models, this study tests the following hypothesis:

> H1: There are reciprocal sequences linking family attachment, deviant peer association, and delinquency.

Second, this study will examine gender effects on the three etiological factors. Thornberry (1987) mentions that relations among etiological factors vary by structural factors. He suggests that the process variables are systematically related to social class. This study investigates whether the reciprocal relations vary by gender. Males and females may have different causal processes. The effects of family factors differ by gender. Females have stronger emotional bonds to families (Hagan et al., 1985; Jensen and Eve, 1976; Singer and Levine, 1988), girls are socialized as unique feminine roles (Adler, 1975; Simon, 1975), they are more supervised at home (Glueck and Glueck, 1934; Hirschi, 1969), and thus they are less likely to commit delinquent behavior. Females and males are also differentially exposed to delinquent conditions and are affected differently by exposure to delinquent conditions (Johnson, 1979; Mears et al., 1998). Males are substantially more likely than females to have delinquent friends and males appear to be more strongly affected by delinquent peers than females. Females and males are differently affected by societal conditions. Females are more stigmatized and harshly treated than males for their delinquent behavior (Chesney-Lind, 1988). Thus, delinquent behavior differently affects social relations. Consequently, this study evaluates the following hypotheses:

H2-a: The effect of family attachment on delinquency is stronger for females than males.

H2-b: The effect of deviant peers on delinquency is stronger for males than females.

H2-c: Female delinquency has stronger negative effects on family relations than male delinquency.

Third, this study will test the effect of different offending types on three etiological factors. Developmental studies suggest that there are distinctive delinquent groups with distinctive etiologies and trajectories within the delinquent population (Patterson et al, 1989, 1992; Moffitt, 1993; Fergusson et al, 1996; Rutter et al., 1998). This study examines how reciprocal relations vary by different types of offenders, represented by onset. Developmental studies suggest at least the two different offending types: early starters/ life-course persistent and late starters/ adolescent-limited. Those who begin delinquency early are more likely to commit delinquency and crime throughout life (Farrington, 1991; Loeber, 1996). This may be due to genetic differences (Moffitt, 1993) or serious problems in early socialization (Patterson, 1982) among early starters that lead them to select deviant peers (Patterson et al., 1991). The late onset group exhibits moderate levels of risk and greater protective factors in the individual and family domain, compared to early starters (Moffitt, 1993; Patterson and Yoerger 1993). Late starters are more subject to late influences, so that family factors are less salient and deviant peers are more significant in their delinquent careers (Patterson, et al., 1991; Simons et al., 1994). Distinctive etiologies lead to different delinquent trajectories in two groups. Early starters encounter antisocial influence in various domains that reinforce delinquency. Thus, family and deviant peers may be more reciprocally related with delinquent behavior among them. For late starters, deviant peers are likely to be the primary cause of delinquency and the relationship is unidirectional. This study tests the following hypotheses:

H3-a: Early starters have more stable levels of delinquency than late starters.

H3-b: The delinquency of early starters is primarily influenced by family attachment and deviant peers, whereas the delinquency of late starters is mainly influenced by deviant peers.

H3-c: For early starters, family attachment and deviant peers are reciprocally related to delinquency, whereas for late starters, the relations between deviant peers and delinquency are unidirectional.

Fourth, this study tests age effects on three etiological factors. The relations among three factors may vary by developmental stage. Thornberry (1987) argued that attachment to parents has a stronger influence on the life of youth during early adolescence than it does at later ages because the family is the most salient arena for social interaction and involvement and parents play a key role in controlling the behavior of youth at these relatively early ages. However, he argues that the overall strength of parental influence get weaker at the ages of middle adolescence as the center of the youth's activities gradually move from home to school and peer network. Thornberry (1987) argued that the effects of peers also vary by age group. He suggested that peers have direct and indirect effect on delinquent behavior at early adolescence. The impact of delinquent peers will continue to grow as social influence shifts from family to peer network during middle adolescence. This study tests the following hypotheses:

H4-a: The effects of family influence on committing delinquency diminish as the adolescent grows.

H4-b: The effects of deviant peer association diminish as the adolescent grows.

In constructing models to examine Thornberry's interactional theory and the above hypotheses, some procedural assumptions are made. The predictors, family attachment and deviant peer association, are assumed to have instaneous or contemporaneous effects. Three variables from prior periods become predictors in the

next wave. Prior family attachment and deviant peer association have cross-lagged effects on the same variables and on each other in the next waves. However, these two variables are not assumed to influence next wave delinquent behavior since the instaneous effects are clearly larger than lagged effects (Agnew, 1991). Prior delinquent behavior is assumed to have lagged effects on next wave family attachment, peer association, and deviant behavior. Finally, social structural characteristics of respondents are incorporated into delinquent process across time. It is assumed that gender, race, residence, and income predict all subsequent variables. According to the above hypotheses, this study proposes the theoretical model as following (Figure 2):

Figure 2. Theoretical model of reciprocal relationships among family attachment, deviant peer association, and delinquency across 4 waves
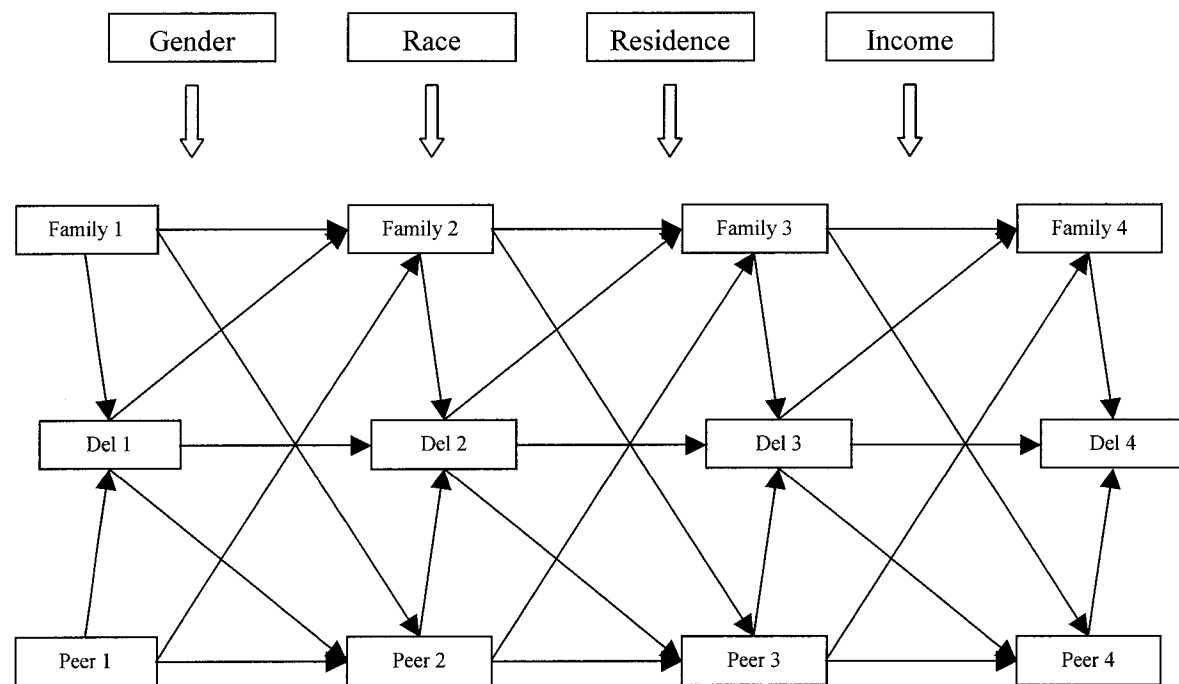
CHAPTER III. METHODS

1. Data

The National Youth Survey (NYS) was designed to examine delinquent behavior, alcohol and drug use in the American youth population (Elliott, 1983). Employing a self-weighting multistage cluster sampling frame work, the NYS obtained a national probability sample of households in the United States in 1976. After the sampling geographic units, 7,998 households were randomly selected and all 2,360 eligible youths living in households were included. Seventy-three percent of those youth, 1,725, participated in the survey. The survey was expanded to a seven-wave panel study by collecting data in 1976, 1977, 1978, 1979, 1980, 1983, and 1987. NYS data has several advantages. The NYS is nationally representative. Most longitudinal datasets are limited to a certain area, thus it is hard to generalize to the national population. The NYS provides a broad range of delinquent behavior, including all levels of seriousness. Many datasets have only males, or overrepresent the male population. However, NYS data includes females in proportion to the male population. Many longitudinal datasets have the disadvantage of covering a limited time period and a limited range of ages. It is sometimes difficult to examine transition in delinquent behavior. The NYS covers a broader age range over a decade.

2. Sample

The total panel contained 1,725 youth aged 11-17 in 1976. This study used a sub-sample of NYS data, which was selected to include age 12 to age 14 in 1977. To maintain

measurement consistency and time period equivalency, this study used data from 1977, 1980, 1983, and 1987. Providing equally spaced three-year intervals between waves, the effective sample size is reduced to 778 adolescents, who are between 12 and 14 years of age in 1977. Three age-cohort groups consist of 252 (32.4 %) of age 12, 257 (33.0 %) of age 13, and 269 (33.6 %) of age 14. This study examines the development of delinquent behavior of these cohorts. The respondents were in early adolescence at wave 1, in middle adolescence at wave 2, in late adolescence at wave 3, and in early adulthood at wave 4. The gender composition is 390 males (50.1%) and 388 females (49.9%). Other demographic variables are measured using 1976 data, the first wave of NYS data. Race is categorized as 'Anglo', 'Black', 'Chicano', 'American Indians', 'Asian', and 'others'. This study coded race as white and non-white. The race composition is 599 white (77%) and 179 non-white (23%). NYS data categorized residence as rural, suburban, and urban area. This study used this category of residence, which is measured as a continuum from rural (-1), to suburban (0) to urban (1). This continuum may reflect an underlying factor such as population density. The residence consists of 218 rural (28.0%), 340 suburban (43.7%), and 219 urban (28.2%). Family income is categorized as 1=$ 6,000 or less, 2=$ 6,001-10,000, 3=$ 10,001-14,000, 4= $ 14,001-18,000, 5= $ 18,001-22,000, 6= $ 22,001-26,000, 7= $ 26,001-30,000, 8=$ 30,001-34,000, 9=$ 34,001-38,000, and 10= $ 38,001 and more. The mean of family income in 1977 is 4.02, which translates into about $ 16,000.

This study identified the onset of delinquent behavior. Patterson et al. (1991) and Patterson and Yoerger (1993) suggested that early starters are involved in delinquent behavior by age 13 or 14. This study defined the different offender types using the onset of delinquent behavior at wave 1. The age definition of early onset of delinquent behavior is somewhat arbitrary, but the period between age 12 to 14 can be regarded as the early

onset of delinquent behavior. Early starters are defined as exhibiting of delinquent behavior at wave 1. The range of delinquent behavior at wave 1 is 0 to 28.17 and this study regards non-delinquent as the score of delinquent behavior from 0 to 1. Thus, early starters are measured as having delinquent behavior scores over 1 at wave 1. Late starters are defined as those who initiated delinquent behavior in wave 2, wave 3 or wave 4. The different offender types consist of 209 non-delinquent (26.9 %), 219 early starters (28.1 %), and 267 late starters (34.3%).

3. Measurement of variables

A. Delinquency

The NYS has strong advantages for measuring delinquent behavior. Many prior studies have failed to distinguish minor from serous delinquent behaviors and have failed to provide clear response categories (Elliott et al., 1985). The NYS provides a broad range of delinquent behaviors at all levels of seriousness. The NYS suggests two types of delinquent scales: Offense-specific and offense-category scales (Elliott et al., 1985, 1989). Offense-specific scales include felony assaults, minor assaults, robbery, felony theft, minor theft, vandalism, and drug use. Offense-category scales contain illegal services, public disorder, status offense, crimes against persons, and general theft. This study selected five offense-specific scales: felony assault, minor assault, robbery, felony theft, and minor theft and two offense-category scales: illegal services and public disorder/status offense (Appendix 1.A). Each scale consists of three or four items which represent the degree of seriousness. Each item is coded as: 0=never; 1=once or twice a year; 2=once or twice every 2-3 months; 3=once a month; 4=once every 2-3 week; 5=once a weak; 6= 2-3 times a week; 7=once a day; 8=2-3 times a day. Respondents were

asked how often in the last year they did one of each item. Delinquent behavior in this study is calculated as following (Appendix 2): first, each scale is calculated as the means of each item, where each item is weighted by the levels of seriousness. Second, each of the resulting seven scales is also weighted by the level of seriousness. Third, delinquent behavior is calculated as the sums of the seven scales. The internal consistency coefficient alpha of the seven scales is .76 at wave 1, .80 at wave 2, .73 at wave 3, and .68 at wave 4. Table 1 presents the mean scores of deviant behavior across 4 waves. Deviant behavior increases until the peak at middle adolescence (2.13) and then declines. Table 2 represents different mean scores by gender. As table 2 shows, male adolescents are more involved with deviant behavior than female adolescents across over time. Table 3 shows mean scores by different types of offenders. Means scores of the late starter group in wave 1 should be 0, but in this study, trivial deviant behaviors are regarded as non-delinquent behavior. Thus, the mean score of late starters in wave 1 (.21) is also presented. Table 3 indicates that the early starter group is significantly more involved with deviant behavior than late starter over 4 waves.

B. Family attachment

Family attachment has generally been measured using the extent to which positive emotional ties exist among family members (Hirschi, 1969; Liska and Reed, 1985; Thornberry, 1991). In this study, family attachment was measured by how close the respondents say they are to their parents. The items of family attachment are importance of parents' influence, family activities, the amount of parental warmth, and parental support (see Appendix 1.B). Family attachment is calculated as the mean of 4 items. The response categories are 1=strongly disagree, 2=disagree, 3=neither, 4=agree, and 5=strongly agree. Factor analysis indicates that they form a single factor and reliability

analysis shows the variable has acceptable internal consistency at each wave. The coefficient alpha is .66 at wave 1, .72 at wave 2, .82 at wave 3, and .85 at wave 4. Table 1 presents the mean scores of family attachment through 4 waves. The mean score is the highest at wave 1 (4.27) and the lowest at wave 4 (4.16). Table 2 illustrates the difference of mean scores by gender. The mean scores of family attachment by gender are not significantly different over the 4 waves. Table 3 presents the mean scores by offender types. The mean scores of the early starter group are lower than the late starter group from wave 1 to wave 3. However, there is no significant difference at wave 4.

C. Deviant peer association

Deviant peers association was measured by asking respondents how many of their friends have engaged in delinquent acts. The list of delinquent acts included cheating on school tests, destroying property, using marijuana, stealing something under $5, hitting someone, breaking into vehicles, selling hard drugs, stealing something over $50, suggesting you break law, getting drunk, using prescription drugs, and giving or selling alcohol (see Appendix 1.C). The response categories are 1=none, 2=very few, 3=some of them, 4=most of them, and 5=all. Deviant peer association is calculated as the mean of items. The coefficient alpha is .84 at wave 1, .89 at wave 2, .86 at wave 3, and .84 at wave 4. Table 1 presents the mean scores of deviant peer association across 4 waves. The lowest point is at wave 1 (1.47) and the highest point is at wave 3 (1.77). Table 1 shows that deviant peer association increases to middle adolescence and then slightly declines in early adulthood. Table 2 presents different means scores by gender. As table 2 shows, male adolescents are more exposed to deviant peers than female adolescents across time. However, there is no significant difference at wave 2. Table 3 represents mean scores by

Table 1. Descriptive statistics of family attachment, deviant peer association, and delinquency

		Wave 1	Wave2	Wave3	Wave 4
Delinquency					
	N	742	703	695	587
	Mean (Std. Dev)	1.18 (2.78)	2.13 (4.53)	1.40 (2.86)	1.23 (2.46)
	Reliability α (N)	.76 (22)	.80 (22)	.73 (22)	.68 (18)
Family attachment					
	N	743	675	573	379
	Mean (Std. Dev)	4.27 (.57)	4.19 (.62)	4.21 (.70)	4.16 (.78)
	Reliability α (N)	.66 (4)	.72 (4)	.82 (4)	.85 (4)
Deviant Peer					
	N	655	689	671	611
	Mean (Std. Dev)	1.47 (.46)	1.76 (.62)	1.77 (.53)	1.68 (.45)
	Reliability α (N)	.84 (13)	.89 (13)	.86 (14)	.84 (14)

Table 2. Descriptive statistics family attachment, deviant peer association, and delinquency by gender

	Wave 1			Wave 2			Wave 3			Wave 4		
	Females	Males	t value	Females	Males	t value	Females	Males	T value	Females	Males	t value
Delinquency												
N	372	370		351	352		352	343		288	299	
Mean	.66	1.70	5.17**	1.60	2.65	3.08**	.73	2.10	6.51**	.55	1.89	6.86**
Std. Dev	1.29	3.64		3.86	5.07		1.84	3.51		1.48	2.99	
Family attachment												
N	371	372		325	350		263	310		176	203	
Mean	4.25	4.29	.94	4.23	4.16	-1.47	4.28	4.16	1.97	4.13	4.17	.49
Std. Dev	.61	.52		.65	.58		.71	.69		.87	.71	
Deviant Peer												
N	339	316		343	346		337	334		321	290	
Mean	1.40	1.51	4.13*	1.71	1.80	1.94	1.68	1.86	4.37**	1.59	1.78	5.34**
Std. Dev	.43	.48		.61	.63		.48	.57		.40	.49	

P ** <.005, P *<.05

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Table 3. Descriptive statistics of family attachment, deviant peer association, and delinquency by different types of offending group

		Wave 1			Wave2			Wave3			Wave 4		
		Early	Late	*t value*	Early	Late	*t value*	Early	Late	*T value*	Early	Late	*t value*
Delinquency													
	N	219	267		207	258		206	261		176	214	
	Mean	3.52	.21	12.74**	4.36	2.03	4.84**	2.62	1.52	3.64**	2.15	1.45	2.50*
	Std. Dev	4.24	.25		6.91	3.09		4.14	2.31		3.35	2.13	
Family attachment													
	N	216	264		190	251		165	220		107	143	
	Mean	4.09	4.35	-.5.04**	4.01	4.21	-3.36**	4.01	4.21	-2.75*	3.99	4.14	-1.41
	Std. Dev	.63	.52		.68	.60		.76	.67		.90	.71	
Deviant Peer													
	N	191	236		202	254		198	251		183	221	
	Mean	1.79	1.37	9.26**	2.09	1.79	5.06**	1.98	1.86	2.50*	1.88	1.74	3.17*
	Std. Dev	.56	.35		.70	.58		.56	.53		.53	.39	

P ** <.005, P *<.05

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different types of offenders. Table 3 shows that the early starter group is significantly more exposed to deviant peers than the late starter group over all 4 waves.

4. Missing data analysis

One of the problems of panel studies is missing data and respondent attrition. Respondents occasionally skip items in one or more data collection periods or they may drop out of the study for a variety of reasons. This data missingness may risk the validity of study. This section describes types of missing data, examines the missing pattern in the sample, and provides a method to treat missing data.

The number of respondents providing complete data gradually declines from wave 1 to wave 4. The numbers of cases with reports of delinquency are 742, 703, 695 and 587 in wave 1, wave 2, wave 3, and wave 4, respectively. The cases of deviant association are 655, 689, 671, and 611. The same numbers for family attachment are 743, 675, 573, and 379. By wave 4, only 49 % of all respondents provided 4 waves of data about family attachment. Thus, it is necessary to examine the patterns of missing cases.

Table 4 presents the missing patterns among the variables, using SPSS 10 Missing Value Analysis module. It presents the number of the observed cases between the first column (present variable) and the second column (missing variable), the number of missing cases of the second column excluded of valid cases of first column, and a result of t test of the significantly difference of means between observed and missing cases over 5% missing values[8]. Regarding the missing pattern of delinquency, residence, race, income, and prior delinquency are related to missing cases of delinquency. Adolescents living in urban areas are less likely to respond to delinquency at wave2. Adolescents with

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8 The missing patterns of all variables are presented in Appendix 3.

Table 4.T-tests for the difference between observed cases and missing cases among family attachment, deviant peer association, and delinquency

Variable (Present)	Variable (Missing)	N (Present)	N (Missing)	Mean (Present)	Mean (Missing)	T value
Residence	Delinquency 2	702	75	-.017	.17	-2.1
Income	Delinquency 3	661	80	3.95	4.61	-2.3
Race	Delinquency 4	587	191	.20	.33	-3.5
Income	Delinquency 4	566	175	4.11	3.72	2.0
Delinquency 2	Delinquency 4	567	136	1.93	2.94	-2.2
Gender	Peers 1	655	123	1.52	1.40	2.5
Income	Peers 1	630	111	4.11	3.49	3.1
Family attach 2	Peers 1	580	95	4.21	4.07	2.0
Family attach 3	Peers 1	486	87	4.25	4.03	2.4
Family attach 4	Peers 1	328	51	4.20	3.85	2.3
Residence	Peers 2	688	89	-.025	.20	-2.7
Family attach 4	Peers 3	363	16	4.18	3.63	2.2
Gender	Peers 4	611	167	1.53	1.40	2.9
Race	Peers 4	611	167	.20	.32	-3.0
Gender	Family attach 2	675	103	1.48	1.61	-2.5
Delinquency 1	Family attach 2	659	83	1.05	2.20	-2.2
Delinquency 4	Family attach 2	549	38	1.16	2.26	-2.1
Peers 4	Family attach 2	565	46	1.67	1.88	-2.8
Age	Family attach 3	573	205	12.95	13.22	-4.2
Gender	Family attach 3	573	205	1.46	1.61	-3.8
Delinquency 1	Family attach 3	555	187	1.02	1.65	-2.0
Delinquency 2	Family attach 3	549	154	1.83	3.17	-2.7
Peers 2	Family attach 3	540	149	1.73	1.87	-2.3
Family attach 1	Family attach 3	554	189	4.30	4.16	2.7
Family attach 2	Family attach 3	540	135	4.24	3.99	3.7
Age	Family attach 4	379	399	12.94	13.10	-2.8
Income	Family attach 4	362	379	4.28	3.77	3.1
Family attach 2	Family attach 4	362	313	42.4	4.13	2.2

Note: Gender (1=male, 2=female), Race (0=white, 1=non-white), Residence (-1=rural, 0=suburb, 1=urban)

higher income are less likely to respond to delinquency at wave3. Non-white adolescents, adolescents with lower income, and with higher delinquency at wave 2 are less likely to respond to delinquency at wave 4.

The missing cases of deviant peer association are related to gender, race, residence, income and family attachment. Male adolescents, adolescents with lower income and lower family attachment at wave 1, wave 2, and wave 3 are less likely to respond to deviant peer association at wave 1. Adolescents living within urban areas are less likely to respond to deviant peer association at wave2. Adolescents with lower family attachment at wave 4 are less likely to respond to deviant peer association at wave 3. Male and non-white adolescents are less likely to respond to deviant peer association at wave 4. As results show, family attachment has the strongest relationship to missing cases of deviant peer association.

The missing cases of family attachment are related to several variables. It is related to age, gender, income, delinquency, deviant peer association, and prior family attachment. Female adolescents, adolescents with higher delinquency at wave 1 and at wave 4, and with higher deviant peer association are less likely to respond to family attachment at wave 2. Older, female adolescents, adolescents with higher delinquency at wave 1 and at wave2, with higher deviant peer association at wave 2, and with lower family attachment at wave 1 and 2 are less likely to respond to family attachment at wave 3. Older, adolescents with lower income, and with lower family attachment at wave 2 are less likely to respond to family attachment at wave 4.

Missing data are distinguished as three types (Rubin, 1976; Little and Rubin, 1987): Missing completely at random (MCAR), missing at random (MAR), and nonignorable missing (NI). MCAR means that the missing data are entirely unrelated statistically to the observed values. MAR means that missingness and data values are

statistically unrelated, conditional on a set of predictors. If an observed variable is predictive of missing data, MAR can be established. NI means that missingness depends on unobserved cases beyond all the information given in the observed data. It means that the resources for the nonresponse are unknown or are related to unobservable variables. The results show that missingness of data is specifically related to variables.

One of the methods to treat incomplete data set is listwise deletion, which eliminates any observations where some data value is missing. Listwise deletion could lead one to ignore valuable information and produce bias in estimates. An alternative to listwise deletion is imputation, in which missing values are replaced with values estimated from all available data. Full information maximum likelihood (FIML) is one method of imputation. FIML draws from Little and Rubin's (1987) theory and is based on the assumption that data are MAR; that is, the missing data can be predicted from observable variables. FIML assumes multivariate normality and maximizes the likelihood of the model given the observed data. FIML utilizes all available information that is complete and produces several covariance matrices that are incorporated into a maximum likelihood function to produce a solution. FIML method estimates will tend to be less biased than other methods (Little and Rubin, 1989; Schafer, 1997). This study estimates FIML values using the AMOS 4.0 program (Arbuckle and Wothke, 1999).

CHAPTER IV. RESULTS

The purpose of this study is to test Thornberry's interactional model. The study hypothesizes that three factors, family attachment, deviant peer association, and delinquency are related reciprocally. In addition, the relations can vary by the effects of gender, different offending types, and age effects. This analysis is estimated using AMOS and employs a FIML structure equation model.

1. Testing Thornberry's theory with all data

The first step is to estimate the theoretical model after controlling the social structural variables of gender, race, residence, and income. Social structural variables are exogenous variables assumed to be correlated each other. These variables predict the family attachment, deviant peer association, and delinquency across 4 waves. This allows structural variables to explain the changes of the three etiological factors over time. This study expects that the residuals of three etiological variables are correlated to each other. It is assumed that the residual of family attachment is correlated to that of deviant peer association in each wave. In addition, the residuals of three etiological variables are correlated over time. It is assumed that the residuals of family attachment, deviant peer association, and delinquency at wave 1 are correlated to those at wave 3 and at wave 4 and the residuals of these variables at wave 2 are correlated to those at wave 4. This measurement strategy is applied to estimate subsequent models.

Table5 Autoregressive model for relations among family attachment, deviant peer association, and delinquency for all sample (N=778)

Predicted variables	Response variables											
	Family 1	Peer 1	Del1	Family2	Peer 2	Del 2	Family3	Peer 3	Del 3	Family 4	Peer 4	Del 4
Gender	-.034	-.154**	-.115**	.017	.006	-.034	.008	-.128**	-.136**	-.030	-.121**	-.146**
Race	.022	-.006	-.101**	.094*	-.163**	.037	.086*	.041	-.004	.034	-.143**	-.023
Residence	-.016	.106*	.082*	-.050	.092*	.025	-.104**	.025	.030	-.086*	.095**	-.014
Income	.038	-.013	-.114**	.071	.003	-.073*	.056	.069*	-.064*	.105*	-.015	-.010
Family 1			-.057	.387**	-.080*							
Peer 1			.470**	-.142**	.418**							
Del 1				-.047	.122**	.239**						
Family 2							-.069*	.478**	.003			
Peer 2							.489**	-.127**	.564**			
Del 2							-.014	.027	.227**			
Family 3										-.020	.482**	-.055
Peer 3										.440**	-.050	.427**
Del 3										.020	.065	.215**
Family 4												-.099*
Peer 4												.332**

χ² (24) =37.97 (p=.035), RMSEA=.027 (.007, .043)
P ** <.005, P *<.05
Note: Gender (1=male, 2=female), Race (0=white, 1=non-white), Residence (-1=rural, 0=suburb, 1=urban), Coefficients are standardized.

The results are presented in table 5 (See, also Appendix 4.A). The chi-square test for the model indicates that it is significant, indicating a poor fit of the model to the data $(\chi^2_{(24)} = 37.97; p = .035)$[9]. However, the RMSEA fit index[10] indicates that the model provides a good fit.

For the model, male adolescents are more likely to associate with deviant peers (-.154) and commit delinquent behavior (-.115) at wave 1. In addition, for male adolescents, the association of deviant peers is significantly increased at wave 3 (-.128) and at wave 4 (-.121) and delinquent behavior is significantly increased at wave 3 (-.136) and wave 4 (-.146). This results shows that gender is an important factor differentiating developmental trajectories.

White adolescents are more likely to commit delinquent behavior at wave 1 (-.101). Also, for white adolescents, deviant peer association is increased at wave 2 (-.163) and at wave 4 (-.143). For non-white adolescents, family attachment at wave 2 (.094) and at wave 3 (.086) is increased in comparison to a prior wave.

Adolescents living in urban areas are more likely to associate with deviant peers (.106) and commit delinquent behaviors (.082) at wave 1. For adolescents living in urban areas, deviant peer association is significantly increased at wave 2 (.092) and wave 4 (.095). By contrast, for adolescents living in rural areas, family attachment is increased at wave 3 (-.104) and at wave 4 (-.086). Adolescents with lower income are more likely to commit delinquency at wave 1 (-.114). For adolescents with lower income, delinquency is

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9 The chi-square test generally tends not to be good fit index since the value increases when the sample size increases (Bollen and Long, 1993).

10 The root means square error of approximation (RMSEA) assesses relative fit per degree of freedom (Steiger, 1990). It is defined as

$$RMSEA = [\max\{(F/d - 1/n - 1), 0\}]^{1/2},$$

where F is the minimized value of the fit function, d is degrees of freedom, n is the sample size, and the statistics has a lower bound of zero. The values of RMSEA are less or equal to .05 indicating a good fit. Generally, the values of RMSEA in the interval (.05, .08) are acceptable range.

increased at wave 2 (-.073) and at wave 3 (-.064). For adolescents with higher income, deviant peer association is increased at wave 3 (.069).

The interactional model hypothesizes that three etiological factors are reciprocally related. Family attachment has inverse effects on delinquency at wave 2 (-.069) and wave 4 (-.099). Thornberry (1987) suggested that attachment to parents has a stronger influence on the life of early adolescence. However, this study shows that family attachment is an important predictor in the highest delinquent rate periods and it is a predictor in adulthood. In addition, the results show no reciprocal effect between family attachment and delinquency as evidence by the lack of significant coefficients linking delinquency a one time to family attachment at the next time.

Family attachment has an indirect effect on delinquency through peer group association. Family attachment at wave 1 has a lagged effect on deviant peer association at wave 2 (-.080), which in turn influences delinquent behavior at wave 2 (.489). This finding suggests that weak family bonding increases deviant peer association, which in turn leads to delinquency (Elliott et al., 1985). The reciprocal effect between family attachment and deviant peer association has been found. Family attachment at wave 1 has a negative effect on deviant peer association (-.080), which influences the family attachment at wave 3 (-.127).

Deviant peer association has direct effects on delinquency at wave 1 (.470), wave 2 (.489), wave 3 (.440), and wave 4 (.332). This is consistent with Elliott et al.'s (1985) argument that delinquent peer association is the most important proximate cause of delinquency. The interactional model hypothesizes that deviant peer association and delinquency are related reciprocally. Deviant peer association at wave 1 has direct effect on delinquent behavior at wave 1 (.470), which influences deviant peer association of wave 2 (.122), which in turn directly affects delinquency at wave 2 (.489). The results

show that there are causal looping relations between deviant peer association and delinquency. Deviant peer association has a lagged effect on family attachment. Deviant peers at wave 1 have negative effect on family attachment at wave 2 (-.142) and deviant peers at wave 2 also negatively influence family attachment at wave 3 (-.127). This shows that deviant peer association decreases family bonds.

Family attachment has relatively weak effect on delinquency compared to the effect of deviant peer association. Family attachment has no reciprocal effect on delinquent behavior. However, family attachment is reciprocally related to deviant peer association. Poor family attachment tends to increase deviant peer association, which in turn weakens future family attachment. Deviant peer association directly influences deviant behavior. In addition, there is a reciprocal effect between deviant peer association and deviant behavior. Deviant peer association increases delinquency, which in turn enhances future deviant peer contact.

2. Gender difference in the interactional model

This study hypothesizes that interactional relations among family attachment, deviant peer association, and deviant behavior vary by gender. To specify the gender effects on interactional relations among three etiological factors to delinquent processes, females and males are separately estimated using the same model. The results for the female sample are presented in table 6 (See, also Appendix 4.B). The RMSEA fit index is .050, which indicates that the model is a good fit to the data.

Table 6 Autoregressive model for relations among family attachment, deviant peer association, and delinquency for females

(N=388)

Predicted variables	Response variables											
	Family 1	Peer 1	Del1	Family2	Peer 2	Del 2	Family3	Peer 3	Del 3	Family 4	Peer 4	Del 4
Race	.051	.097	-.082	.152**	-.187**	-.005	.118**	.019	.041	.043	-.086	-.025
Residence	.002	.055	.072	-.117*	.073	.039	-.062	.038	-.006	-.061	.074	-.020
Income	.075	.075	-.080	.104*	-.049	-.142**	.114**	.143**	-.035	.105	.005	-.119*
Family 1			-.138**	.392**	-.043							
Peer 1			.460**	-.078	.418**							
Del 1				-.093	.183**	.148**						
Family 2						-.121*	.470**	.015				
Peer 2						.468**	-.079	.582**				
Del 2							-.148*	-.064	.319**			
Family 3									.023	.636**	-.028	
Peer 3									.378**	-.005	.417**	
Del 3										.079	.053	.272**
Family 4												-.155*
Peer 4												.282**

$\chi^2(24) = 47.00$ (p=.003), RMSEA=.050 (.028, .071)

P ** <.005, P *<.05

Note: Race (0=white, 1=non-white), Residence (-1=rural, 0=suburb, 1=urban), Coefficients are standardized.

A. Female model

The effects of social structural variables except gender are also estimated in this model. White adolescents are more likely to associate with deviant peers at wave 2 (-.187). On the contrary, non-white adolescents are more likely to be attached to the family at wave 2 (.152) and family attachment is increased at wave 3 (.118) compared to wave 2. Adolescents living in rural areas are more likely to have strong the family bonds (-.117). Adolescents with higher income are more likely to be attached the family at wave 2 (.104) and family attachment is increased at wave 3 (.114). Adolescents with lower income are more likely to commit deviant behavior at wave 2 (-.142) and deviant behavior is increased at wave 4 (-.119).

Family attachment has directly negative effect on delinquent behavior at wave 1 (-.138), wave 2 (-.121) and wave 4 (-.155). On the contrary, delinquent behavior has a lagged effect on future family attachment. The result shows causal looping relations between family attachment and delinquency. Family attachment at wave 2 directly influences delinquent behavior at wave 2, which in turn has a lagged effect on family attachment at wave 3 (-.148).

Deviant peer association has direct effect on delinquency at wave 1 (.460), wave 2 (468), wave 3 (.378), and wave 4 (.282). In addition, deviant behavior at wave 1 has a lagged effect on deviant peer association at wave 2 (.183). This shows that there are also reciprocal effects between deviant peer association and delinquency. Deviant peer association at wave 1 directly influences delinquent behavior at wave 1, which in turn has a lagged effect on deviant peer association at wave 2. This deviant peer association directly influences delinquent behavior at wave 2.

Table 7 Autoregressive model for relations among family attachment, deviant peer association, and delinquency for males

(N=390)

Predicted variables	Response variables											
	Family 1	Peer 1	Del 1	Family2	Peer 2	Del 2	Family3	Peer 3	Del 3	Family 4	Peer 4	Del 4
Race	-.010	-.126*	-.093	.012	-.140*	.078	.046	.060	-.035	-.016	-.211**	-.025
Residence	-.038	.160**	.089	.028	.106*	.009	-.146**	.010	.049	-.094	.117*	-.012
Income	-.002	-.111	-.118*	.029	.056	-.018	-.019	.006	-.080	.070	-.039	.047
Family 1				-.081	.363**	-.071						
Peer 1				.498**	-.215**	.378**						
Del 1				-.034	.137*	.272**						
Family 2							-.026	.481**	-.026			
Peer 2							.502**	-.156*	.573**			
Del 2							.056	.085	.187**			
Family 3										-.068	.317**	-.081
Peer 3										.488**	-.099	.450**
Del 3										-.016	.063	.183**
Family 4												-.092
Peer 4												.357**

$\chi^2 (24) =29.42$ (p=.205), RMSEA=.024 (.000, .050)

P ** <.005, P *<.05

Note: Race (0=white, 1=non-white), Residence (-1=rural, 0=suburb, 1=urban), Coefficients are standardized.

B. Male model

The results for the male sample are presented in table 7 (See, also Appendix 4.C). The RMSEA fit index is .024, which indicates that the model is a good fit of data. Social structural variables are related to the delinquent process. Non-white adolescents are more likely to associate with deviant peers at wave 1 (-.126). Furthermore, the association of deviant peers is increased at wave 2 (-.140) and wave 4 (-.211) compared to the prior wave. Adolescents living in urban areas are more likely to associate with deviant peers at wave 1 (.160). For urban adolescents, deviant peer association is increased at wave 2 (.106) and at wave 4 (.117). By contrast, adolescents living in rural areas are more likely to have attachments to family at wave 3 (-.146). Adolescents with lower incomes are more likely to commit deviant behavior (-.118) at wave 1.

The male sample has significant paths that are different from the female sample. The results show that there are no significant direct and lagged effects of family attachment on delinquent behavior. Family attachment is not a good predictor of delinquent behavior in the male sample.

Deviant peer association has direct effects on delinquency at wave 1 (.498), wave 2 (.502), wave 3 (.488), and wave 4 (.357). Conversely, delinquent behavior at wave 1 has a lagged effect on deviant peer association at wave 2 (.137). This result indicates that there are reciprocal effects between deviant peer association and delinquency; that is, deviant peer association at wave 1 influences delinquent behavior at wave 1, which in turn has a lagged effect on deviant peer association at wave 2. Deviant peer association directly influences delinquent behavior at wave 2.

Deviant peer association at wave 1 and 2 also has lagged effects on family attachment at wave 2 (-.215) and wave 3 (-.156). This path indicates that for the male

sample, association with deviant peers rather than delinquent behavior is negatively related to family attachment.

C. Comparing male and female models

This study hypothesizes that delinquent processes vary by gender. The hypothesis (H2-a) states that the effect of family attachment on delinquency is stronger for females than males. The results support this hypothesis. For the female sample, family attachment directly affects deviant behavior in early adolescence, middle adolescence, and early adulthood. For the male sample, family attachment has no direct effect on deviant behavior. In addition, females and males have different reciprocal relationships. For the female sample, family attachment affects delinquency within middle adolescence, which in turn influences family attachment in late adolescence. For both the female and the male sample, deviant peers directly affect delinquency within early adolescence, which in turn affects deviant peers in middle adolescence.

The hypothesis (H2-b) posits that the effect of deviant peers on delinquency is stronger for males than females. As the results show, the standardized coefficients of deviant peer associations on delinquency for males are stronger than those for females across 4 waves (.460, .468, .378, .282, for female and .498, .502, .488, .357 for male). Thus, male adolescents are influenced by deviant peers more than female adolescents. This hypothesis is supported.

The hypothesis (H2-c) suggests that female delinquency has stronger negative effect on family relations than male delinquency. As mentioned above, for female adolescents, deviant behavior in middle adolescence affects family attachment in late adolescence, whereas for male adolescents, there are no effects of deviant behavior on family attachment. It seems that delinquency has a stronger negative effect on females'

family relations than it does for male adolescents. Thus, this hypothesis is confirmed. However, the cause of weakened family attachment is different for male adolescents. For male adolescents, deviant peer association negatively affects family attachment. That is, for male adolescents, deviant peer association rather than delinquency weakens family relations.

3. Different between early and late starters

This study hypothesizes that interactional relations among family attachment, deviant peer association, and deviant behavior vary by different offending type. The model of early starter group and late starter group are separately estimated. The variables of family attachment, deviant peer association, and delinquency at wave 1 are omitted in the model for the late starter group. The results for early starter group are presented in table 8 (See, also Appendix 4.D). The RMSEA fit index is .046, which indicates that the model is a good fit of data.

A. Early starter model

Social structural variables are related to the delinquent process of early starter groups. Male adolescents are less likely to be attached to the family (-.147) and are more likely to commit deviant behavior (-.158) at wave 1. For male adolescents, the association of deviant peers is increased at wave 3 (-.150) and deviant behavior is also increased at wave 3 (-.162) compared to the previous wave. Considering race difference, for white adolescents, the association of deviant peers is increased at wave 2 (-.187) and wave 4 (-.164). By contrast, for non-white adolescents, family attachment is increased at wave 3 (.191) compared to the prior wave. For rural adolescents, family attachment is increased

Table 8 Autoregressive model for relations among family attachment, deviant peer association, and delinquency for early starters

(N=219)

Predicted variables	Response variables											
	Family 1	Peer 1	Del1	Family2	Peer 2	Del 2	Family3	Peer 3	Del 3	Family 4	Peer 4	Del 4
Gender	-.147*	-.088	-.158*	-.019	.077	-.031	-.003	-.150*	-.162**	-.119	-.090	-.066
Race	.083	-.147	-.093	.123	-.187**	.044	.191*	.003	.023	.051	-.164*	-.082
Residence	.018	.084	.106	-.003	.117	.079	-.189**	-.022	.097	.074	.146*	-.008
Income	-.019	-.055	-.178*	.030	.008	-.077	.137*	.089	-.119*	.028	-.035	-.041
Family 1				-.043	.463**	-.187**						
Peer 1				.417**	-.067	.336**						
Del 1				-.058	.120	.174**						
Family 2							-.107	.419**	.039			
Peer 2							.548**	-.199*	.467**			
Del 2							.109	.140	.286**			
Family 3										-.029	.480**	-.029
Peer 3										.458**	-.064	.459**
Del 3										.089	-.061	.160*
Family 4												-.041
Peer 4												.491**

$\chi^2 (24) = 34.97$ (p=.069), RMSEA=.046 (.000, .077)

P ** <.005, P *<.05

Note: Gender (1=male, 2=female), Race (0=white, 1=non-white), Residence (-1=rural, 0=suburb, 1=urban), Coefficients are standardized.

at wave 3 (-.189) compared to the previous wave. In contrast, for adolescents living in urban areas, the deviant peer association is increased at wave 4 (.146). Adolescents with lower income are more likely to commit deviant behavior (-.178) at wave 1. For adolescents with lower income, delinquency is increased at wave 3 (-.119) compared to the prior wave. For adolescents with higher income, family attachment is increased at wave 3 (.137).

As results show, family attachment has no effects on delinquency. However, family attachment has a lagged effect on future deviant peer association. Family attachment at wave 1 is associated with deviant peer association at wave2 (-.187).

Deviant peer association has direct effects on deviant behavior at wave 1(.417), wave 2 (.548), wave 3 (.458), and wave 4 (.491). However, deviant behavior does not affect deviant peer association. Deviant peer association has a lagged effect on future family attachment. Deviant peer association at wave 2 is negatively associated with family attachment at wave 3 (-.199). For early starters, the effect of family attachment on deviant behavior is mediated by deviant peer association. This finding is consistent with the posited delinquent process of the early starter model of Patterson et al. (1991).

Concerning the stability of delinquent behavior, prior deviant behavior consistently affects future deviant behavior. The stability coefficients are at wave 2 (.174), at wave 3 (.286) and at wave 4 (.160) for early starters.

B. Late starter model

The results for the late starter group are presented in table 9 (See, also Appendix 4.E). The RMSEA fit index is .057, which indicates that the model does not quiet fit the data. But the low chi-square value indicates that it is in the acceptable range. Social structural variables are also incorporated in the delinquent process. For male adolescents,

Table 9 Autoregressive model for relations among family attachment, deviant peer association, and delinquency for late starters (N=267)

Predicted variables	Response variables								
	Family2	Peer 2	Del 2	Family3	Peer 3	Del 3	Family 4	Peer 4	Del 4
Gender	.038	-.026	-.042	.062	-.098	-.116*	.051	-.122*	-.211**
Race	.075	-.101	.086	.003	.066	-.004	.045	-.083	-.013
Residence	.008	.125*	-.023	-.030	-.035	-.044	-.077	.112	-.036
Income	.158*	.026	-.153*	.011	.007	-.009	.156*	.013	.002
Family 2			-.061	.538**	-.028				
Peer 2			.481**	-.040	.607**				
Del 2				-.039	-.089	.002			
Family 3						-.079	.404**	-.071	
Peer 3						.493**	.018	.380**	
Del 3							.097	-.049	.153*
Family 4									-.051
Peer 4									.163*

$\chi^2(10) = 18.55$ (p=.046), RMSEA=.057 (.007, .096)
P ** <.005, P *<.05
Note: Gender (1=male, 2=female), Race (0=white, 1=non-white), Residence (-1=rural, 0=suburb, 1=urban), Coefficients are standardized.

deviant behavior is increased at wave 3 (-.116) and wave 4 (-.211). In addition, for male adolescents, deviant peer association is increased at wave 3 (-.122). Considering the race difference, the results show that there is no racial difference. Adolescents living in urban areas are more likely to associate with deviant peers (.125) at wave 2. Adolescents with lower income are more likely to commit delinquency at wave 2 (-.153). In contrast, adolescents with higher income are more likely to have stronger family bonds at wave 2 (.158). In addition, for adolescents with higher income, family attachment is increased at wave 4 (.156) compared to the previous wave.

In the late starter model, there is no effect of family attachment on delinquency. In addition, family attachment is not associated with any other variables. This confirms that family factors are less salient for late starters.

Deviant peer association has a direct effect on delinquency at wave 2 (.481), wave 3 (.493), and wave 4 (.163). This finding supports that late starters are affected by deviant peer group rather than family factors (Patterson, 1989; Moffitt, 1993; Silberg et al., 1996). However, deviant peer association has no lagged effects on other variables.

Concerning the stability of delinquent behavior, delinquency at wave 2 does not significantly affect delinquency at wave 3, but delinquency at wave 3 affects delinquency at wave 4 (.153).

C. Comparing early and late starter models

The hypothesis (H3-a) posits that early starters have more stable levels of delinquency than late starters. As shown above, for the early starter group, prior deviant behavior consistently affects future deviant behavior across time. For the late starter group, deviant behavior in middle adolescence is not related to deviant behavior in late adolescence. In addition, the stability coefficient of deviant behavior from late

adolescence to early adulthood is lower than for the early starter group. Thus, early starters have more stable deviant behavior than late starters. The hypothesis (H3-a) is supported.

The hypothesis (H3-b) posits that the delinquency of early starters is primarily influenced by family attachment and deviant peers, whereas the delinquency of late starters is mainly influenced by deviant peers. As mentioned above, for early starters, deviant peer association consistently affects deviant behavior across time. Family attachment dose not directly affect deviant behavior. However, family attachment in early adolescence affects deviant behavior in middle adolescence through deviant peer association in middle adolescence. In addition, deviant peer association in middle adolescence affects family attachment in late adolescence. On the contrary, for late starters, deviant behavior in late starters is affected by only deviant peer association. Thus, this hypothesis is supported.

The hypothesis (H3-c) posits that for early starters, family attachment and deviant peers are reciprocally related to delinquency, whereas for late starters, the relations between deviant peers and delinquency are unidirectional. As the findings show in the hypothesis (H3-b), for early starters, family attachment and deviant peers are related to delinquency. Family attachment in early adolescence has a lagged effect on deviant peers in middle adolescence, which in turn influences family attachment in late adolescence. For early starters, family attachment and deviant peers are reciprocally related. However, for late starters, there is no reciprocal relation found. Thus, this hypothesis is supported.

4. Age effects of the interactional model

Developmental studies show that delinquent behavior peaks in middle adolescence and then declines over time. As descriptive statistics show, deviant behavior peaks in middle adolescence. Many studies have shown that middle adolescence is the period of the highest involvement of deviant behavior (Farrington, 1986a; Elliott et al., 1989; Gottfredson and Hirschi, 1990). This pattern is consistently found after controlling gender and different types of offender. The age-crime curve is the same in different genders and types of offenders.

The hypothesis (H4-a) suggests that the effects of family influence on committing delinquent behavior diminish as the adolescent grows. Family attachment has significant effect on delinquency at wave 2 (-.069) and at wave 4 (-.099). The results show that the effect of family attachment is slightly increased during the early adulthood period. In the female sample, family attachment significantly affects delinquency at wave 1 (-.138), at wave 2 (-.121), and at wave 4 (-.155). The effects of family attachment change across time for the female sample. The middle adolescence period exhibits the lowest effects of family attachment. For the male sample, it is difficult to identify the variation of the effect of family attachment since there is no significant effect on delinquency. This study cannot identify the variation of family attachment by different offender types, because there are no significant direct effects. Generally, age variation in family attachment's effects does not support the hypothesis of the interactional theory.

The hypothesis (H4-b) posits that the effects of deviant peer association diminish as the adolescent grows. For the overall sample, the results show that the effects of deviant peers on delinquency peak at wave 2 and get smaller. Standardized coefficients have changed at wave 1 (.470), at wave 2 (.489), at wave 3 (.440) and at wave 4 (.332).

This implies that peer group influence is the best proximate predictor on committing delinquent behavior during the entire period of adolescence. The effect peaks in middle adolescence and decreases as adolescents grow. Age variations of the effects of deviant peers on delinquency vary by gender. For females, the effects of deviant peers on delinquency are at wave 1 (.460), at wave 2 (.468), at wave 3 (.378) and at wave 4 (.282). The effects of deviant peers peak during the middle adolescent period and then decline. For males, the effects of deviant peers on delinquency are at wave 1 (.498), at wave 2 (.502), at wave 3 (.488), and at wave 4 (.357). The effects of deviant peers are high during the entire adolescent period and decline in the early adulthood period. Age variation in the effect of deviant peers on delinquency operates differently for different offender types. For early starters, the effects of deviant peers on delinquency are at wave 1 (.417), at wave 2 (.548), at wave 3 (.458), and at wave 4 (.491). The results indicate that the effects of deviant peers peak during the middle adolescent period, slightly decline during the late adolescence, and increase again in early adulthood. For the late starter group, the effects of deviant peers are at wave 2 (.481), at wave 3 (.493), and at wave 4 (.163). The effects of deviant peers peak during late adolescence and radically decline at adulthood. The results show that the effects of deviant peers vary by age. For the entire sample, the results support the hypothesis that the influence of deviant peers peaks at middle adolescence and then declines. This pattern is also found for both females and males. However, this pattern is not found for different types offenders. For the early starter group, deviant peer influences are highly stable through adolescence and early adulthood. For the late starter group, deviant peers influences are high at middle and late adolescence and then noticeably decline at early adulthood.

CHAPTER V. DISCUSSION AND CONCLUSION

Thornberry's interactional theory suggests that deviant behavior is best explained as a causal network not only affected by social factors but also affecting the development of those social factors. Variables measuring social control, social learning, and delinquency are reciprocally related over the individual life cycle. However, previous studies did not adequately include theoretically significant measures of both social control and social learning variables. This study included indicators of both social control and social learning. Family attachment was selected to represent social control and deviant peer association was selected to reflect social learning. This study examined the reciprocal relations among family attachment, deviant peer association, and delinquency across a person's life. In addition, this study examined variation in reciprocal relations by gender and different offending types.

1. Reciprocal effects

Figure 3. The relationships between family attachment and delinquency
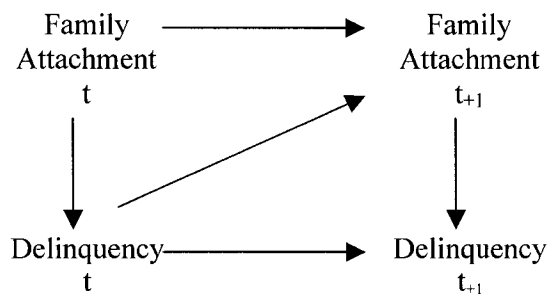
Figure 3 presents the hypothesized relationship between family attachment and delinquency in the interactional model. According to this model, family attachment as time t is expected to affect delinquency within the same time period, and delinquency in

turn is expected to affect family attachment at later time. Overall, the evidence for this pattern was mixed. The paths from family attachment to delinquency were significant for the sample as a whole for the time periods when they were in middle adolescence and early adulthood; it was not significant in early and late adolescence. In addition, this study found little support for the hypothesis that delinquency affects subsequent family attachment. However, reciprocal relationships were found in a specific group. For female adolescents, deviant behavior in early adolescence had a lagged affect on family attachment in middle adolescence. This finding is similar to previous research in that the reciprocal relationship is not consistently supported (Liska and Reed, 1985; Agnew; 1985; Paternoster, 1988; Jang and Smith, 1997). This study shows that the effects of family attachment on deviant behavior are more consistent than the effects of deviant behavior on family attachment.

Figure 4. The relationships between deviant peer association and delinquency

Deviant ──────────▶ Deviant
Peers   Peers
t   t+1

Delinquency──────────▶ Delinquency
t   t+1
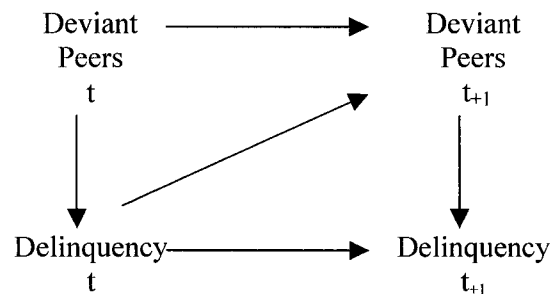
Figure 4 shows the hypothesized relationship between deviant peers and delinquency. In the model, this study expected deviant peers influence delinquent behavior within the same period of time, indicated by the instaneous or contemporaneous paths from deviant peers to delinquency. And, delinquency at one time affects deviant peers at a later time. The results showed that the paths from deviant peers to delinquency were consistently strong, even stronger than the stability coefficients linking deviant

behavior at one point in time to deviant behavior at the next time point. The effects of deviant peers on deviant behavior were consistently observed across gender, different offending types, and developmental stages. This study also showed that deviant behavior has an effect on subsequent deviant peer association. However, this result was not uniformly consistent across all time periods. This lagged path was found from early adolescence to middle adolescence. Overall, the findings concur with previous studies by Elliott and Menard (1996) and Warr and Stafford (1991) in that the path from deviant peers to delinquency is stronger and more consistent than the lagged path from delinquency to deviant peer association (Matsueda and Anderson, 1998).

Figure 5. The relationships between family attachment and deviant peer association
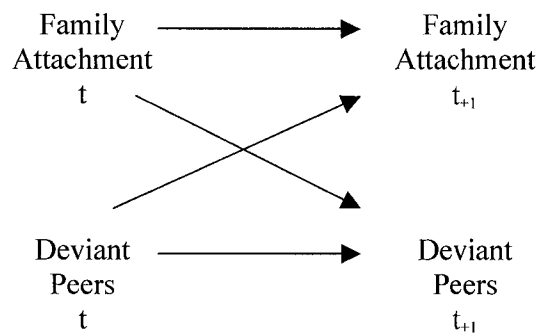
Figure 5 shows the hypothesized relationship between family attachment and deviant peer association. Interactional theory suggests that low social control increases the likelihood of association with deviant peers and of delinquency and deviant peer association leads to a further reduction in family attachment. This study expected that family attachment and deviant peer association at one time has cross-lagged effect on the same variables a later time. The results showed that weakened family attachment in early adolescence leads adolescents to develop relationships with deviant peers and increases their delinquency in middle adolescence. The findings also showed that deviant peer

association in early and middle adolescence deteriorates family attachment in middle and late adolescence.

2. Structural Position and gender

Interactional theory suggests that the person's structural position determines the initial variation in the process leading to deviant behavior. This study expected that gender, race, residence, and income would predict the relationships among family attachment, deviant peer association, and delinquency across over time. The findings showed that structural variables are systematically related to deviant behavior trajectories. Male adolescents are more likely to be exposed to deviant peers and participate in delinquency. This gender effect increases over time. White adolescents are more likely to initially commit delinquent acts. Adolescents living within urban areas are more likely to initially be exposed to deviant peers and participate in delinquency. Adolescents with lower income are more likely to initially be involved in delinquency. The findings suggest that deviant behavior processes may vary by gender.

This study also hypothesized that interactional relations among family attachment, deviant peer association, and deviant behavior vary by gender. The results showed that gender is an important factor shaping deviant processes. The mean scores for family attachment were not different by gender, but the effects of family attachment on deviant behavior were different by gender. For female adolescents, family attachment inhibits deviant behavior relatively consistently over time, late adolescence being the exception. For male adolescents, family attachment does not affect deviant behavior. As other investigators have found, family attachment is a significantly stronger predictor of deviant behavior and crime for females than for males (Covington, 1985; Alarid, et al., 2000).

The effects of deviant peer association on deviant behavior also vary by gender. Consistent with previous studies, this study shows that male adolescents are exposed to deviant peers to a greater degree than female adolescents and male adolescents are influenced by deviant peers to a greater degree than female adolescents (Johnson, 1979; Mears et al., 1998).

The most interesting finding of this study is that the reason why family bonds weaken across time is different for males and females. For female adolescents, deviant behavior weakens family attachment. For male adolescents, deviant peer association rather than deviant behavior causes the deterioration of family attachment. There are two possible explanations for this finding. First, deviant behaviors of female adolescents may be more likely to deteriorate future family relations than those of male adolescents. According to social reaction perspective, female adolescents are more stigmatized and punished for deviant behavior (Chesney-Lind, 1988); that is, female deviant behaviors result in greater and more immediate negative feedback to their family. Second, measurement errors for a measure of deviant peers among males seem to be more correlated with the measure of deviant behavior than females. In light of the latent trait implications, deviant peer association might be regarded as an indicator of deviant behaviors (Farrington, 1986b; Gottfredson and Hirschi, 1987). Gottfredson and Hirschi (1987) suggested that the response errors of indicators of deviant peers correlate with those of deviant behaviors. Matsueda and Anderson (1998) partially supported this hypothesis. According to this implication, for male adolescents, the effects of deviant behavior on future family attachment may disappear since deviant peer association is highly correlated with deviant behavior. Rather, deviant peer association, which is the antecedent variable of deviant behavior, negatively affects future family attachment.

3. Different between early and late starters

Criminal propensity, represented by the timing of the onset of deviant behavior affects initial variation in the deviant behavior trajectories. This study classified the distinction between early starters and late starters. This study hypothesized that the stability of deviant behavior, etiological factors of deviant behavior, and causal processes vary by two different offending groups. The results showed that adolescents who begin deviant behavior at an early age show higher and more persistent deviant behavior than late starters. This is consistent with the findings that most developmental studies suggest that those who begin delinquency early are more likely to commit delinquency and crime throughout life (Farrington, 1991; Loeber, 1996).

The offender types have different etiological factors. In explaining the early onset of deviant behavior, Patterson and Moffitt suggest that a fundamental factor is ineffective socialization. The consequence of ineffective socialization leads early starters to have stable and weak social bonds to their families. Poor family bonding allows higher association with deviant peers, which in turn increases levels of deviant behavior (Elliott et al., 1985; Patterson et al., 1992). On the contrary, for the late onset of deviant behavior, Patterson and Moffitt suggest that deviant peer influence is a key factor initiating deviant behavior. Unlike early starters, late starters are generally well socialized. Under the influence of delinquent peers, they begin a short period of experimental deviant behavior. The results showed that early starters have weaker family bonds than late starters from early adolescence to late adolescence and higher association with deviant peers across time.

The different etiological factors of deviant behavior result in different causal processes. This study expected that delinquency of early starters is primarily influenced

by family attachment and deviant peers and delinquency of late starters is mainly influenced by deviant peers. The results showed that there are different causal processes for the two groups. For early starters, there are two paths of deviant behavior. First, family attachment affects deviant behavior mediated by deviant peer association. In addition, family attachment has a feedback effect on deviant peer association. Second, deviant peer association directly affects deviant behavior. For late starters, deviant behavior is affected by only deviant peer association. The finding is consistent with previous studies that two groups have unique delinquent processes. Adolescents who initiate deviant behavior early have trajectories reciprocally linking poor family bonds and deviant peers across adolescence. That is, it is a reason why early starters have stable delinquent behavior that early starters have cumulative negative consequences, which indicate interactional relationships among poor family bonds, deviant peers, and delinquency over adolescence. However, late starter adolescents have relatively unstable deviant trajectories influenced by single etiological factor, deviant peers.

4. Age effects

Interactional models stress that the etiological factors predicting deviant behavior vary through developmental stages. Thornberry (1987) argued that attachment to parents has a stronger influence on life during early adolescence, but the strength of parental influences get weaker as the adolescent grows. This study tested this hypothesis. The results showed that family bonds, however, could be a protective factor in high delinquency period. Moreover, family bonds are a protective factor in the early adulthood period (Sampson and Laub, 1994). This finding is consistent with the study by Jang (1999) that the effects of attachment to parents on delinquency remain significant through

out adolescence. The effects of deviant peers on delinquency also vary by age. Previous research shows that effects of deviant peers increase and peak in middle adolescence and decrease as adolescents grow (Jang, 1999). The results supported this hypothesis. The effects of deviant peers are consistent with the transition of deviant behavior across time. However, this pattern is not found in the early starter group. Among early starters, deviant peer influences are highly stable through out adolescence and early adulthood.

5. Contributions and Limitations

This study contributes to the expansion of interactional theory by examining the variation of age, gender and criminal propensity. Most longitudinal studies dealt with the changes for relatively short time periods. Previous studies testing interactional models (Thornberry et al., 1991, 1994) also did not fully cover the transition throughout adolescence. Interactional theory suggests deviant behavior processes vary by early, middle, and late adolescent stages (Figure 1). Each developmental stage has unique interactional relations among social control elements, social learning elements and delinquency. Previous studies were tested on the reciprocal relations in early adolescence or transition from early adolescence to middle adolescence. Thus, it missed how interactional relations are linked by developmental stages. This study examined the long term effects of delinquent processes from early to late adolescence and into early adulthood, over approximately 10 years.

Interactional theory suggests that reciprocal effects and developmental changes are interwoven in deviant behavioral trajectories. However, initial variation of social category and individual propensity were not adequately examined in interactional model. This study suggests gender and criminal propensity are important to determine deviant

behavior processes. Male and females are different deviant behavior trajectories. This study suggests that social control effects are more appropriate for female group in interactional model. Early starters and late starters are also different deviant behavior trajectories. This study suggests that the interactional model is more appropriate for understanding in the early starter group and its relatively stable delinquency.

This study has limitations that must be acknowledged. There is a limitation in the measure of family attachment. The concepts of family attachment are drawn from 'attachment to parents' (Hirschi, 1969). Attachment to parents refers to the emotional ties to parents, which focuses on a conventional context. Interactional theory expands attachment to parents in a broad sense of control concepts in the family. Thornberry (1987) defined attachment to parents as the affective relationship between parents and child, communication patterns, parenting skills such as monitoring and discipline, parents-child conflict, and the like. However, this study used family attachment narrowly focusing on social bonds to parents due to the limited items in NYS data. Further studies should incorporate wider ranges of family relations.

This study does not cover the preadolescence period. Most deviant behavior is initiated in early adolescence, but delinquent propensity, such as behavioral or conduct problems is initiated in preadolescence. Thus, developmental studies emphasize the transition from preadolescence to adolescence. The relations among parental influence, deviant peer group, and deviant behavior constitute in preadolescence periods (Patterson et al., 1991). The reciprocal relationships should contain preadolescence to fully capture variations between early life and adulthood.

This study uses autoregressive procedures. Most longitudinal studies use this approach. However, autoregressive models have the limitation of identifying individual trajectories in changes over time. Autoregressive models measure the response variable

predicted by same variables in only the previous wave. This leads to difficulty in measuring actual individual changes over time. An alternative method of measuring multiple waves of data is growth curve analysis (Rogasa, 1980). Growth curve models estimate the initial level and the changes of variables in multiple waves. It can measure more accurately individual changes in deviant behavior in multiple waves. Further study is suggested to apply growth curve models to testing the interactional model.

Theoretical and methodological complexity and limited data have hindered direct test of Thornberry's interactional models. Nonetheless, interactional models provide many implications for understanding dynamic delinquent processes. Delinquent processes are not identical. Further studies should be more concerned the diverse variation by social category and individual propensity in delinquent processes.

APPENDIX 1. ITEMS FOR THE PRESENT STUDY

A. Items of deviant behavior

		Wave 1	Wave 2	Wave 3	Wave 4
Felony Assault					
	N	749	706	698	642
	Mean (Std. Dev.)	.081 (.29)	.090 (.42)	.078 (.31)	.074 (.33)
Items					
Attacked someone with the idea of seriously hurting or killing him/her					
	N	753	706	698	643
	Mean (Std. Dev.)	.033 (.20)	.059 (.34)	.057 (.24)	.062 (.28)
Had (or tried to have) sexual relations with someone against their will					
	N	749	706	698	642
	Mean (Std. Dev.)	.008 (.089)	.009(.092)	.043 (.066)	.011 (.18)
Been involved in gang fight					
	N	753	706	698	643
	Mean (Std. Dev.)	.13 (.45)	.074 (.31)	.053 (.32)	.012 (.15)
Minor Assault					
	N	753	705	696	589
	Mean (Std. Dev.)	.35 (.69)	.23 (.62)	.25 (.61)	.31 (.75)
Items					
Hit (or threatened to hit) a teacher or other adult at school					
	N	753	705	696	n/a
	Mean (Std. Dev.)	.088 (.37)	.065 (.31)	.086 (.093)	n/a
Hit (or threatened to hit) a someone at work					
	N	n/a	n/a	594	589
	Mean (Std. Dev.)	n/a	n/a	.069 (.27)	.066 (.28)
Hit (or threatened to hit) a someone else					
	N	n/a	n/a	698	643
	Mean (Std. Dev.)	n/a	n/a	.27 (.83)	.27 (.76)
Hit (or threatened to hit) one of your parents					
	N	753	706	698	643
	Mean (Std. Dev.)	.053 (.30)	.058 (.38)	.036 (.19)	.016 (.14)
Hit (or threatened to hit) other students					
	N	753	706	697	n/a
	Mean (Std. Dev.)	.69 (1.11)	.40 (.19)	.13 (.48)	n/a
Robbery					
	N	752	706	696	643
	Mean (Std. Dev.)	.040 (.28)	.032 (.29)	.006 (.098)	.009 (.17)
Items					
Used force to get money or things from other students					
	N	753	706	696	n/a
	Mean (Std. Dev.)	.039 (.23)	.024 (.19)	.00 (.00)	n/a
Used force to get money or things from a teacher or other adults at school					
	N	752	706	n/a	n/a
	Mean (Std. Dev.)	.005 (.089)	.004 (.084)	n/a	n/a
Used force to get money or things from other people					
	N	753	706	698	643
	Mean (Std. Dev.)	.024 (.21)	.021 (.24)	.004 (.066)	.009 (.17)
Felony Theft					
	N	753	706	698	643
	Mean (Std. Dev.)	.059 (.43)	.100 (.50)	.092 (.52)	.055 (.31)
Items					

Stolen (or tried to steal) a motor vehicle

N	753	706	698	643
Mean (Std. Dev.)	.013 (.30)	.017 (.13)	.013 (.20)	.006 (.066)

Stolen (or tried to steal) something more than $50

N	753	706	698	643
Mean (Std. Dev.)	.015 (.16)	.051 (.33)	.037 (.34)	.028 (.25)

Broken into a building or vehicle to steal something

N	753	706	698	643
Mean (Std. Dev.)	.041 (.28)	.047 (.30)	.047 (.33)	.020 (.23)

Bought, sold or held stolen goods

N	753	706	698	643
Mean (Std. Dev.)	.056 (.28)	.084 (.42)	.11 (.49)	.072 (.42)

Minor Theft

N	751	706	698	643
Mean (Std. Dev.)	.13 (.42)	.23 (.70)	.15 (.54)	.12 (.54)

Items

Stolen (or tried to steal) things < $5

N	753	706	698	643
Mean (Std. Dev.)	.19 (.56)	.20 (.71)	.15 (.56)	.15 (.61)

Stolen (or tried to steal) things between $5 and $50

N	751	706	698	643
Mean (Std. Dev.)	.052 (.30)	.079 (.43)	.066 (.39)	.067 (.37)

Taken a vehicle for a ride without permission

N	753	706	698	643
Mean (Std. Dev.)	.035 (.20)	.11 (.47)	.059 (.34)	.025 (.22)

Illegal Service

N	748	706	698	641
Mean (Std. Dev.)	.38 (.27)	.18 (.88)	.14 (.67)	.16 (.72)

Items

Been paid for having sexual relations with someone

N	749	706	698	642
Mean (Std. Dev.)	.005 (.089)	.013 (.30)	.010 (.23)	.016 (.21)

Paid for having sexual relations with someone

N	n/a	n/a	698	642
Mean (Std. Dev.)	n/a	n/a	.007 (.084)	.014 (.19)

Sold marijuana

N	753	706	698	643
Mean (Std. Dev.)	.056 (.42)	.21 (.90)	.21 (.89)	.20 (.89)

Sold hard drug

N	752	706	698	642
Mean (Std. Dev.)	.004 (.063)	.037 (.38)	.044 (.47)	.064 (.56)

Public disorder/Status offenses

N	746	704	698	643
Mean (Std. Dev.)	.31 (.79)	1.04 (1.88)	.51 (1.00)	.39 (.85)

Items

Been loud, rowdy, or unruly in public place

N	753	706	698	643
Mean (Std. Dev.)	.47 (1.12)	.46 (1.03)	.51 (1.00)	.39 (.85)

Run away from home

N	752	706	n/a	n/a
Mean (Std. Dev.)	.052 (.24)	.065 (.27)	n/a	n/a

Had sexual intercourse with person of the opposite sex

N	747	704	n/a	n/a
Mean (Std. Dev.)	.12 (.59)	.84 (1.65)	n/a	n/a
Cronbach's Alpha	.7649	.8043	.7307	.6846

B. Items of family attachment

	Wave 1	Wave 2	Wave 3	Wave 4
How much have your parents influenced what you've thought and done?				
N	744	675	573	381
Mean	4.21	4.15	4.03	3.95
Std. Dev.	.94	.98	.95	1.01
How important have the things you've done with your family been to you?				
N	752	675	573	381
Mean	4.131	4.21	4.19	4.26
Std. Dev.	.84	.87	.85	.82
How much you agree or disagree that "I feel close to my family" (wave 1 and 2)?				
How much warmth and affection have you received you're your parents (wave 3 and 4)?				
N	753	706	574	379
Mean	4.31	4.21	4.30	4.20
Std. Dev.	.70	.70	.84	.98
How much you agree or disagree that "my family doesn't take much interest in my problems" (wave 1 and 2, inversely coded)?				
How much support and encouragement have you received from your parents (wave 3 and 4)?				
N	753	706	574	379
Mean	4.24.	4.18	4.34	4.21
Std. Dev.	.73	.76	.83	.97
Cronbach's Alpha	.6558	.7240	.8192	.8459

C. Items of deviant peer association

		Wave 1	Wave 2	Wave 3	Wave 4
cheated on school tests cheated on income tax (wave4)					
	N	672	696	684	623
	Mean (Std. Dev.)	2.40 (1.11)	2.58 (1.10)	2.09 (1.04)	1.41 (.72)
purposely damaged or destroyed property					
	N	678	701	690	641
	Mean (Std. Dev.)	1.48 (.75)	1.45 (.74)	1.39 (.67)	1.24 (.56)
used marijuana or hashish					
	N	678	702	687	640
	Mean (Std. Dev.)	1.46 (.92)	2.19(1.32)	2.42 (1.32)	2.35 (1.21)
stolen something worth less than $5					
	N	666	703	686	638
	Mean (Std. Dev.)	1.64 (.89)	1.64 (.94)	1.57 (.89)	1.44 (.75)
hit or threatened to hit someone without any reason					
	N	679	703	688	642
	Mean (Std. Dev.)	1.82 (.95)	1.55(.77)	1.41 (.73)	1.27 (.58)
used alcohol					
	N	676	704	687	642
	Mean (Std. Dev.)	1.78 (1.12)	2.87 (1.37)	3.56 (1.30)	3.70 (1.22)
broken into a vehicle or building to steal something					
	N	677	704	688	642
	Mean (Std. Dev.)	1.12 (.47)	1.19 (.53)	1.15 (.49)	1.10 (.38)
sold hard drugs such as heroin, cocaine, and LSD					
	N	679	704	688	641
	Mean (Std. Dev.)	1.05 (.30)	1.18 (.56)	1.20 (.54)	1.25 (.62)
	Factor loading	.610	.700	.529	.404
stolen something worth more than $50					
	N	674	704	687	640
	Mean (Std. Dev.)	1.06 (.26)	1.16 (.47)	1.18 (.53)	1.15 (.47)
suggested you do something that was against the law					
	N	678	704	689	641
	Mean (Std. Dev.)	1.26 (.61)	1.39 (.80)	1.44 (.85)	1.37 (.81)
	Factor loading	.478	.537	.437	.497
gotten drunk once in awhile					
	N	676	704	688	642
	Mean (Std. Dev.)	1.78 (1.11)	2.80(.1.40)	3.38 (1.33)	3.47 (1.28)
used prescription drugs such as amphetamines or barbiturates when there was no medical need for them					
	N	675	703	687	641
	Mean (Std. Dev.)	1.10 (.42)	1.29(.72)	1.37 (.75)	1.33 (.67)
sold or given alcohol to kids under 18					
	N	678	702	689	641
	Mean (Std. Dev.)	1.16 (.52)	1.57(.96)	1.53 (.82)	1.43 (.73)
pressured or forced someone to do more sexually than he/she wanted to do?					
	N	n/a	n/a	682	635
	Mean (Std. Dev.)	n/a	n/a	1.12 (.37)	1.11 (.39)
Cronbach's Alpha		.8431	.8899	.8634	.8387

APPENDIX 2. ITMES OF DELINQUENCY AND SPSS SYNTAX

A. Items of delinquency in 1977 (wave 1)

1) Felony assault
    (v284) Attacked someone with the idea of seriously hurting or killing him/her
    (v318) Had (or tried to have) sexual relations with someone against their will
    (v290) Been involved in gang fight
2) Minor assault
    (v302) Hit (or threatened to hit) a teacher or other adult at school
    (v304) Hit (or threatened to hit) one of your parents
    (v306) Hit (or threatened to hit) other students
3) Robbery
    (v320) Used force to get money or things from other students
    (v322) Used force to get money or things from a teacher or other adults at school
    (v326) Used force to get money or things from other people
4) Felony theft
    (v266) Stolen (or tried to steal) a motor vehicle
    (v268) Stolen (or tried to steal) something more than $50
    (v336) Broken into a building or vehicle to steal something
    (v270) Bought, sold or held stolen goods
5) Minor theft
    (v282) Stolen (or tried to steal) things < $5
    (v332) Stolen (or tried to steal) things between $5 and $50
    (v312) Taken a vehicle for a ride without permission
6) Illegal Service
    (v286) Been paid for having sexual relations with someone
    (v292) Sold marijuana
    (v310) Sold hard drug
7) Public disorder/Status offenses
    (v308) Been loud, rowdy, or unruly in public place
    (v276) Run away from home
    (v288) Had sexual intercourse with person of the opposite sex

B. SPSS syntax in wave 1

```
/*Feloney assult1*/
compute fas1=( v284*3 +v318*2 + v290)/3.
execute.

/*Minor assult1*/
compute mas1=(v302*3 + v304*2 + v306)/3.
execute.

/*Roberry1 */
compute rob1= (v320 + v322*2 + v326*3)/3.
execute.

/*Felony Theft1*/
compute fth1=(v266*4 + v268*3 + v336*2 + v270)/4.
execute.

/*Minor Theft1*/
compute mth1=(v282 + v332*2 + v312*3)/3.
execute.

/*Illegal Service1*/
compute ise1=(v286 + v292*2 + v310*3)/3.
execute.

/*Public disorder and status offense1*/
compute pds1= ( v308 + v276*2 + v288*3)/3.
execute.

/*Delinquency at wave 1 */
compute del1=fas1*2 + mas1 + rob1*2 + fth1*2 + mth1 + ise1 + pds1.
execute.
```

APPENDIX 3. T-TEST FOR THE DIFFERENCE BETWEEN OBSERVED CASES AND MISSING CASES

		Age	Gender	Race	RESIDE	Income	DEL1	DEL2	DEL3	DEL4	Peer1	Peer2	Peer3	Peer4	FATCH1	FATCH2	FATCH3	FATCH4
Age	t	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	df	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	P(2-tail)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	# Present	778	778	778	777	741	742	703	695	587	655	689	671	611	743	675	573	379
	# Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mean(Present)	13.02	1.50	.23	1.29E-03	4.02	1.1808	2.1278	1.4043	1.2330	1.4659	1.7584	1.7719	1.6824	4.2682	4.1900	4.2142	4.1563
	Mean(Missing)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gender	t	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	df	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	P(2-tail)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	# Present	778	778	778	777	741	742	703	695	587	655	689	671	611	743	675	573	379
	# Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mean(Present)	13.02	1.50	.23	1.29E-03	4.02	1.1808	2.1278	1.4043	1.2330	1.4659	1.7584	1.7719	1.6824	4.2682	4.1900	4.2142	4.1563
	Mean(Missing)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Race	t	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	df	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	P(2-tail)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	# Present	778	778	778	777	741	742	703	695	587	655	689	671	611	743	675	573	379
	# Missing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mean(Present)	13.02	1.50	.23	1.29E-03	4.02	1.1808	2.1278	1.4043	1.2330	1.4659	1.7584	1.7719	1.6824	4.2682	4.1900	4.2142	4.1563
	Mean(Missing)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
RESIDE	t	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	df	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	P(2-tail)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	# Present	777	777	777	777	740	741	702	694	587	654	688	670	610	742	674	573	379
	# Missing	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	0	0
	Mean(Present)	13.02	1.50	.23	1.29E-03	4.02	1.1820	2.1308	1.4063	1.2330	1.4659	1.7583	1.7727	1.6835	4.2685	4.1903	4.2142	4.1563
	Mean(Missing)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Income	t	.4	-1.2	-1.6	-1.2	.	3.8	-.6	.8	-.4	.0	-.5	-.5	-1.5	.9	-.2	.6	1.1
	df	39.5	39.7	38.7	40.6	.	55.5	31.3	41.1	21.2	26.5	30.8	35.1	21.8	31.2	30.1	29.8	16.6
	P(2-tail)	.716	.237	.124	.225	.	.000	.534	.423	.676	.987	.618	.627	.161	.387	.881	.530	.282
	# Present	741	741	741	740	741	714	673	661	566	630	659	638	590	713	647	544	362
	# Missing	37	37	37	37	0	28	30	34	21	25	30	33	21	30	28	29	17
	Mean(Present)	13.02	1.49	.22	-5.41E-03	4.02	1.2085	2.1035	1.4182	1.2238	1.4659	1.7553	1.7695	1.6778	4.2721	4.1893	4.2197	4.1706
	Mean(Missing)	12.97	1.59	.35	.14	.	.4762	2.6722	1.1343	1.4802	1.4646	1.8256	1.8182	1.8095	4.1750	4.2054	4.1121	3.8529
DEL1	t	.3	.7	-1.7	-1.1	2.3	.	-.1	.2	-.6	-.6	.4	1.6	1.9	1.5	.9	.8	.9
	df	38.0	38.4	37.5	38.4	29.0	.	16.3	25.1	12.5	6.1	15.6	23.9	12.8	10.1	16.4	18.0	8.3
	P(2-tail)	.729	.512	.105	.274	.031	.	.905	.850	.568	.574	.699	.122	.086	.163	.400	.410	.413
	# Present	742	742	742	741	714	742	687	672	574	648	673	648	598	732	659	555	370
	# Missing	36	36	36	36	27	0	16	23	13	7	16	23	13	11	16	18	9
	Mean(Present)	13.02	1.50	.22	-5.40E-03	4.05	1.1808	2.1254	1.4071	1.2237	1.4646	1.7600	1.7776	1.6866	4.2736	4.1923	4.2189	4.1628
	Mean(Missing)	12.97	1.44	.36	.14	3.22	.	2.2292	1.3225	1.6410	1.5824	1.6923	1.6118	1.4890	3.9091	4.0938	4.0694	3.8889
DEL2	t	-.1	.1	-.5	-2.1***	.8	-.5	.	-1.2	-1.9	.7	.5	.3	-.7	-.6	.3	1.0	.5
	df	91.2	90.3	89.1	90.0	78.9	60.8	.	31.7	19.6	57.5	1.0	33.7	22.5	62.7	2.0	23.7	7.2
	P(2-tail)	.957	.923	.628	.042	.415	.614	.	.235	.066	.512	.716	.774	.500	.542	.802	.342	.620
	# Present	703	703	703	702	673	687	703	663	567	606	687	639	589	688	672	549	371
	# Missing	75	75	75	75	68	55	0	32	20	49	2	32	22	55	3	24	8
	Mean(Present)	13.02	1.50	.23	-1.71E-02	4.04	1.1645	2.1278	1.3490	1.1796	1.4690	1.7590	1.7733	1.6798	4.2645	4.1912	4.2236	4.1604
	Mean(Missing)	13.03	1.49	.25	.17	3.79	1.3848	.	2.5500	2.7458	1.4270	1.5385	1.7433	1.7500	4.3136	3.9167	4.0000	3.9687

APPENDIX 3.
(Continued)

		Age	Gender	Race	RESIDE	Income	DEL1	DEL2	DEL3	DEL4	Peer1	Peer2	Peer3	Peer4	FATCH1	FATCH2	FATCH3	FATCH4
DEL3	t	-.5	1.3	.3	-1.3	-2.3***	-.1	.2	.	.8	.3	-.9	2.1	1.1	1.2	1.3	.9	1.9
	df	102.7	102.7	103.4	105.5	94.7	82.9	61.1	.	29.2	78.6	47.8	1.0	24.3	81.5	41.8	2.0	9.5
	P(2-tail)	.652	.212	.760	.202	.023	.924	.820	.	.446	.756	.372	.276	.279	.220	.195	.464	.095
	# Present	695	695	695	694	661	672	663	695	564	593	650	669	589	672	636	570	369
	# Missing	83	83	83	83	80	70	40	0	23	62	39	2	22	71	39	3	10
	Mean(Present)	13.02	1.51	.23	-1.01E-02	3.95	1.1776	2.1330	1.4043	1.2417	1.4675	1.7546	1.7730	1.6852	4.2775	4.1985	4.2158	4.1687
	Mean(Missing)	13.06	1.43	.22	9.64E-02	4.61	1.2119	2.0417	.	1.0181	1.4504	1.8225	1.3929	1.6071	4.1796	4.0513	3.9167	3.7000
DEL4	t	-1.3	-.8	-3.5***	-1.4	2.0***	.8	-2.2***	-.1	.	.1	-1.9	-.6	.5	.9	.9	1.3	1.9
	df	322.3	322.5	283.7	314.1	275.1	396.3	195.4	241.7	.	225.3	177.8	173.3	58.0	248.6	175.4	124.0	32.3
	P(2-tail)	.193	.430	.001	.162	.049	.447	.026	.882	.	.899	.066	.524	.593	.356	.391	.185	.066
	# Present	587	587	587	587	566	574	567	564	587	513	556	544	558	577	549	478	349
	# Missing	191	191	191	190	175	168	136	131	0	142	133	127	53	166	126	95	30
	Mean(Present)	13.00	1.49	.20	-2.04E-02	4.11	1.2152	1.9327	1.3976	1.2330	1.4671	1.7344	1.7650	1.6861	4.2790	4.2004	4.2333	4.1834
	Mean(Missing)	13.09	1.52	.33	6.84E-02	3.72	1.0635	2.9412	1.4331	.	1.4615	1.8589	1.8015	1.6429	4.2304	4.1448	4.1184	3.8417
Peer1	t	.8	2.5***	-1.7	.3	3.1***	1.9	-1.5	.4	-.7	.	.6	1.1	-.3	.7	2.0***	2.4***	2.3***
	df	168.1	172.8	161.7	168.4	169.4	219.7	124.9	172.2	99.6	.	124.1	134.6	94.0	120.9	122.8	110.5	57.6
	P(2-tail)	.432	.015	.095	.782	.002	.061	.129	.705	.459	.	.550	.276	.731	.455	.044	.018	.023
	# Present	655	655	655	654	630	648	606	593	513	655	595	573	535	648	580	486	328
	# Missing	123	123	123	123	111	94	97	102	74	0	94	98	76	95	95	87	51
	Mean(Present)	13.03	1.52	.22	4.59E-03	4.11	1.2261	2.0190	1.4181	1.2060	1.4659	1.7641	1.7810	1.6798	4.2743	4.2103	4.2469	4.2043
	Mean(Missing)	12.97	1.40	.29	-1.63E-02	3.49	.8688	2.8076	1.3239	1.4200	.	1.7226	1.7187	1.7002	4.2263	4.0658	4.0316	3.8480
Peer2	t	-.6	-.1	-.4	-2.7***	.9	-.9	-.8	-1.4	-1.4	.8	.	-.1	-1.0	.4	2.8	1.7	2.2
	df	112.7	111.7	110.4	111.3	98.6	74.4	15.6	45.6	32.5	73.8	.	46.0	34.8	83.5	14.5	33.8	15.8
	P(2-tail)	.574	.891	.692	.009	.389	.393	.445	.167	.184	.433	.	.949	.328	.689	.014	.106	.045
	# Present	689	689	689	688	659	673	687	650	556	595	689	629	578	674	660	540	363
	# Missing	89	89	89	89	82	69	16	45	31	60	0	42	33	69	15	33	16
	Mean(Present)	13.02	1.50	.23	-2.47E-02	4.05	1.1421	2.1060	1.3346	1.1954	1.4701	1.7584	1.7715	1.6775	4.2708	4.2015	4.2310	4.1798
	Mean(Missing)	13.07	1.51	.25	.20	3.80	1.5580	3.0625	2.4107	1.9059	1.4244	.	1.7772	1.7684	4.2428	3.6833	3.9394	3.6250
Peer3	t	-.3	.5	-.6	-1.6	-1.4	.2	-.7	1.2	-.5	-.6	-1.2	.	1.0	1.7	1.7	2.7	2.5***
	df	144.8	141.7	139.0	148.6	128.3	128.4	102.7	31.2	45.2	107.4	76.8	.	44.7	119.3	69.8	21.6	23.5
	P(2-tail)	.729	.625	.569	.112	.157	.825	.469	.221	.592	.565	.246	.	.312	.092	.100	.012	.022
	# Present	671	671	671	670	638	648	639	669	544	573	629	671	572	649	616	554	356
	# Missing	107	107	107	107	103	94	64	26	43	82	60	0	39	94	59	19	23
	Mean(Present)	13.02	1.50	.23	-1.49E-02	3.97	1.1888	2.1017	1.4205	1.2117	1.4621	1.7511	1.7719	1.6868	4.2820	4.2021	4.2234	4.1896
	Mean(Missing)	13.05	1.48	.25	.10	4.34	1.1259	2.3880	.9885	1.5019	1.4925	1.8346	.	1.6172	4.1729	4.0636	3.9474	3.6413
Peer4	t	-2.0	2.9***	-3.0***	-1.7	-.6	.5	-.9	-1.3	-1.5	-.1	-1.1	-.7	.	.0	-.3	-.7	-.7
	df	263.5	267.2	237.3	269.2	211.5	289.8	176.1	153.1	28.9	180.9	143.8	125.0	.	228.0	156.7	125.6	22.3
	P(2-tail)	.051	.004	.003	.082	.524	.584	.374	.191	.153	.956	.277	.516	.	.984	.751	.492	.494
	# Present	611	611	611	610	590	598	589	589	558	535	578	572	611	598	565	482	358
	# Missing	167	167	167	167	151	144	114	106	29	120	111	99	0	145	110	91	21
	Mean(Present)	12.99	1.53	.20	-2.30E-02	3.99	1.2035	2.0668	1.3471	1.1768	1.4654	1.7459	1.7657	1.6824	4.2680	4.1867	4.2054	4.1494
	Mean(Missing)	13.13	1.40	.32	8.98E-02	4.13	1.0868	2.4430	1.7223	2.3132	1.4679	1.8233	1.8074	.	4.2690	4.2068	4.2610	4.2738
FATCH1	t	1.1	.2	-1.4	-2.2	.9	.2	.2	.7	-.9	.2	.5	1.4	1.2	.	-.6	.1	.8
	df	36.8	37.2	36.5	37.8	29.2	9.5	15.1	26.6	9.2	6.1	14.5	22.7	12.6	.	15.0	19.3	7.2
	P(2-tail)	.263	.877	.162	.034	.369	.815	.812	.492	.385	.860	.644	.177	.257	.	.562	.915	.476
	# Present	743	743	743	742	713	732	688	672	577	648	674	649	598	743	660	554	371
	# Missing	35	35	35	35	28	10	15	23	10	7	15	22	13	0	15	19	8
	Mean(Present)	13.03	1.50	.22	-1.08E-02	4.04	1.1828	2.1325	1.4128	1.2174	1.4663	1.7602	1.7768	1.6855	4.2682	4.1883	4.2148	4.1617
	Mean(Missing)	12.86	1.49	.34	.26	3.64	1.0333	1.9111	1.1543	2.1333	1.4286	1.6769	1.6266	1.5385	.	4.2667	4.1974	3.9062

APPENDIX 3.
(Continued)

		Age	Gender	Race	RESIDE	Income	DEL1	DEL2	DEL3	DEL4	Peer1	Peer2	Peer3	Peer4	FATCH1	FATCH2	FATCH3	FATCH4
FATCH2	t	-1.6	-2.5***	.2	-1.8	1.8	-2.2***	-2.7	-1.5	-2.1***	-1.7	-3.0	-1.5	-2.8***	1.9	.	1.9	2.9
	df	139.0	136.5	135.6	132.4	120.4	87.5	31.0	60.9	39.9	85.6	29.9	61.6	51.1	97.6	.	33.3	16.8
	P(2-tail)	.116	.013	.860	.080	.074	.032	.010	.129	.043	.100	.006	.126	.007	.064	.	.067	.009
	# Present	675	675	675	674	647	659	672	636	549	580	660	616	565	660	675	540	362
	# Missing	103	103	103	103	94	83	31	59	38	75	29	55	46	83	0	33	17
	Mean(Present)	13.00	1.48	.23	-1.78E-02	4.08	1.0526	1.9700	1.3182	1.1617	1.4528	1.7417	1.7612	1.6665	4.2837	4.1900	4.2361	4.1892
	Mean(Missing)	13.14	1.61	.22	.13	3.63	2.1988	5.5484	2.3328	2.2632	1.5672	2.1379	1.8909	1.8773	4.1446		3.8561	3.4559
FATCH3	t	-4.2***	-3.8***	1.4	1.5	1.9	-2.0***	-2.7***	.2	-.1	-1.1	-2.3***	-.3	1.9	2.7***	3.7***	.	3.0
	df	370.0	366.0	385.8	351.9	369.5	219.4	198.4	160.9	154.4	251.3	214.7	157.3	215.1	287.1	179.4	.	26.8
	P(2-tail)	.000	.000	.152	.125	.059	.049	.007	.755	.955	.262	.024	.755	.060	.007	.000	.	.005
	# Present	573	573	573	573	544	555	549	570	478	486	540	554	482	554	540	573	353
	# Missing	205	205	205	204	197	187	154	125	109	169	149	117	129	189	135	0	26
	Mean(Present)	12.95	1.46	.24	2.62E-02	4.11	1.0234	1.8349	1.4168	1.2301	1.4528	1.7279	1.7687	1.6995	4.3037	4.2389	4.2142	4.2004
	Mean(Missing)	13.22	1.61	.20	-6.86E-02	3.77	1.6480	3.1721	1.3473	1.2454	1.5034	1.8689	1.7869	1.6185	4.1640	3.9944	.	3.5577
FATCH4	t	-2.8***	-1.9	-.2	1.8	3.1***	-1.4	-1.4	.6	.0	-.1	-1.4	-.1	1.4	-.4	2.2***	1.1	.
	df	775.7	774.0	774.6	775.0	702.4	727.9	676.7	693.0	446.6	652.9	675.0	653.7	556.3	731.8	627.2	426.2	.
	P(2-tail)	.005	.062	.838	.076	.002	.163	.155	.529	.961	.921	.176	.934	.151	.675	.030	.276	.
	# Present	379	379	379	379	362	370	371	369	349	328	363	356	358	371	362	353	379
	# Missing	399	399	399	398	379	372	332	326	238	327	326	315	253	372	313	220	0
	Mean(Present)	12.94	1.46	.23	5.01E-02	4.28	1.0383	1.8967	1.4683	1.2287	1.4641	1.7279	1.7703	1.7043	4.2594	4.2383	4.2401	4.1563
	Mean(Missing)	13.10	1.53	.23	-4.52E-02	3.77	1.3226	2.3860	1.3319	1.2391	1.4677	1.7924	1.7737	1.6513	4.2769	4.1342	4.1727	.

Note: Gender (1=male, 2=female), Race (0=white, 1=non-white), Residence (-1=rural, 0=suburb, 1=urban)
Column line (Observed cases), Row line (Missing cases)
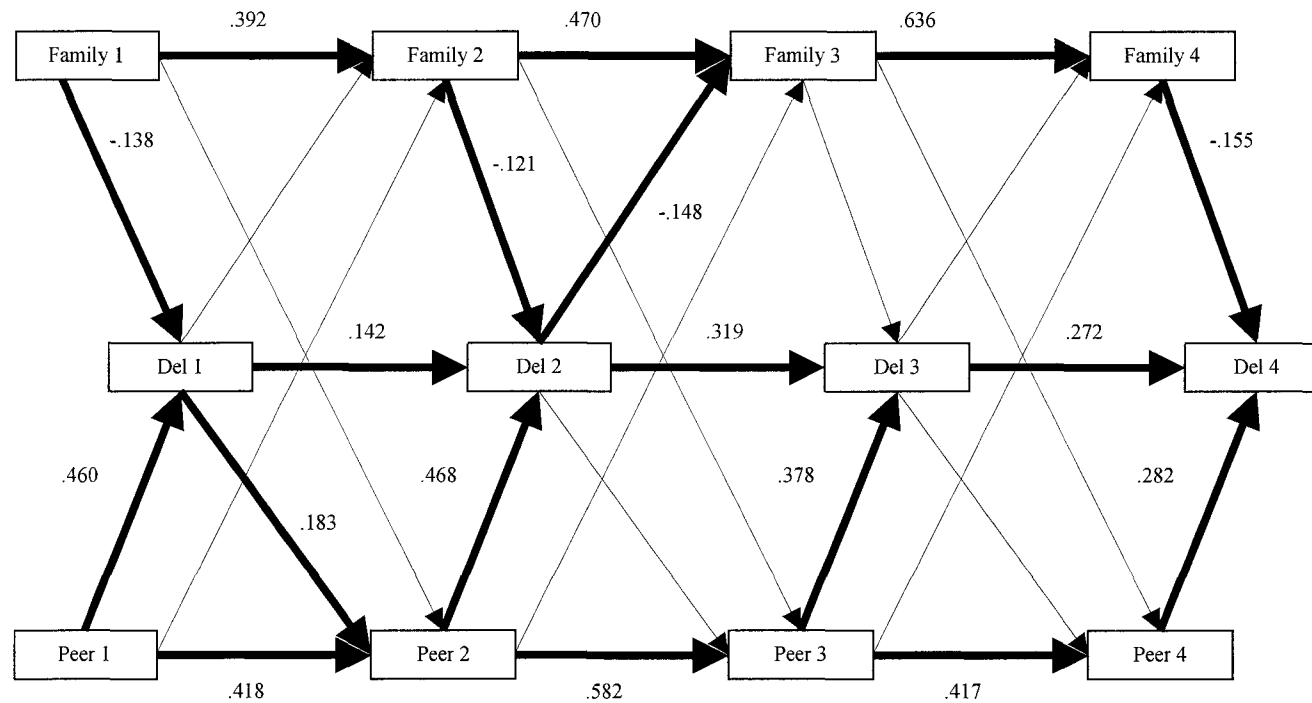
APPENDIX 4.A All sample model
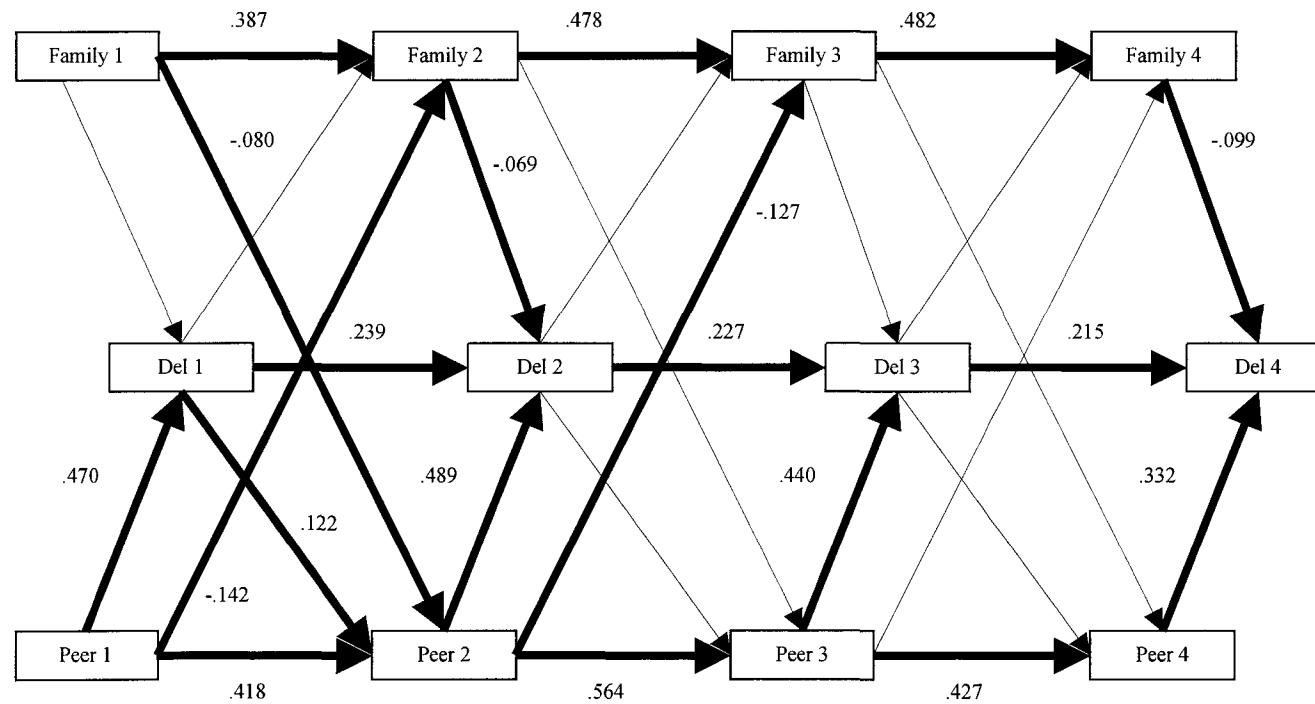
Note: N=778. χ^2 (24) =37.97 (p=.035), RMSEA=.027 (.007, .043)
Thick lines represent significant path (P< .05)
Social structural variables and the residual correlations are not presented in this diagram.
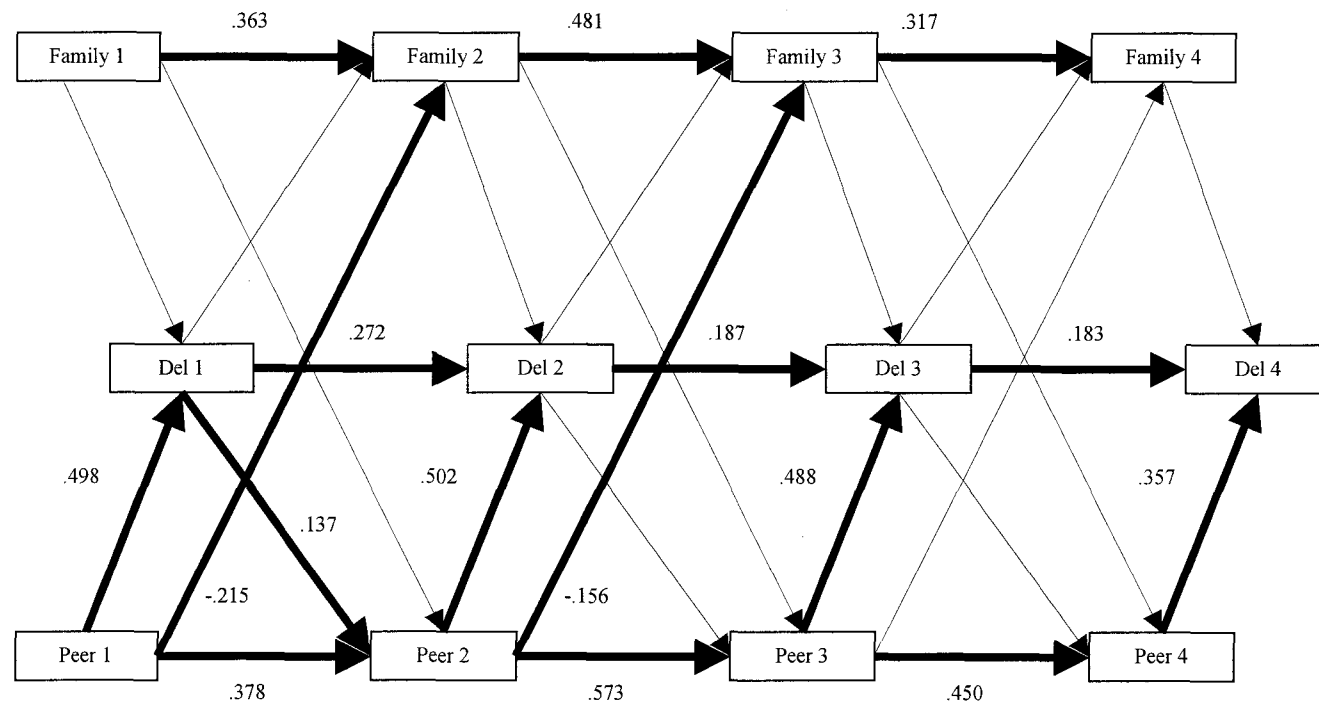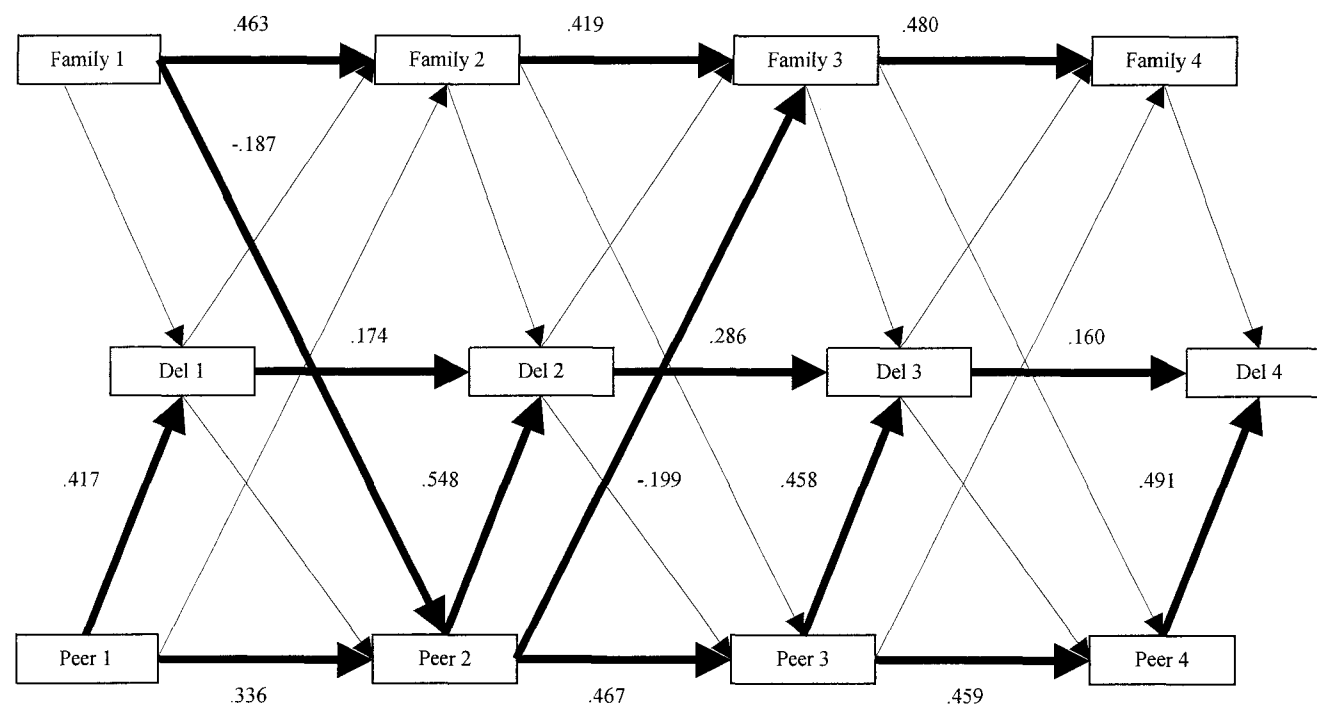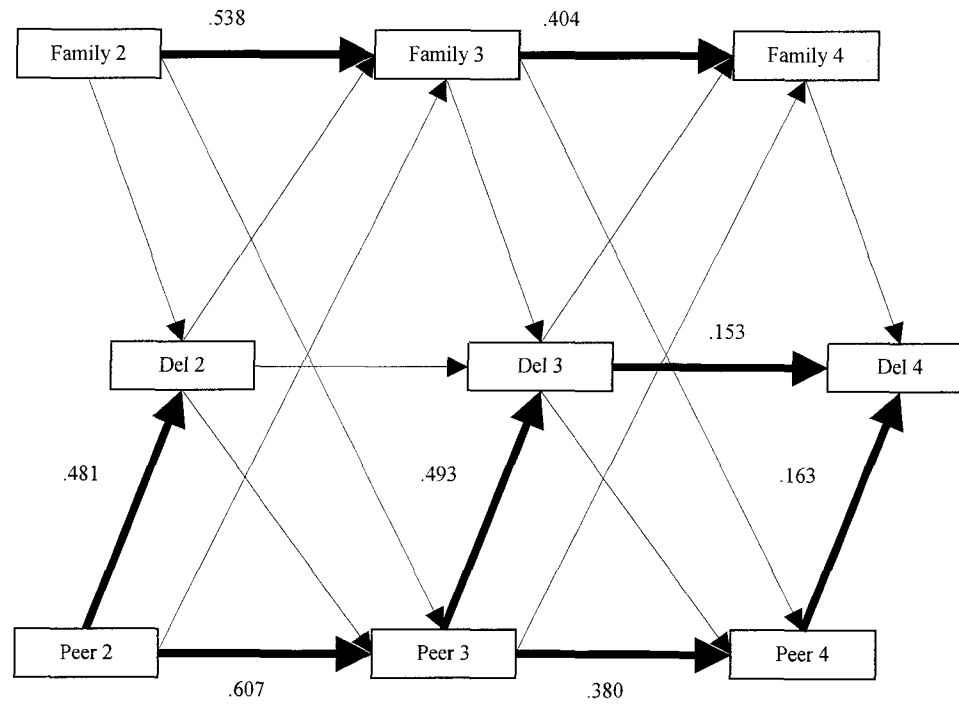
APPENDIX 4.B Female model

Note: N=388. χ^2 (24) =47.00 (p=.003), RMSEA=.050 (.028, .071)
Thick lines represent significant path (P< .05)
Social structural variables and the residual correlations are not presented in this diagram.

APPENDIX 4.C Male model

Note: N=390. χ^2 (24) =29.42 (p=.205), RMSEA=.024 (.000, .050)
Thick lines represent significant path (P< .05)
Social structural variables and the residual correlations are not presented in this diagram.

APPENDIX 4.D Early starter model

Note: (N=219) χ^2 (24) =34.97 (p=.069), RMSEA=.046 (.000, .077)
Thick lines represent significant path (P< .05)
Social structural variables and the residual correlations are not presented in this diagram.

APPENDIX 4.E Late starter model

Note: χ^2 (10) =18.55 (p=.046), RMSEA=.057 (.007, .096)
Thick lines represent significant path (P< .05)
Social structural variables and the residual correlations are not presented in this diagram.

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