ABSTRACT

Title of Document: THE ASSOCIATION OF NEGATIVE FAMILY PROCESSES IN ADOLESCENCE AND HEALTH STATUS AND BODY MASS INDEX IN LATE ADOLESCENCE AND EARLY ADULTHOOD

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Extant research suggests that negative family processes during adolescence may be detrimental to health over time. Informed by family systems theory and the biopsychosocial perspective, this study examined the association of negative family processes in early adolescence and health status and body mass index in late adolescence and early adulthood. Data from U.S. males and females in two-parent households from the National Longitudinal Survey of Youth 1997 were examined over a ten year period from early adolescence to early adulthood.

Results from logistic regressions and multiple regressions suggest that negative parent-child processes (NPCP) and negative inter-parental processes (NIPP) are associated with elevated risk for poorer health status but are not associated with body mass index. Logistic regressions estimated the association between NPCP and

NIPP and youth's risk of very good, good and poor health status, respectively, as compared to excellent health status. Specifically, there is a step function for the association between NPCP and risk for poorer health status in late adolescence and early adulthood, between NIPP and risk for poorer health status in late adolescence and between NIPP and risk for the poorest health status category in early adulthood. Mental health, unhealthy behaviors (tobacco use, marijuana use and alcohol use), and healthy behaviors (i.e. physical activity) partially mediated the association between NPCP and NIPP, respectively, and health status in late adolescence, and mental health and tobacco use (only for NPCP) partially mediated the association with health status in early adulthood. All analyses are independent of race, gender, maternal education, health status in early adolescence, BMI in early adolescence, parental health status, and parental BMI. Moderation by maternal education and implications for public health, future research, programming, and therapy are discussed.

THE ASSOCIATION OF NEGATIVE FAMILY PROCESSES IN ADOLESCENCE AND HEALTH STATUS AND BODY MASS INDEX IN LATE ADOLESCENCE AND EARLY ADULTHOOD

By

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Dedication

This dissertation is dedicated to two absolutely wonderful parents, Debbie and David, two fabulously stellar sisters, Mariel and Catherine, and one amazingly incredible man, Dan.

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Chapter 1: Introduction

The family is influential in adolescent health and development (Campbell, 2004; Skeer, 2009; Troost & Filsinger, 2004). Adolescence can sometimes be a turbulent time for youth and their parents, characterized by negative family relationships (Herrenkohl, Kosterman, Hawkins, & Mason, 2009). Negative family processes include cognitions (i.e. thoughts), behaviors and interactions within the family that garner negative results (Luecken, Kraft, & Hagan, 2009). According to Conger and Elder (1994), negative family processes include cognitions (i.e., thinking poorly of other family members, not wanting to be like a family member, and not enjoying spending time with them); individual behavior (i.e., screaming when angry, not expressing affection, insulting or criticizing, not encouraging or helping family members and blaming family members for problems); and interactions (i.e., often making plans and canceling them, willing to compromise when disagreeing, praising other family members when doing well, and not doing things the individual thinks are important) (Conger & Elder, 1994).

Negative family processes are associated with elevated risk for poor physical health, whereas supportive relationships low in negativity are associated with enhanced health in adulthood (Campbell, 2005; Coyne & DeLongis, 1986; Kiecolt-Glaser & Newton, 2001). Extant literature suggests that while supportive relationships protect individuals from poor health, negative relationships can deteriorate an individual's health (Campbell, 2005; Coyne & DeLongis, 1986; Kiecolt-Glasser & Newton, 2001). Indeed, negative family relationships can

negatively impact physical health more so than supportive relationships protect health (Campbell, 2005). Given the importance of family processes to adolescent health and development and the detrimental effect of negative family processes on health in adulthood, these findings suggest that negative family processes in adolescence might be linked to poor health outcomes.

Extant research suggests that negative family processes during adolescence can be detrimental to long-term mental and physical health outcomes. For example, individuals from families with high levels of negativity are more likely to report depression symptoms as adults than are individuals from families low in negativity (Herrenkohl, Kosterman, Hawkins, & Mason, 2009). In addition to poor mental health outcomes, individuals from families with negative family processes (i) have relatively poorer health specific behaviors like diabetes management (Weidner et al., 1992); (ii) are likely to report more poor health symptoms like pain and distress (Logan & Scharff, 2005; Schanberg et al., 1998; Scharff et al., 2005; Warfield et al., 1999); and (iii) show a decreased ability to rebound from health problems (Gil et al., 1992).

The few studies that have examined a link between negative family processes and poor health are either cross-sectional or have focused on the influence of negative family processes on health-specific outcomes, like diabetes (Weidner et al., 1992). Few studies have examined the impact of negative family processes on the overall perceived health of adolescents. Extant literature suggests there are at least two important factors in adolescence that, in part, predict adulthood health: adolescent health status and body weight (Allen & Armstrong, 2006; Fabricius & Luecken,

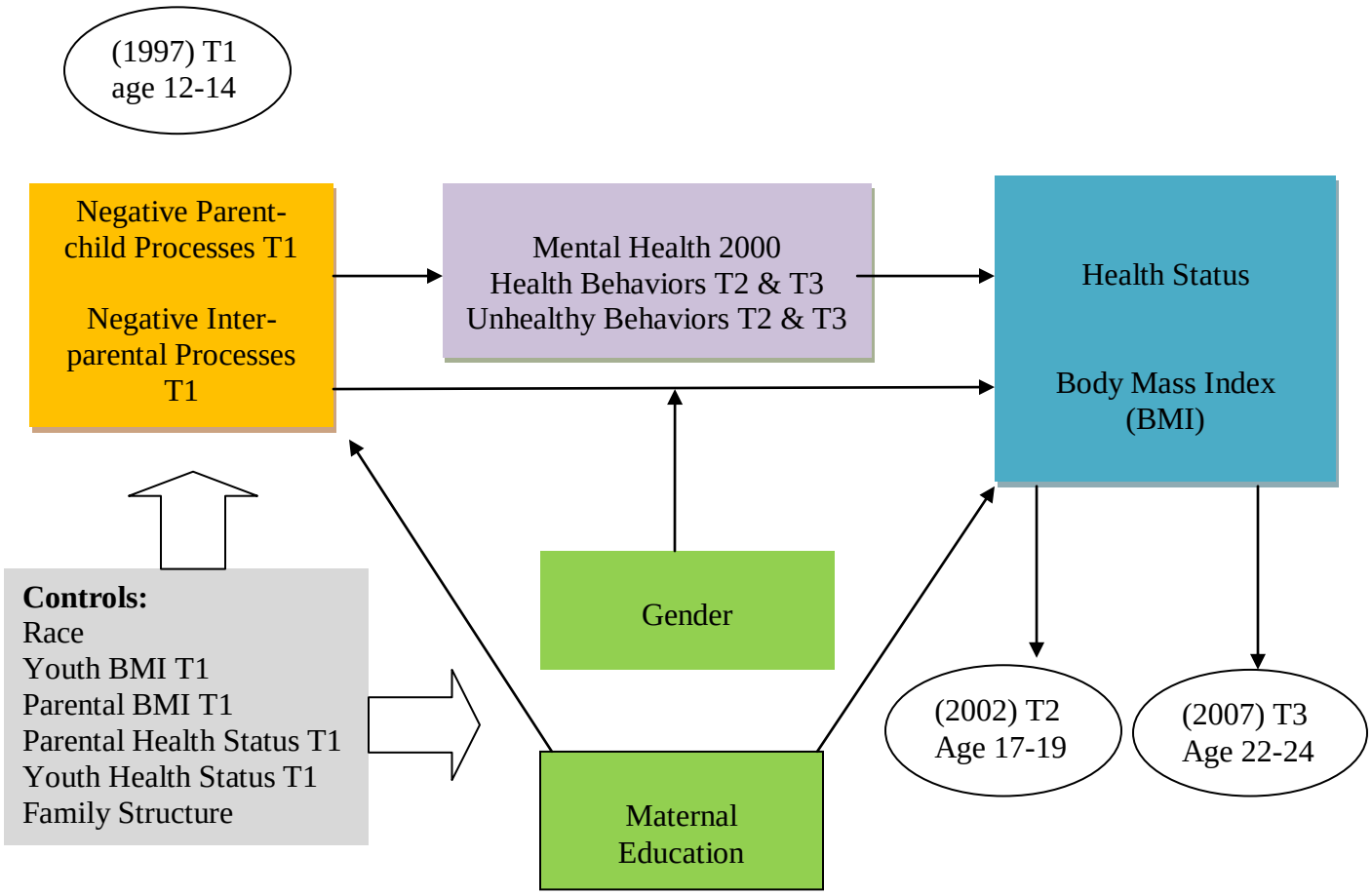
2007). Individuals who perceive themselves to be in poor health (Ferraro & Yu, 1995) or have high body weight (Kitzmann & Beech, 2006) are more likely to suffer from a myriad of diseases, health conditions and relatively higher mortality than those in good health and normal weight (CDC, 2010). Little is known regarding the exposure of negative family processes during adolescence and individual health status and body weight longitudinally. Thus, understanding the impact of negative family processes during adolescence on these two important adolescent predictors of adulthood health would fill a gap in the literature.

Informed by family systems theory and the biopsychosocial perspective, three pathways from negative family processes to poor health were examined. First, the association between adolescent negative family processes and health during late adolescence and early adulthood was examined. Second, this study examined the degree to which adolescent poor mental health mediate the association of negative family processes and adolescent and early adulthood health. Third, this study examined whether the association between negative family processes and poor health is mediated by the adolescent engaging in unhealthy or healthy behaviors. Finally, we examined whether the above associations differ depending on gender or maternal education.

This study is longitudinal in design so that the influence of negative family processes could be examined over the short- and long-term. Data from the Longitudinal Survey of Youth 1997 was analyzed to examine the research questions from this study. Two areas of negative family processes were examined: negative parent-child processes and negative inter-parental processes. To examine the

association of early adolescent negative family processes on late adolescence and early adulthood health, negative inter-parental and parent-child processes were assessed in 1997 when the youth were 12-14 years old. To examine the association of negative family processes in adolescence on health status and body mass index five years later, scores on these factors were assessed in 2002 when the youth were 17-19 years old were used. Finally, to assess the impact of negative family processes in adolescence on health ten years later, data on health status and body mass index were collected in 2007 when the youth were 22-24 years old were used. Figure 1 presents the study's design.

Figure 1: The Possible Pathways from Adolescent Negative Family Processes to Health Status and BMI



Chapter 2: Theoretical Framework

This study of the impact of negative family processes on health status and body mass index is informed by family systems theory and the biopsychosocial perspective. Other studies have used these two theoretical orientations to examine family processes and health outcomes. For example, family systems and the biopsychosocial perspective were used to examine the association between family factors and alcohol problems (Fischer, Korinek & Mulsow, 2007), as well as the biopsychosocial correlates predicting headache (Kroner-Herwig, Morris & Heinrich, 2007).

Family systems theory highlights the importance of 1) understanding that family interactions influence individual functioning, 2) examining the subsystems within the system and 3) viewing possible contextual factors that influence the family (and therefore, the individual). However, because family systems theory does not directly describe how negative family processes could be associated with individual members' health, we are augmenting it with the biopsychosocial perspective. Similar to systems theory, the biopsychosocial perspective highlights the intersection of multiple factors (e.g. social, psychological and biologic) in influencing an individual's functioning. Thus, the theoretical framework used in this study represents a combination of family systems theory's focus on the influence that family interactions have on individual well-being and the biopsychosocial perspective's identification of a link between family processes (i.e., social relationships) and physical health outcomes.

Family Systems Theory

The tenets of (1) viewing families as a system, (2) describing the interdependence and mutual influence of systems (3) the importance of subsystems, and, (4) the importance of context are the guiding principles of family systems theory that provide the framework for this study.

First, family systems theory posits that the family is a system that is identifiable as more than just a collection of individuals and can be viewed as an entity itself (Whitchurch & Constantine, 2004; White & Klein, 2002). The focus in family systems theory is not on the individual but rather the individual's interactions with his/her family system (Whitchurch & Constantine, 2004). In regards to examining negative family processes, negativity within the family is naturally systemic because it occurs between at least two people. Therefore, when examining negative family processes it is important to study the entire family system, not just one person's behavior. Components within each system are dependent on each other and thus are mutually influential (Whitchurch & Constantine, 2004; White & Klein, 2002). Therefore, negativity within the family influences all family members – regardless of which family members directly participate in the negative processes. Negative interactions have a ripple effect and tend to influence everyone within the family system who is exposed to it. This concept of 'holism' links each member of the family to the others (Whitchurch & Constantine, 2004) and is particularly evident for negative behavior. Youth can be exposed to negative family processes either through negative communication that they, themselves are involved in, or through

being exposed to negative interactions that they observe (both known as “inputs” into the system). Additionally, the negative interactions that they are involved in, or exposed to, may influence their own behavior (known as “outputs” from the system) (Anderson, 2004). For example, youth who observe their parents fighting would not perceive the fighting as a neutral event. This exposure to fighting could alter different individual processes - such as mental health (through higher levels of depression symptoms), individual behavior, or as this study is hypothesizing, physical health as well. Thus, family system theory’s concepts of mutual influence and interdependence suggest that exposure to negative family processes would influence individual behavior and outcomes.

A second tenet of family systems theory is that there are subsystems within each larger system (Whitchurch & Constantine, 2004; White & Klein, 2002). Each subsystem interacts within itself much like the larger system – and multiple subsystems make up the innerworkings of the larger system. In this study, two main subsystems will be examined: the parental subsystem (how the parents interact with each other) (Fabricius & Luecken, 2007), and the parent-child subsystem (how the parent and the child interact with each other) (Mackey & Streisand, 2008). The parental subsystem is the “control subsystem” within the family (White & Klein, 2002). It is influential in adolescent development, as is the parent-child subsystem (White & Klein, 2002). This is because within each subsystem an individual’s understanding and perception of his/her world is created. Therefore, to understand the factors influencing an individual’s life, viewing the parent-child and inter-parental subsystems from the individual’s perception is crucial. For example, an outsider

might view a youth's parents as frequently yelling at each other, but if the youth views these interactions as normal talking, the youth will not perceive this interaction to be stressful. Within systems theory, there is no objective reality of truth, therefore, the individual's perception becomes his/her reality (Whitchurch & Constantine, 2004). Because the negative association must occur through the adolescent's perspective in order for potential negative consequences to exist, this study examines negativity within the inter-parental and parent-child subsystems from the perspective of the youth.

Fourth, when examining the associations of negative family processes with individual outcomes such as health status and body weight, understanding the context that may influence these factors is critical. Context is reflected in family systems theory as a hierarchical suprasystem that interacts with the system of the family (White & Klein, 2002). Suprasystems are the systems outside of the family system that influence the family system (Whitchurch & Constantine, 2004). Examples of such suprasystems are racial and ethnic suprasystems, gender and socioeconomic status. The suprasystem that will be investigated in the present study is comprised of factors that have the potential to influence both the amount of negativity within a family and the health status and body weight of youth. These factors include socioeconomic status, race, and gender.

Another aspect of the context is the developmental stage of family members. During adolescence, the family is a vital system for individual health and development. Adolescence can be a particularly vulnerable time period for youth, because their physical bodies are developing and internal psychological processes are

being learned and developed (King et al., 2005). As children grow into adolescents and then young adults, the influence of the family remains important. Indeed, previous studies have shown that familial interactions during adolescence have a lasting effect into adulthood (Skeer, McCormick, Normand, Buka & Gilman, 2009). Taking this into consideration, this study examines the extent to which negative family processes (negative parent-child processes and negative inter-parental processes) during early adolescence is related to individual health status and body mass index during late adolescence and early adulthood. This study investigates the relations between these factors over a 10-year period.

Biopsychosocial Perspective

As mentioned previously, the biopsychosocial perspective augments family systems theory and provides a framework that explicitly describes how social interactions impact individual physical health. The biopsychosocial perspective includes physical, psychological and social dimensions (Fischer, Korinek & Mulsow, 2007). These three main processes are pivotal when examining individual outcomes (Fischer, Korinek & Mulsow, 2007). Similar to family systems theory, the three dimensions of this perspective are mutually influential. For example, a negative social process such as negative family processes would influence a psychological process, such as depression, that in turn negatively impacts an individual's health. This tri-factor process is not necessarily causal, as each factor mutually influences the other two factors like the systems concept of a "feedback loop". Thus, when

examining a physical process, identifying and examining social and psychological processes is crucial.

This interdependent process is further supported by the physiologic process of the body. When an individual is exposed to a perceived stressor – in this study, the stressful exposure is negative family processes – the body releases cortisol and other stress hormones (Michael, Torres & Seemann, 2000). These elevated stress hormones "alter core features of the appetite regulation system, and the metabolic parameters underlying it" (Glass & McAtee, 2006, 1650), thereby increasing an individual's risk for poor health (Michael, Torres & Seemann, 2000) and higher body weight over time (Glass & McAtee, 2006).

Following the biopsychosocial model, negative family processes, mental health and physical health are all factors that have been found to be interrelated. For example, stressful family interactions in adolescence are associated with higher resting blood pressure and hypertension in adults (Clark & Armstead, 2000). Negative family processes in adolescence have also been found to be linked to depressive symptoms in adulthood (Herrenkohl, Kosterman, Hawkins & Mason, 2009). Taken together, these studies represent the three interactional processes of the biopsychosocial perspective. Indeed, the physiologic stress response is an example of how the intersection of both social and psychological factors impact physical/biologic health. In short, the biopsychosocial perspective acknowledges the importance of examining physical, psychological and social factors in concert with each other for systemic understanding.

Summary

In sum, family systems theory posits that the family is a key system influencing individuals through familial processes. Since family systems theory does not directly address the link between family processes and individual health, the biopsychosocial perspective is used to augment family systems theory for this study. The biopsychosocial perspective explains health multifactorially in a way that acknowledges the interrelationships of biological, psychological and social factors, much like the concept of mutual influence in family systems theory.

Applying Family Systems Theory and the Biopsychosocial Perspective

Applying family systems theory and the biopsychosocial perspective to this study suggests that three possible pathways may link negative family processes with poor health:

1) According to the concept of interdependence within family systems theory and the understanding within the biopsychosocial model of the impact of social forces on one's physiologic health, adolescent negative family processes could be directly associated with poor health.

2) The biopsychosocial model suggests that an association could exist between the social (i.e. negative family processes), the psychologic (i.e., mental health) and the biologic (i.e., physical health). Negative family processes could increase youth's levels of poor mental health that, in turn, impact health.

3) The systems and biopsychosocial concepts of interdependence and mutual influence suggest that an association exists between the social (i.e. negative family

processes), the psychologic (i.e. behavioral) and the biologic (i.e. physical health). Therefore, the third pathway is that negative family processes could disrupt healthy behaviors that in turn impact poor health.

The following section discusses the theoretical underpinnings of this study. Afterwards, the extant literature supporting the identified model will be discussed.

Pathway #1: How negative family processes could be directly associated with poor health.

The family exerts a major influence on individual health and behavior (Skeer et al., 2009). Combining family systems and the biopsychosocial perspective suggests that since family relationships represent one of the most influential factors in adolescent health, it is physiologically plausible that negative family interactions would negatively impact adolescent health status and body weight (Skeer, McCormick, Normand, Buka & Gilman, 2009). The term 'embodiment' describes this process (Glass & McAtee, 2006). Embodiment describes "the sculpting of internal biological systems that occurs as a result of prolonged exposure to particular environments. It represents how features of social and built environments become internalized, or get 'under the skin'" (Glass & McAtee, 2006). Specifically, exposure to a negative family environment in adolescence may result in internalized stress which could manifest in poor health over time (Kiecolt-Glaser & Newton, 2001).

Pathway #2: How negative family processes could be associated with poor health through poor mental health.

The interconnectedness from the biopsychosocial perspective suggests that negative relational interactions negatively impact both psychological and physical health. For example, negative family processes are associated with elevated poor mental health (Yen, Hsu, Liu, Huang, Ko, Yen & Cheng, 2006), and poor mental health are associated with poor health status and higher BMI (Katon et al., 2010). Having family relationships that are supportive and low in negativity are hypothesized to decrease the psychological and physical stress of those within them (Olson, Sprenkle & Russell, 1979). Therefore, the interactions between the biological, psychological and social domains would be positive. This positive effect of supportive relationships would provide important stress reducing functions so that individuals could cope with negative influences. Conversely, the impact of negative family processes would cause negative outcomes in the psychological and biologic domains. Negative family processes can engender greater internalization of stress that can often result in poorer mental health. Therefore, a second pathway from negative family processes to health could be through mental health.

Pathway #3: How negative family processes could be associated with poor health through disrupting healthy behaviors (e.g., fruit and vegetable consumption, and physical activity).

The interdependence of the social (i.e., familial), psychological (i.e., behavioral) and physical (i.e., health) dimensions is a crucial concept in the

biopsychosocial perspective, which holds that nothing occurs in isolation. Negative family processes may disrupt parents' ability to parent as effectively as they could (Gregory et al., 2006). This includes providing necessary health promoting messages, monitoring and enforcing positive health behaviors (Gregory et al., 2006). Behaviors like fruit and vegetable consumption and physical activity – which are linked to good health – are less likely to occur in families with more negative processes (Gregory et al., 2006). Therefore, the third pathway that negative family processes could impact youth health is through disrupting these health promoting behaviors like fruit and vegetable consumption and physical activity.

Application Summary

In sum, family systems theory and the biopsychosocial perspective guide this study. These theories suggest that multiple pathways could exist from the influence of adolescent negative family processes to poor health. The biopsychosocial perspective identifies the mutually influential interdependence of social processes, psychological processes and physical health. Therefore, negative family processes could directly impact an adolescent's health through the stress induced by negativity and the resulting physiologic effects that increase risk for poor health. Negative family processes could also impact both the psychological and the physical domains by negatively influence psychological well-being through depressive symptoms, which, in turn, could result in elevated risk for poor health. Finally, negative family processes could interfere with health promoting behaviors such as physical activity and diet, which could negatively impact individual health. These are the theoretically

driven pathways for this study. The next section discusses the extant literature supporting these associations.

Chapter 3: Background

Family relationships represent one of the most influential factors in adolescent development (Skeer, McCormick, Normand, Buka, & Gilman, 2009) and health (Campbell, 2005; Troost & Filsinger, 2004). Personal relationships can enhance health (Kiecolt-Glaser, 1999) or be a principal source of mental and physical stress (Campbell, 2005; Levenson, Carstensen, & Gottman, 1993; Liu & Umberson, 2008; Luecken, Kraft, & Hagan, 2009). Men and women who report high relationship satisfaction have few health complaints and are generally in good health (Campbell, 2005; Kiecolt-Glaser & Newton, 2001; Levenson, Carstensen, & Gottman, 1993; Liu & Umberson, 2008), whereas individuals who report higher stress levels tend to be in poor health (Campbell, 2005; Kiecolt-Glaser & Newton, 2001; Steptoe, 2008). Higher levels of stress have also been linked to immune suppression and increased blood pressure in adults (review in Kiecolt-Glaser & Newton, 2001). However, having positive family relationships substantially reduces the risk for poor health in adults (Cierpka, Reich, & Kraul, 1998; Kiecolt-Glaser & Newton, 2001; Johner, 2007). Since family interactions can enhance or deteriorate health (Kiecolt-Glasser & Newton, 2001), negative family interactions/processes could influence the health of youth (McClure & Myers, 1999).

Family relationships during adolescence can sometimes be negative (Herrenkohl, Kosterman, Hawkins, & Mason, 2009). Negative family interactions

create a physiologic stress response that could elevate an individual's risk for poor health (Kiecolt-Glaser & Newton, 2001; Luecken, Kraft, & Hagan, 2009). This chapter defines negative family processes; describes the association of negative family processes with poor health in the extant literature; and identifies health status and body weight as two important adolescent constructs of adulthood health. This chapter also identifies the gaps in knowledge, research questions and hypotheses that are addressed by the current study.

Negative Family Processes

Historically, family processes in adolescence were considered to be very negative as youth differentiated from their parents through conflict (Steinberg, 1990; 2001). However, recent research suggests that it is not usual for adolescents to be engaged in angry, intense and frequent fighting with their parents through adolescence (Steinberg, 2001). However, the developmental tasks in adolescence suggest that there is a possibility for negative parent-child and inter-parental processes (McGoldrick, Carter & Garcia-Preto, 2011). Transitioning from early adolescence to late adolescence, and then to early adulthood elevates youth's vulnerability to stress (Conger & Conger, 2002; McGoldrick, Carter & Garcia-Preto, 2011).

First, the family is a vital system for individual health and development during adolescence. Adolescence can be a particularly vulnerable time period for youth, because their physical bodies are developing and internal psychological processes are being learned and developed (Conger & Conger, 2002; King et al., 2005;

McGoldrick, Carter, & Garcia-Preto, 2011, 2010). Adolescents seem to have a heightened sensitivity to influences around them (Conger & Conger, 2002; Ge et al., 1994; Moffitt, 1993). Family processes in adolescence are associated in late adolescence with mental health, engagement in healthy or risky behaviors, emotion management and stress reactivity (Chung, Flook, & Fuligni, 2009; Cole & McPherson, 1993; DeCarlo Santiago & Wadsworth, 2009; Dong, Sanchez, & Price, 2004; Jewell & Stark, 2003; Herrenkohl, Kosterman, Hawkins & Mason, 2009; Michael, Torres, & Seemann, 2007).

Second, as shown in previous studies, the impact of family processes in adolescence has a lasting effect into adulthood (McLaughlin et al., 2010; Skeer, McCormick, Normand, Buka, & Gilman, 2009). For example, young adults from families with more negative processes were more likely to develop anxiety or mood disorders in adulthood than youth from families with fewer negative processes (McLaughlin et al., 2010).

Third, there is a developmental difference between early adolescence, late adolescence and early adulthood. Adolescence is a time when the individual is finding his/her identity and is still strongly attached to his/her family of origin (McGoldrick, Carter, & Garcia-Preto, 2011). In early adolescence (age 12-14), most youth are in middle school and starting to have a little more independence but still have a close relationship with their family of origin (McGoldrick, Carter, & Garcia-Preto, 2011). As youth grow up and progress through adolescence and enter late adolescence (age 17-19), they continue to develop a sense of self apart from their family of origin (McGoldrick, Carter, & Garcia-Preto, 2011). Yet the family

continues to provide valuable support and influence (McGoldrick, Carter, & Garcia-Preto, 2011; Moore, Guzman, Lippman et al., 2004).

As the individual enters adulthood, his/her ties remain with the family of origin but it becomes less influential (McGoldrick, Carter, & Garcia-Preto, 2011). Though the influence of family processes in adolescence often remains strong in adulthood (as noted earlier), for some individuals, the negative influence of adolescent environments can be countered through individual positive behaviors in adulthood (Rutter, 1993; Werner, 1993). Therefore, though we expect (i.e. hypothesize) that negative family processes in adolescence would be associated with poor health outcomes in both late adolescence and early adulthood, we distinguish between the two time periods to account for a possible attenuating effect.

The decision to examine multiple time periods is consistent with other studies that emphasized the importance of assessing the longitudinal influence of adolescent factors on later adolescence and early adulthood (Gordon-Larsen, The, & Adair, 2010; Wang, Chyen, Lee, & Lowry, 2008). Additionally, assessing multiple time periods is consistent with the emphasis of family systems theory on the importance of the developmental context of individuals within the family system.

Positive versus Negative Family Processes

Negative family processes are stress inducing aspects of personal relationships (Gottman & Katz, 1989; Kiecolt-Glaser & Newton, 2001; Luecken, Kraft, & Hagan, 2009). Extant research traditionally views both negative and positive family processes (i.e. conflict, aggression and criticism and family warmth, closeness and support) as

important influences of youth development (Campbell, 2005). However, when viewing health outcomes, other studies suggests that while positive relationships can protect individuals from poor health, negative family processes significantly deteriorate health (Campbell, 2005). Furthermore, when weighing the positive and negative effects, respectively, negative family processes *negatively* impact physical health more than supportive relationships benefit health (Campbell, 2005; Edwards et al., 2001). The current study focused on examining the impact of negative family processes on individual health.

Family Subsystems

Although there are multiple subsystems within the family, this study addresses two important subsystems for adolescent development: the parental subsystem and the parent-child subsystem. From a systems perspective, both subsystems create/engage in negative family processes: one through observing negative processes and the other through direct exposure to the negative processes.

Inter-parental processes. The first subsystem is the interactions between a youth's parents. In this study, all youth live in the same household with two parents who are in a couple relationship. Therefore, not only do the youth's parents have the role of co-parents, but they are also in an intimate relationship with each other. The dynamics of working so closely with another individual within the "control subsystem" can sometimes be negative (White & Klein, 2002). Negative inter-parental processes have been found to exert a powerful influence on child outcomes – specifically, negative inter-parental processes are associated with poor academic

achievements (2007), distress (Harold, Fincham, & Osborne, 1997), depression (Schudlich & Cummings, 2003) and behavioral problems (Cummings & Davies, 2002).

Parent-child processes. The second subsystem is the parent-child subsystem. The parent-child subsystem is very important for youth and adult development (Birditt, Rott & Fingerman, 2009; Morrison, Rimm-Kauffman, & Pianta, 2003). Negative processes between parents and youth are sometimes considered usual in adolescence (Herrenkohl, Kosterman, Hawkins & Mason, 2009) in adulthood (Birditt, Rott & Fingerman, 2009), and sometimes only for distressed families (Steinberg, 2001).

As discussed earlier, there are varying stereotypes and reports of the frequency of negative familial interactions during adolescence. One study found that between the ages of 14 to 18, negative family processes increases (Herrenkohl, Kosterman, Hawkins & Mason, 2009), while an earlier study found that the same negative family process between youth and their parents remains consistent through middle school (Galambos & Almeida, 1992) and high school (Chung, Flook & Fuligni, 2009). Results from another study followed family processes over adolescence found that, for the most part, adolescents report low levels of negative processes toward their mother and father in early adolescence (Moore et al., 2004). Additionally, that reports of negative processes slightly increase through adolescence from age 12-13 to 16-17 (Moore et al., 2004). Taken together, these findings suggest that starting in early adolescence (prior to age 14), exposure to negative family processes either stays the same or increases. Our study assesses negative family

processes during this early adolescent period thus capturing the minimum amount of the youth's exposure to negative family processes.

Negative Family Processes and Health Outcomes

A family environment characterized by negative processes is associated with poor disease-specific health outcomes for adolescents. For example, negative family relationships are related to poor diabetes management, including less than optimal lipid profiles, lower adherence to glucose management behavior (Weidner et al., 1992), and a decreased ability to rebound from health problems (Gil et al., 1992). Additionally, Jacobson (1994) found that negative family interactions are more crucial for metabolic balance for diabetic youth than other family factors such as family rules and structure (Jacobson et al., 1994). These findings underscore the importance of family interactions to individual health.

Family processes also play an important part in general health and recovery. Family members' interactions with each other are linked to physical symptoms and pain responses in adolescents (Drotar, 1997; Scharff et al., 2005; Warfield et al., 1999). In contrast, families with negative family processes that are rigid and have many "family rules" are associated with greater pain and poorer physical functioning than supportive families (Drotar, 1997; Schanberg et al., 1998; Scharff et al., 2005; Warfield et al., 1999). Families with many negative processes also hinder recovery from surgery. Adolescents from families with negative family processes who underwent orthopedic surgery reported more pain in recovery than others from families that were less negative (Gil et al., 1992; Moos & Moos, 2009).

In addition to increasing pain levels and decreasing physical functioning, the stress caused by negative processes is also associated with negative physiologic responses in youth (Michael, Torres, & Seemann, 2007). For example, negative family environments are associated with higher mean arterial blood pressure in African American youth (Clark & Armstead, 2000). Additionally, family quarrelling (an aspect of negative processes) explained 6% of the variance in headache frequency among adolescents aged 9-14, whereas a supportive family environment was protective against headache frequency (Kroner-Herwig, Morris, & Heinrich, 2007). These findings suggest that family processes are important determinants of health among adolescents. However, these outcomes focus on only one aspect of adolescent health, thus an understanding of these influences on overall health is unknown.

Two adolescent constructs of adulthood health. Extant literature has identified two main constructs of adolescent health that are particularly predictive of health in adulthood: overall health status and body mass index (BMI) (Allen & Armstrong, 2006; Ferraro & Yu, 1995). Both health status and BMI are global health indicators that are highly correlated to physical health and mortality – thus making them significant predictors of future health (Allen & Armstrong, 2006; Fabricius & Luecken, 2007).

Adolescence represents an important period for promoting health as an adult (Flynn et al., 2006; Glass & McAtee, 2006). For the most part, research on the influence of family processes on adolescent health focus on specific aspects of health (i.e. obesity, diabetes, asthma, and cardiovascular disease), failing to capture a complete understanding of overall adolescent health. The seeds for poor health can be

sown in youth but often do not reach fruition until adulthood (Flynn et al., 2006). Indeed, exposure to factors in adolescence "explain trajectories of health in adulthood, decades later" (Flynn et al., 2006; Glass & McAtee, 2006).

Additionally, parental divorce is highest in adolescence and parental divorce is usually characterized by high levels of negative interactions (Davies et al, 2007). Childhood parental divorce attenuates cortisol in young adulthood (Kraft & Luecken, 2009), which shows that experiencing negativity in adolescence impacts the physiologic processes of the body which in turn can elevate risk for poor health (Kraft & Luecken, 2009). Linking these findings to the concept of embodiment discussed above, the physiologic impact of negative family processes could very well be heightened given the developmental context of youth (Glass & McAtee, 2006). Therefore, this study examines the effect of negative family processes in early adolescence on late adolescence and early adulthood health (Flynn et al., 2006).

Health Status

Studies have used the overall perception of health as reported by the youth as a good measure of future health (Allen & Armstrong, 2006; Fabricius & Luecken, 2007; Manor, Matthews, & Power, 2001). Health status is generally stable through adulthood (Manor, Matthews, & Power, 2001) and youth health status is a good predictor of health (i.e., physical health, hospitalization and mortality) as an adult (Fabricius & Luecken, 2007; Frome et al., 1996). Thus, when examining the longitudinal effects of negative family processes in adolescence on adulthood health,

the assessment of perceived overall health during adolescence is a good predictor of health as an adult.

For example, Fabricius and Luecken (2007) asked college students to report retrospectively about the degree of one specific negative family process – parental conflict - in their late adolescence as well as their current health status. They found that students who retrospectively reported greater parental conflict six years earlier had lower perceived health status in college indicating the lasting effect of familial conflict on adult health. Despite the cross-sectional and retrospective nature of the study, this finding suggests that there is something in the processes of families with negative processes that increases youth's risk for negative poor health over time.

Body Mass Index

Having a high Body Mass Index (BMI) is significantly related to poor health (DHHS, 2001; Greenblatt, 2003; Ogden, Carroll, & Curtin, 2010). Obese individuals are at risk for more than 30 related diseases, and at least 300,000 Americans die each year from obesity-related diseases (CDC, 2010; Greenblatt, 2003). In fact, obesity-related diseases "now rival tobacco as the leading cause of preventable death in America" (Greenblatt, 2003, 5). Due to the association between high BMI and poor health, BMI is a good predictor of health in adulthood.

In adolescence, higher BMI percentile is also significantly related to poor health risk factors such as high blood pressure or high cholesterol (CDC, 2010; Freedman et al., 2007). Indeed, in a national sample of adolescents, 70% of obese youth had one or more risk factor for cardiovascular disease (Freedman, Zuguo,

Srinivasan, Berenson, & Dietz, 2007). Additionally, overweight children are more likely to be obese adults – one study found that 80% (n=854) of children who were overweight between age 10-15 were obese when they were 25 years old (Whitaker et al., 1997), and another found that the prevalence of obesity doubled from early twenties to early thirties (Gordon-Larsen, The, & Adair, 2010). Therefore, high BMI in adolescence is a good predictor of poor health as an adult.

Body weight is a product of a combination of genetics, healthy behaviors and environment (Hooper, Burnham, & Richey, 2009; Loos & Bouchard, 2003). The current study used parental body mass index as a control to account for the genetic contribution, and fruit and vegetable consumption and physical activity were used as mediators to account for the contribution of health-promoting behaviors (discussed further below). While the contribution of these two factors to body weight is uncontested, emerging research acknowledges that family interactions may also be associated with body weight (Flynn et al., 2006). In a cross-sectional convenience sample of 10-15 year olds, negative family processes (defined as family cohesion and negative family processes) are associated with current adolescent weight status such that high levels of negative processes are linked to high body weight (Hooper, Burnham, & Richey, 2009). Guided by family systems theory, the authors suggest that given their findings, negative family processes could be a worthwhile factor to focus on in understanding adolescent body weight (Hooper, Burnham, & Richey, 2009). Additionally, in an earlier cross-sectional study, negative family processes (i.e. hostile, conflictual, low cohesion, and low expressiveness interactions) were related to obesity in female adolescents (Mendelson, White, & Schleicker, 1995). But while

these studies demonstrate an association between negative family processes and body weight, it is important to note that they only reflect cross-sectional linkages.

However, some studies have suggested that there could be a longitudinal association between negative family processes and body weight. For example, Crossman, Sullivan, and Benin (2006) found that another family process – family closeness/support – was associated with body weight over time. Specifically, they found that females who felt cared for by their parents in adolescence were at reduced risk for high body weight six years later in early adulthood, while males who reported low levels of closeness with their parents in adolescence were more likely to have high body weight six years later in young adulthood (Crossman et al., 2006). These findings suggest that the youth's relationship with their parents in adolescence could be an important factor associated with later body weight. Yet, as discussed above, negative family processes have a far worse physiologic effect than supportive relationships. The hypothesized negative association in this study between negative family processes and adolescent health seems particularly plausible given these findings.

Finally, Paradis, Reinherz, Giaconia, Beardslee, Ward, and Fitzmaurice (2009) examined the long term influence of adolescent family arguments on physical health through age thirty. Family arguments and physical violence are two dimensions of negative family processes. The authors found that being exposed to family arguments and violence prior to age 18 increased the respondents' risk for poorer physical health at age 30 by two times compared to those with less exposure to these negative family processes (Paradis et al., 2009). Even though the authors

measured physical health by whether the respondent had experienced any serious health problems in the past year – a different construct of health than is being used in the current study – the findings suggest that negative familial interactions in adolescence exert a significant impact on physical health problems in adulthood. Additionally, Paradis and colleague's (2009) definition of negative family processes used specific measures of whether arguments had increased through adolescence and whether violence was present in the family, leading the authors to note that future studies detailing information about broader negative family processes would be beneficial (Paradis et al., 2009). This study addresses this shortcoming and assesses negative parent-child and inter-parental family processes.

Taken together, these findings provide support for this study's examination of the impact of negative family processes in adolescence on physical health in adulthood.

Gap in Literature

From a family systems and biopsychosocial perspective, poor health and obesity are complex problems that require more than just individual-level factors. Much attention has been placed on examining individual factors that contribute to body weight and poor health- from specific health promoting behaviors to examination of motivations behind individual choices (Glass, Rasmussen, & Schwartz, 2006) with some success in better understanding some influences. However, large gaps remain in understanding additional important factors influencing poor health and obesity (Glass, Rasmussen, & Schwartz, 2006; Glass & McAtee,

2006). Family interactions are one such important influence to which youth are exposed that significantly relates to adolescent health (Glass & McAtee, 2006; Hooper et al., 2009). If the family interactions are negative then youth could be at enhanced risk for poor health status and body weight (McClure & Myers, 1999; Rhee, 2008). This study fills this gap in the literature by examining the longitudinal association of negative family processes in adolescence and poor health in adulthood.

Mediators: Health Behaviors

The CDC has identified critical adolescent health behaviors: including alcohol, marijuana use, tobacco use, nutrition, and physical activity (CDC, 2010). These behaviors are important to long-term health and well-being (CDC, 2010; DHHS, 2001; Turner, Irwin, & Millstein, 1991). Additional research supports these as particular risk behaviors for poor health. For example, Kulbok, & Cox (2002) found that sexual activity, substance use (alcohol, marijuana and other drugs), smoking and exercise accounted for 74% of the variance in the composite of health and healthy behaviors in adolescents.

The family is often the place where health behaviors are established. Due to the developmental context of youth, the family greatly influences youth behavior (Lehman, Taylor, Kiefe, & Seeman, 2005; Michael, Torres, & Seemann, 2007). Negative family processes can disturb healthy behaviors (Gregory, Caspi, Moffitt, & Poulton, 2006; Price, Day, & Yorgason, 2009) as well as increase youth's engagement in unhealthy behaviors (Turner, Irwin, & Millstein, 1991). Body weight is the balance between energy consumed and energy expended – therefore, nutrition

and physical activity are important health promoting behaviors that directly influence body weight (Price, Day, & Yorgason, 2009). In addition, negative family processes increase youth's risk for engaging in unhealthy or risky health behaviors. Engaging in risky health behaviors, like tobacco use, marijuana, substance use (like cocaine) and sexual behavior, increase when exposed to negative family processes.

Physical Activity. Physical activity reduces individuals' risk of cardiovascular disease, hypertension, diabetes and early mortality (CDC, 2010). Additionally, engaging in physical activity on a regular basis increases strength, builds healthy bones and is associated with lower cholesterol and blood pressure (CDC, 2010) – all aspects of good health and lower body weight. However, 65% of youth do not engage in the recommended 60 minutes of physical activity at least five days of the week (CDC, 2010) which might be why by the age of 12, over 40% of youth have one risk factor for cardiovascular disease (Richter, Harris, Paine-Andrews et al., 2000). Negative family processes are associated with less frequent physical activity (Mackey & Streisand, 2008). Exposure to negative inter-parental processes among 17-19 year olds is negatively associated with health behaviors (Michael, Torres & Seemann, 2007).

Nutrition Behaviors. Fruit and vegetable consumption is an important aspect of good health and one of the critical health behaviors (CDC, 2010; Flynn et al., 2006). Negative family processes can make it difficult to manage family meals and control child behavior (Rhee, 2008). Families with more negative processes eat fewer meals together and less fruits and vegetables (Rhee, 2008; Price, Day, & Yorgason, 2009).

Substance Use. Using substances, like cigarettes, alcohol, marijuana and other drugs, in adolescence is linked to poorer health in adulthood (Turner, Irwin, & Millstein, 1991). Negative family processes are associated with greater risk for experimenting with substances in adolescence. For example, youth with parents who are emotionally detached from them are more likely to experiment with tobacco, alcohol, marijuana, cocaine and other drugs (Turner, Irwin, & Millstein, 1991). Additionally, another study found that parents who did not listen to their children's worries, spent little free time with each other, and did not provide help when needed – all aspects of negative family processes – had youth who were more likely to drink alcohol and drink excessively (Kuntsche & Kuendig, 2006). Furthermore, though some studies have shown the importance of peer influences over family influences for adolescent behavior, recent reviews have highlighted the more predictive influence family factors for adolescent substance use (at least for initiation to drinking) (Jung, 1995; Kingon & O'Sullivan, 2001).

Mediator: Mental Health

Negative family processes are linked with the emotional state of youth (Chung, Flook, & Fuligni, 2009; Michael, Torres, & Seemann, 2007). Negative family processes among 14-17 year olds are predictive of poorer mental health as adults (DeCarlo Santiago & Wadsworth, 2009; Herrenkohl, Kosterman, Hawkins, & Mason, 2009). Additionally, negative family processes and low levels of supportive family relationships are associated with risk of depression among adolescents (Cole

& McPherson, 1993; Jewell & Stark, 2003). Further, poor mental health is linked to high body weight and poor health (Dong, Sanchez, & Price, 2004).

Moderators

Maternal Education. Maternal education is commonly used as a proxy for socioeconomic status (Cornelilisse-Vermaat, Antonides, Van Ophem, & Van Den Brink, 2006). Extensive studies have established the link between low socioeconomic status and negative family processes (Slee & Murray-Harvey, 2007), depression, unhealthy behaviors, poor health status and higher BMI (Brown & Siahpush, 2006; Cornelilisse-Vermaat, Antonides, Van Ophem, & Van Den Brink, 2006; Sobal & Stunkard, 1989). Given how socioeconomic status impacts negative family processes, depression, healthy behaviors, and individual health status and BMI, maternal education was used as a proxy for socioeconomic status as a moderator in this study.

Gender. Gender differences have been found in interactions with family members as well as health and body weight (Chung, Flook & Fuligni, 2009; Crossman et al., 2006). Adolescent girls and boys respond to negative family processes differently (DeCarlo Santiago & Wadsworth, 2009; Paradis et al., 2009). For example, maternal-youth conflict occurred more frequently than paternal-youth conflict and girls reported greater exposure to inter-parental conflict than boys (Chung, Flook, & Fuligni, 2009). Additionally, cross-sectional research found that females from families lower in closeness and more negative processes were associated with obesity than females who were normal weight (Mendelson, White, & Schliecker, 1995). These gender differences suggest that females and males might

perceive relationship interactions differently and consequently, the association with health might differ. Additionally, gender differences have been found with body weight (Stradmeijer, Bosch, Koops & Seidell, 2000). Therefore, gender was used as a moderator in this study.

Control Variables

Other factors may influence the association between negative family processes in adolescence and health: parental body mass index and health status, race/ethnicity, and family structure.

Parental Body Mass Index and Health Status. Individuals inherit biological and genetic influences on their body weight and overall health from their parents. People who live together tend toward similar patterns (Garn, LaVelle, & Pilkington, 1984). For these reasons, a strong predictor of both adolescent and early adulthood BMI and health is parental high BMI (Crossman, Sullivan, & Benin, 2006). For example, youth are between two and five times more likely to be obese if one parent is obese as compared to youth in families with no obese parents (Hooper et al, 2009; Yoon, Scheuner, & Khoury, 2003). And when both parents are obese, the risk for the youth being obese increases 60-80% (Garn, et al., 1984). Additionally, youth who have a mother who is obese become obese at an earlier age than youth with a non-obese mother and stay obese through adulthood (Gordon-Larsen, Adair, & Suchindran, 2007). For example, Crossman, Sullivan and Benin found that adolescents who had an obese parent were at a much greater risk for obesity six years later than adolescents who did not have an obese parent. In sum, parental body weight

exerts a strong and lasting influence on adolescent body weight. Therefore, parental body weight and perceived health status were used as controls in this study.

Racial/Ethnic Influences. Racial differences have been identified in family processes, health behaviors (Gordon-Larsen, Mullan Harris, Ward & Popkin, 2003), health outcomes (Steinberg et al., 1999) and body weight (Ogden, Carroll & Curtin, 2010). For example, compared to Caucasian American families, African American families tend to report less negative family processes compared to Caucasian families (Amodeo, Griffin, Fassler, Clay, & Ellis, 2007). Additionally, Asian youth perceive infrequent inter-parental arguments within their families as compared to Caucasians (Chung, Flook & Fuligni, 2009); Latino families report being closer to each other than Caucasian families (Rivera, 2008); and African American families report higher levels of satisfaction than Caucasian families (McAdoo, 1982). Further differences in health behaviors like physical activity and consumption of fruits and vegetables have been found in Hispanics, African Americans and Caucasians (Gordon-Larsen, Mullan Harris, Ward & Popkin, 2003). Given the differing associations of race on negative family processes, health behaviors and health outcomes, race was used as a control in this study.

Family Structure. Different family structures have varying effects on psychological and physical outcomes (Johner, 2007; Zimmerman et al., 2008). Some studies have found differences in two-parent biological families versus non-biological (step-parent families) (Johner, 2007; McAdoo, 1982), therefore, family structure was used as a control in this study.

Summary

Extant literature suggests that negative family relationships may be detrimental to healthy adolescent growth and development. Health status and BMI represent two important adolescent health constructs predictive of health in adulthood. Therefore, this study examined the association of adolescent negative family processes over a ten year period to assess its longitudinal influence on health status and BMI.

Hypotheses

1) NPCP and NIPP will be associated with, respectively, a) elevated risk of poor self-reported health status and b) elevated Body Mass Index in a) late adolescence (T2), and b) early adulthood (T3).

   a. Additionally, the association between negative family processes and health status and BMI, respectively, will attenuate over time when comparing late adolescence (T2) to early adulthood (T3).

2) Poor mental health (of the youth) will attenuate the association between NPCP, and NIPP, respectively and a) risk for poor perceived health status, and b) elevated BMI.

3) Engaging in unhealthy behaviors (e.g., using tobacco, alcohol, and marijuana) will attenuate the association between NPCP and NIPP, respectively, and a) risk for poor perceived health status and b) elevated BMI.

4) Engaging in healthy behaviors (e.g., eating fruits and vegetables and engaging in physical activity) will attenuate the association between NPCP and NIPP, respectively, and a) risk for poor perceived health status, and b) elevated BMI.

5) The association between NPCP and NIPP, respectively, and a) health status, and b) BMI will be stronger among youth with a mother who attended high school than among mothers who attended college or graduate school.

6) The association between NPCP and NIPP, respectively, and a) health status, and b) BMI, respectively, will be stronger among females than among males.

Chapter 4: Methods

Sample

Data from the National Longitudinal Survey of Youth of 1997 (NLSY97) was used. The NLSY97 is an annual survey of a nationally representative sample of 12-14 year old residents of the United States of U.S. residents born in 1980 through 1984. Respondents were aged 12-17 in 1997 when the study began. In addition, the NLSY97 also includes information on all siblings aged 12-14 who resided in the same household as the index participant. Three waves of data were used: 1997 (T1), 2002 (T2), and 2007 (T3).

Measurement

Health Status

Health status was assessed in T1, T2 and T3 by asking respondents "how would you describe your present health? Is it…poor, fair, good, very good or excellent? Respondents who answered poor or fair were grouped together because of the small sample who reported poor health as an adolescent (n= 11 in T1, n = 19 in T2, n= 34 in T3). Health status was reverse coded so that the analysis can be in reference to respondents' risk for poor health.

Body Weight

Body weight and height were reported in T1, T2 and T3. Body mass index was calculated using the formula: BMI = [weight in pounds/(height in inches) x (height in inches)] x 703 (Sobal, Rauschenbach & Frongillo, 2003). Because of developmental differences among females and males, the adult BMI cannot be used for adolescents. Therefore, respondents' BMI was compared to age and gender specific norms. The body weight and height of each respondent was recorded.

For T1 and T2, BMI percentiles were based on CDC's age and gender specific recommendations for assessing BMI in children and adolescents (Cole et al., 2000; CDC, 2010). In all three time periods there were some nonprobable outlier scores that were excluded: for T1 (n = 4) and T2 (n= 11), and T3 (n = 4). A continuous variable for BMI percentile was used for T1 and T2. BMI percentile at T1 (continuous variable) was used as a control, and BMI percentile at T2 (continuous variable) was

used as a dependent variable. In T3, the continuous BMI score was used as a dependent variable.

Family Processes

Parent-Child Processes. Parent-child processes were assessed in T1 by a scale adapted from Conger & Conger's Iowa Youth and Family Project (Conger & Elder, 1994). Respondents were queried about their relationship with their mother and father, respectively and were asked three questions: "I think highly of him/her"; "S/he is a person I want to be like"; and "I really enjoy spending time with him/her". These three questions were assessed on a 5 point likert scale from "0" (Strongly Disagree), "1" (Disagree), "2" (Neutral), "3" (Agree), and "4" (Strongly Agree). Five additional questions assessed respondents' perception of supportiveness of each parent: 1) "how often does s/he praise you for doing well?"; 2) "how often does s/he criticize you for your ideas"; 3) "how often does s/he help you do things that are important to you"?; 4) "how often does s/he blame you for her problems?"; and 5) "how often does s/he make plans with you and cancel for no good reason?". These five questions were assessed on a five-item likert scale from "0" (Never), "1" (Rarely), "2" (Sometimes), "3" (Usually), and "4" (Always). Responses to these eight items are summed ranging from 0-32 with higher scores reflecting more positive processes (NLSY97 Family Process Supplement Guide).

This variable was initially modeled as a continuous independent variable, however, ultimately it was determined that it would be best to categorize this variable into two groups: respondents who report negative parent-child processes (NPCP) and

respondents who report positive parent-child processes. The reason for this dichotomization was that the continuous variable models a one unit increment in the family process variable. We reasoned a larger increment would be more meaningful. This categorization will better answer the question of whether exposure to negative family processes is linked to health status and BMI and is used in the following analyses.

Respondents were categorized as having a positive relationship with their parents if they scored at least 24 points on the scale (Hair, Moore, Garett et al., 2005). These respondents answered usually (a score of 3 on the 4 point likert scale) or better to each of the 8 items. An indicator variable was created for respondents who scored a 24 or below indicating NIPP (given a "1"), versus respondents who scored over a 24 indicating positive inter-parental processes (given a "0").

Inter-parental Processes. Inter-parental processes was assessed in T1 with the following six-items (Conger & Elder, 1994): 1) "Does s/he scream at him/her when s/he is angry? (reverse coded)"; 2) Is s/he fair and willing to compromise when they disagree"; 3) Does s/he express affection or love for him/her?; 4) Does s/he insult or criticize him/her or his/her ideas? (reverse coded)"; 5)"Does s/he encourage or help him/her with things that are important to him/her?"; and 6) Does s/he blame him/her for her/his problems? (reverse coded). Respondents answered on a 5-point likert scale from "0" (Never), "1" (Rarely), "2" (Sometimes), "3" (Usually), and "4" (Always). The NLSY97 summed all the questions after reverse coding the questions asking about criticizing and blaming behavior. Higher scores reflect more positive relationships. For the respondents who missed answering one of the six items, the

NLSY imputed a score weighted on a 24 point scale (i.e., rawscore *(6/6-missing) (NLSY Family Process Supplement). Youth who answered fewer than 5 items were coded as missing. The score ranges from 0 to 24. This variable was initially modeled as a continuous independent variable, however, ultimately it was determined that it would be best to categorize this variable into two groups: respondents who report NIPP and respondents who report positive inter-parental processes.

Respondent's parents were categorized as having a positive relationship with eachother if they scored at least 18 points on the scale (Hair, Moore, Garett et al., 2005). These respondents answered usually (a score of 3 on the 4 point likert scale) or better to each of the 6 items. Therefore, an indicator variable was created for respondents who scored an 18 or below indicating NIPP (given a "1"), versus respondents who scored over an 18 indicating positive inter-parental processes (given a "0").

Health Behaviors

The degree of involvement with various healthy behaviors was assessed in T2 and T3 with the following questions: 1) "In a typical week, how many days do you engage in exercise that lasts 30 minutes or more?" Respondents reported from "0" to "7" days. Physical activity was analyzed as a continuous variable; 2) "In a typical week, how many times per week do you eat fruit?" and "In a typical week, how many times do you eat vegetables other than French fries or potato chips?" Respondents reported from "1" I do not typically eat fruit/vegetables, "2" 1-3 times, "3" 4-6 times, "4" 1x a day, "5" 2x a day, "6" 3x a day or "7" 4 or more times per day. Responses

were summed to indicate total consumption of fruits and vegetables in a typical week (Gross, Pollock, & Braun, 2010). Fruit and vegetable consumption was analyzed as a continuous variable; 3) “Have you had a drink of an alcoholic beverage since the last interview? (By a drink we mean a can or bottle of beer, a glass of wine, a mixed drink, or a shot of liquor)”. Respondents answered “1” yes or “0” no.; 4) “Have you smoked a cigarette since the last interview?”. Respondents answered “1” yes, or “0” no;. 5) “Since the date of last interview, have you used marijuana, even if only once, for example: grass or pot?”. Respondents answered “1” yes, or “0” no.

Mental Health

Mental Health was assessed in 2000 (between T1 and T2) with the following five-item Scale (Carmine & Zeller, 1985): 1) “How much of the time during the last month have you been a very nervous person?”; 2) “How much of the time during the last month have you felt calm and peaceful?” (reverse-coded); 3) “How much of the time during the last month have you felt downhearted and blue?; 4) “How much of the time during the last month have you been a happy person? (reverse-coded)”; and 5) “How much of the time during the last month have you felt so down in the dumps that nothing could cheer you up?”. Respondents answered on a five-item scale: “1” (all of the time), “2” (most of the time), “3” (some of the time), and “4” (none of the time). Responses were summed (range: 5-20) with higher scores reflecting better mental health. For ease of analysis, the 5-20 range was recoded to 0-15. Since the current study assesses the impact of negative mental health (i.e. more emotional

problems), this Mental Health Scale was reverse coded so that higher scores reflect poorer mental health.

Gender and Maternal Education

Respondents were asked if they are "1" (male) or "2" (female). The mother of the youth respondent was asked "What is the highest grade completed?" Responses included "0" (None), "1" (1st-8th grade), "2" (9th-11th grade), "3" (12th grade), "4" (some college), "5" (college degree), "6" (some graduate school), or "7" (graduate/professional degree). This variable was recoded into a dichotomous variable: college or graduate school education (1) and high school education or less (0).

Control Variables

Family Structure. The family structure in 1997 was reported as both biological parents, two-parent bio mother, two-parent bio father, bio mother only, bio father only, adoptive parent, foster parent, no parent – grandparent), no parent – other relative, and other. Since only youth living in two-parent families are asked the family process variables, only households that reported two-parent households are included in the analytic sample for the current study. We created an indicator variable: 1) two biological parents; and 0) one biologic parent and one step parent, or two non-biologic parents. Family structure in T1 was used as a control variable in this study.

Race/Ethnicity. Respondents' race was asked in T1. Respondents reported "1" (Black), "2" (Hispanic), "3" (Other), and "4" (Non-Black/Non-Hispanic). Indicator variables were created with "White" as the reference group. Race was used as a control. Due to the small sample size in the "other" race category (mixed race, asian, Indian or other than Hispanic, white or black), the Hispanic and other category were combined.

Parental Health Status. At time 1 the youth's responding parent were asked: "How would you describe your present health? Is it…poor, fair, good, very good or excellent?". Respondents who reported fair health or poor health was collapsed into one variable due to only 2% reporting being in poor health. Respondents rated their own health status as "4" (poor/fair), "3" (good), "2" (very good), "1" (excellent). For a more parsimonious model, parental health status was dichotomized into an indicator variable of excellent or very good health status versus good, fair or poor health status.

Parental Body Mass Index. The body mass index of the respondents' parent was calculated from parent's self-reported body weight and height (BMI = [weight in pounds/(height in inches) x (height in inches)] x 703) (Sobal, Rauschenbach & Frongillo, 2003). Parental BMI was used as a continuous variable. Parental BMI was used as a control.

Sampling Weights

The NLSY97 provides sampling weights. However, since we have a selective sample (only those youth with two-parent households), weights are not helpful. Additionally, since we are modeling data in regression analyses, the NLSY97 administrators state that using the provided weights when performing regression

analyses "may lead to incorrect estimates. If particular groups follow significantly different regression specifications, the preferred method of analysis is to estimate a separate regression for each group or to use indicator variables to specify group membership; regression on a random sample of the population would be misspecified." Therefore, following the NLSY97 guidelines sampling weights were not used in the regression analyses, rather the variables that were oversampled in the NLSY97 sampling design (i.e. race) were used as indicator variables to control for group membership. For the descriptive statistics, both weighted and unweighted statistics were examined. The unweighted versus the weighted descriptive statistics differed by less than 1.5%. The unweighted descriptive statistics are reported below. Of note is that the results are the same with or without weights.

Assumptions of Logistic Regression

Since the dependent variable health status is ordinal with categories of excellent, very good, good and poor health status we began by fitting a cumulative logistic regression model. The cumulative logistic regression model assumes a proportional distance between each category of the dependent variable (i.e., the proportional odds assumption) (Stokes, Davis, & Koch, 2000), such that the odds of being in the reference group can be estimated compared to the cumulative effects over the lower categories. If the proportional odds assumption is not met, then a generalized regression would be run specifying a reference group (excellent health) – in essence treating health status as a nominal variable.

Assumptions of Multiple Regression

Multiple regression models were fit for BMI percentile at T2 and BMI at T3. All assumptions of multiple regression were tested prior to analysis (Berry, 1993; Tabachnik & Fidell, 2007): 1) continuous and unbounded variables; 2) the predictor variables will have more than zero variance; 3) no multicollinearity of the predictor variables; 4) the most relevant variables as deemed by theory and previous research will be included; 5) homoscedasticity will be checked by examining scatter plots; and 6) the relationship is hypothesized to be linear.

Analytic Plan

Additionally, since a proportion of the sample are siblings, the sample is not independent. We used “proc survey logistic” (for logistic regressions) and “proc survey regression” (for multiple regressions) to control for the clustering effect of respondents who are in the same family. Therefore, whether respondents are from the same family was controlled for in all of the analyses. All analyses were conducted using SAS statistical software. Additionally, there are substantial differences in sample size for each hypothesis and time period, therefore, rather than restricting analyses to the nonmissing across variables and time periods, all available observations for each dependent variable within each time period were used for the analyses.

Chapter 5: Results

Sample Description

NLSY97 data were available for 2942 youth aged 12-14 in T1, 2825 respondents had nonmissing responses for the study variables in T2 and 2616 in T3. There were 327 siblings included in the study. Below we describe four analytic samples corresponding to the twelve hypotheses being considered.

The analytic sample for the analyses examining health status in T2 is n=2189, and n=1894 for T3. The analytic sample for the analyses examining BMI in T2 is n=2052, and n= 1753 for T3. The analytic sample for predicting health status, and predicting BMI, at T2 and T3 was compared with the overall sample to determine the differences between the two samples. Compared with the analytic samples for health status and BMI, the overall sample is more likely to have a mother with a high school education, less likely to be white, and less likely to be female.

Descriptive Statistics

Table 1 shows the means, standard deviations, range and proportion (%) for variables used to examine the association of negative family processes in T1 and health status and BMI in T2 and T3.

Table 1

Variables Used to Examine the Association of Negative Family Processes and Health Status and BMI (n=2942)

Variables	*M*	*SD*	Range	N or %
Parent-child Processes [a]			0-1	2942
Positive Parent-child			1	65%
Negative Parent-child			0	35%
Inter-parental Processes [a]			0-1	2942
Positive Inter-parental			1	63%
Negative Inter-parental			0	37%
Health Status T1	1.86	0.86	1-4	2942
Excellent Health			0-1	41%
Very Good Health			0-1	35%
Good Health			0-1	20%
Poor/Fair Health			0-1	4%
Health Status T2	2.044	0.88	1-4	2656
Excellent Health			0-1	31%
Very Good Health			0-1	39%
Good Health			0-1	24%
Poor/Fair Health			0-1	6%
Health Status T3	2.11	0.90	1-4	2463
Excellent Health			0-1	28%
Very Good Health			0-1	39%
Good Health			0-1	26%
Poor/Fair Health			0-1	7%
BMI Percentile T1	65.74	26.09	1-99.8	2942
BMI Percentile T2	63.49	27.94	1.8-99.8	2486
Body Mass Index T3	26.32	5.93	15-67	2405
Mental Health Index 2000 [a]	4.64	2.43	0-15	2701
Fruit & Vegetable Consumption T2[b]	5.87	2.31	2-14	2655
Fruit & Vegetable Consumption T3[b]	6.22	2.32	2-14	2463
Physical Activity T2[c]	2.64	2.64	0-7	2652
Physical Activity T3[c]	2.64	2.65	0-7	2455

Marijuana T2	0-1	2640
Use Marijuana		27%
No Marijuana		73%
Marijuana T3	0-1	2415
Use Marijuana		19%
No Marijuana		81%
Alcohol T2	0-1	2648
Use Alcohol		67%
No Alcohol		33%
Alcohol T3	0-1	2423
Use Alcohol		82%
No Alcohol		18%
Tobacco T2	0-1	2649
Use Tobacco		41%
No Tobacco		59%
Tobacco T3	0-1	2455
Use Tobacco		41%
No Tobacco		58%
Gender	0-1	2942
Female		48%
Male		52%
Maternal Education	0-1	2940
Mother High School		54%
Mother College & Graduate		46%
Race	0-1	2942
Black		15%
White		66%
Hispanic/Other		19%
Family Structure T1	0-1	2942
Both Biological Parents		82%

Bioparent with Stepparent				18%
Parental Health Status				2634
Excellent or Very Good Health				65%
Good or Poor Health				35%
Parental BMI T2	26.56	5.64	10-68	2493
underweight T1				1.7%
normal weight T1				44%
overweight T1				31%
obese T1				23%
Age T1				2942
12				34%
13				34%
14				33%

Note: [a] Higher scores indicate more negative family processes, mental health, respectively; [b] The mean for fruit and vegetable consumption cannot be interpreted to reflect the numbers of days in a week but rather indicate higher total consumption of fruit and vegetables; [c] number of days per week respondent exercises 30 minutes or more.

Dependent Variables

Over the study period, respondents reported to be in excellent health decreased from 41% at T1 to 28% at T3. In T1 and T2, respondents were, on average, in the normal BMI range for age and gender. The average BMI in T3 (26) was one point over the cut-off for normal weight.

The sample, on average, increased BMI over the ten years of the study. In T1, 1.63% of respondents are underweight, 69% normal weight, 17% overweight, and 12% obese. In T2, over 2% are underweight, 68% normal weight, 16% overweight, and 13% obese – very similar proportions to T1. In T3, 3% are underweight, 47% are

normal weight, 31% overweight, 20% are obese. As respondents aged, more respondents entered the obese category.

Independent Variables

Thirty-five percent of respondents at T1 reported negative parent-child (NPCP) processes and 37% of respondents reported negative inter-parental (NIPP) processes. On average, respondents report mental health scores of 4.64 (range 0-15) reflecting low levels of poor mental health. Respondents reported drinking more alcohol and less smoking and marijuana use as young adults than as adolescents. Twenty-six percent of respondents reported that they never exercise, whereas, 12% exercise daily. The proportion of respondents who do not exercise increased to 27% as young adults. The majority of respondents reported eating fruits and vegetables 2-6 times or 8-12 times a week, which averages out to a maximum of 2 servings of fruits and vegetables a day (significantly less than national recommendations). Specifically, 1.7% of respondents parents were underweight (under 18.5), 44% were normal weight (BMI = 18.5-24.9); 31% were overweight (BMI = 25-29.9); and 23% were obese (BMI > 30). Gender, maternal education, family structure and race are as reported in Table 1.

Analyses

Subsystem Analysis. Parent-child processes and inter-parental processes were modeled separately. According to family systems theory, the parent-child relationship and the inter-parental relationship are two important subsystems related to youth development. By modeling them in the same regression model it would be assessing

the impact of parent-child processes, for example, independent of inter-parental processes (and vice versa). Since processes within the family do not operate independently of each other modeling them together in the same regression model would be unwise/unrealistic. Accordingly, each hypothesis was modeled separately for each family process (inter-parental processes and parent-child processes).

Models fit to test hypotheses. The first aim of this study assessed the effect of NPCP and NIPP, respectively, in early adolescence on health status and BMI percentile in late adolescence (T2). The second aim of this study assessed the effect of NIPP, and NPCP, respectively in early adolescence on health status and BMI, respectively, 10 years later (in early adulthood) (T3). The hypotheses of mediation and moderation were, therefore, assessed in both T2 and T3.

Mediation. Mediation was examined according to Baron and Kenny (1986). Three conditions for testing whether the hypothesized mediator variable mediated the association between the family process variable and the health outcome were examined: 1) whether the family process variable was associated with the mediator variable; 2) whether the family process variable was associated with the dependent variable (either health status or BMI); and 3) when adding the mediator variable into the model with the family process variable and the health dependent variable (health status or BMI), whether the mediator variable was associated with the dependent variable. If all three of these conditions were met, then in order for the mediator variable to mediate the association, the association between the family process variable and the health dependent variable must be less when including the mediating variable in the model. If all of these conditions were met, then the Sobel test was used

to determine whether the mediation "significantly carries the influence of an independent variable to a dependent variable" (Soper, 2011). For the Sobel test, regression coefficients and standard errors for the association between the family process variable and the mediator variable, as well as the regression coefficient and the standard error for the association between the mediator variable and the dependent variable, were entered into the online Sobel equation. If the Sobel test was significant ($p < 0.05$) then the variable was determined to mediate the association between the family process variable and health status or BMI. Lastly, the amount that the mediating variable explains the association between negative family processes and health status, and BMI, respectively, was determined according to Szklo & Nieto (2006) using the following equation: [(relative risk of model without the mediator minus the model with mediator) divided by (model without mediator minus 1.0) times 100].

Moderation. Moderation by gender and/or maternal education was assessed according to Baron and Kenny (1986). Interaction terms between the hypothesized moderator (i.e. maternal education or gender) and each family process variable were created. Then the interaction term was included in the model along with the family process variable and the moderating variable. If the interaction term is significant then the moderating variable significantly moderates the association between the family process variable and health status or BMI, respectively. If the interaction term is significant, then the sample was split by level of the moderator so that direction of the moderation can be detected. Within each level of the moderator, the association

between the family process variable and the dependent variable was examined separately for each category.

Model Assumptions. All model assumptions for ordered logistic regressions and multiple linear regressions were tested prior to fitting models. The proportional odds assumption for the ordered logistic regression was not met for either T2 or T3 indicating that rather than cumulative logits, generalized logistic regression models need to be fit. Therefore, excellent health status (the reference group) is compared to very good health status, then compared to good health status, and compared to fair/poor health status. For this study, all outcomes were assessed as the odds for being in poorer health as compared to excellent health. All assumptions for multiple linear regression were met. However, the impact of negative family processes on BMI may not be constant along the BMI continuum. Therefore, to determine whether a possible nonlinear relationship exists, quadratic terms were created by squaring and cubing the BMI terms and were included in the model (Allison, 1999). The results for the quadratic terms did not differ from the linear terms, therefore, only the linear terms are reported below.

The Association of Negative Family Processes and Health Status

Initially, the continuous measure of parent-child processes (reversed so higher scores reflect more NPCP) was modeled. When fitting the continuous NPCP variable, the point estimates reflected a significant step function (increasing negative processes associated with elevated risk for poorer health) but were extremely small and the confidence intervals were tight. For example, as compared to excellent health,

reporting more negative parent-child processes was associated with risk for very good health (O.R. 1.02, 95% C.I. 1.00-1.04), good health (O.R. 1.07, 95% C.I. 1.05-1.10), and poor health (O.R. 1.10, 95% C.I. 1.07-1.14). Similarly small and tight results were found for the models for negative inter-parental processes, as well. Therefore, the indicator variable of NPCP and NIPP, respectively, were used instead of the continuous variables.

Negative Parent-Child Processes (NPCP)

NPCP at Time 2. NPCP is associated with elevated odds for being in poorer health in T2 (as compared to youth who report excellent health) independent of the control variables. Specifically, there is a step function – NPCP is associated with 1.31, 1.70 and 2.47 times elevated odds for each poorer health status category (Table 2).

Table 2

Summary of Logistic Regression Analysis Predicting Health Status in T2 from Negative Parent-Child Processes (n=2189)

		Health Status T2			
		Crude Model		Adjusted Model	
Predictor	Health Status	O.R.	95% C.I.	O.R.	95% C.I.
Negative Parent-Child Processes[a]	Excellent	1.00	----	1.00	---
	Very Good	1.37	1.10-1.70	1.31	1.05-1.64
	Good	1.92	1.51-2.45	1.70	1.32-2.20
	Fair/Poor	2.91	1.99-4.27	2.47	1.65-3.72

Maternal College or Graduate Education[b]	Excellent	1.00	----
	Very Good	1.04	0.85-1.29
	Good	0.82	0.64-1.06
	Fair/Poor	0.66	0.43-1.03
Black[c]	Excellent	1.00	----
	Very Good	0.79	0.59-1.07
	Good	0.86	0.61-1.28
	Fair/Poor	1.36	0.82-2.26
Hispanic/Other[c]	Excellent	1.00	----
	Very Good	0.90	0.65-1.24
	Good	0.88	0.61-1.28
	Fair/Poor	0.95	0.52-1.73
Gender[d]	Excellent	1.00	----
	Very Good	1.56	1.27-1.93
	Good	1.91	1.49-2.44
	Fair/Poor	1.27	2.18-4.93
Family Structure[e]	Excellent	1.00	----
	Very Good	0.89	0.68-1.17
	Good	0.70	0.51-0.93
	Fair/Poor	0.90	0.53-1.53
Youth Health Status T1[f]	Excellent	1.00	----
	Very Good	0.66	0.50-0.88
	Good	0.40	0.30-0.54
	Fair/Poor	0.27	0.17-0.42
Parental Health Status[g]	Excellent	1.00	----
	Very Good	0.80	0.64-1.02
	Good	0.75	0.57-0.99
	Fair/Poor	0.60	0.39-0.92
BMI Percentile T1	Excellent	1.00	----
	Very Good	0.97	0.98-1.01
	Good	0.98	0.96-1.00
	Fair/Poor	0.98	0.94-1.02
BMI Percentile T1[2]	Excellent	1.00	----
	Very Good	1.00	1.00-1.00
	Good	1.00	1.00-1.00
	Fair/Poor	1.00	1.00-1.00

Parental BMI at T1	Excellent	1.00	----
	Very Good	1.11	0.96-1.29
	Good	1.07	0.97-1.19
	Fair/Poor	1.05	0.94-1.18
Parental BMI^2	Excellent	1.00	----
	Very Good	1.00	0.99-1.01
	Good	1.00	0.99-1.01
	Fair/Poor	1.00	0.99-1.01

Note: [a]Youth exposed to relatively higher negative parent-child processes were coded 1 and youth exposed to relatively fewer negative parent-child processes were coded 0; [b]Youth with a mother with a college or graduate education were coded 1, and youth with a mother with a high school education were coded 0; [c]Reference group is White; [d]1: female, 0: male; [e]Youth who live in the household with two biologic parents was coded 1, youth who live with a biologic parent and a stepparent or adoptive parents were coded 0; [f]Youth who reported excellent or very good health status in T1 were coded 1, youth who reported good or poor health status in T1 were coded 0; [g]Respondents whose parent reported excellent or very good health status in T1 was coded 1, and respondents whose parent reported good or poor health status in T1 was coded 0. O.R. = Odds Ratio. 95% C.I. = 95% Confidence Intervals.

Mediation. Table 3 shows the models fit to test each mediation hypothesis: 1) the independent association of NPCP and health status in T2 (model 1), mediation by 2) mental health (model 2), 3) unhealthy behaviors (model 3), and 4) healthy behaviors (model 4). The conditions for mediation by mental health were met and mental health significantly mediated the association between NPCP and health status in T3 (Sobel tests $p<0.01$). Addition of poor mental health between T1 and T2 reduced the association between NPCP and poor health status at T2 by 19%, 26%, and 24%, respectively, as compared to excellent health.

Regarding the conditions of mediation for unhealthy behaviors, NPCP was significantly associated with alcohol use, marijuana use, and tobacco use in T2, but only marijuana use and tobacco use were also significantly associated with health

status in T2, and reduced the association between NPCP and health status in T2, therefore, the conditions for mediation were met and unhealthy behaviors significantly mediated the association (Sobel tests $p < 0.05$). Addition of respondents' engagement in unhealthy behaviors to the regression model reduced the association between NPCP and health status in T2 by 13%, 13%, and 7% of the association between NPCP and poorer health status in T2 (Table 3 model 3). Using alcohol did not impact the association between NPCP and health status in T2, though marijuana and tobacco use did mediate the association. The hypotheses were supported since unhealthy behaviors mediated the association between NPCP and risk for poor health.

Regarding the conditions for mediation by healthy behaviors, the conditions for mediation were met for physical activity but not for fruit and vegetable consumption in T2. NPCP was associated with FVC in T2, and FVC was associated with health status in T2 but did not significantly mediate the association (Sobel tests $p > 0.05$) of NPCP and health status. NPCP was associated with physical activity in T2, and physical activity was associated with health status in T2. The addition of engagement in physical activity into the model significantly mediated the association between NPCP and health status at T2 (Sobel test $p < 0.05$). Engaging in physical activity reduced 6%, 7% and 7%, respectively, of the association between NPCP and poorer health status (Table 3 Model 4). As hypothesized, engaging in healthy behaviors, like physical activity, mediated the association between NPCP and risk for poor health.

Moderation. The interaction term of NPCP and gender was not significantly associated with health status in T2 (not shown), therefore, gender did not moderate

Table 3

Summary of Logistic Regression Analysis Predicting Health Status in T2 by Negative Parent-child Processes: Mediation Analyses, Independent of Control Variables (n=2189)

		Health Status T2							
		Adjusted Model (Model 1)		Mental Health (Model 2)[+]		Unhealthy Behaviors (Model 3)[+]		Healthy Behaviors (Model 4)[+]	
Variable	*Health Status*	*O.R.*	*95% C.I.*	*O.R.*	*95% C*	*O.R*	*95% C.I.*	*O.R*	*95% C.I.*
Negative Parent-Child Processes[a]	Excellent	1.00	----	1.00	----	1.00	----	1.00	----
	Very Good	1.31	1.05-1.64	1.25	1.00-1.56	1.27	1.01-1.59	1.29	1.03-1.61
	Good	1.70	1.32-2.20	1.52	1.17-1.96	1.61	1.25-2.09	1.65	1.28-2.14
	Poor	2.47	1.65-3.72	2.12	1.40-3.23	2.36	1.57-3.56	2.35	1.56-3.55
Mental Health[b]	Excellent			1.00	----				
	Very Good			1.10	1.05-1.15				
	Good			1.23	1.17-1.30				
	Poor			1.30	1.20-1.41				
MarijuanaT2[c]	Excellent					1.00	----		
	Very Good					1.15	0.87-1.50		
	Good					1.36	0.99-1.86		
	Poor					1.22	0.72-2.06		
Alcohol T2[d]	Excellent					1.00	----		
	Very Good					1.13	0.88-1.45		
	Good					0.94	0.71-1.26		
	Poor					1.10	0.67-1.81		
Tobacco T2[e]	Excellent					1.00	----		
	Very Good					1.65	1.29-2.11		
	Good					2.24	1.69-2.98		
	Poor					1.98	1.22-3.20		

Physical Activity T2[f]	Excellent	1.00	----
	Very Good	0.91	0.87-0.95
	Good	0.85	0.81-0.90
	Poor	0.81	0.73-0.89
Fruit & Vegetable Consumption T2[g]	Excellent	1.00	----
	Very Good	0.96	0.92-1.01
	Good	0.92	0.87-0.97
	Poor	0.83	0.75-0.93

Note: [a]Negative Parent-child Processes coded as 1 youth exposed to relatively higher negative processes, and 0 youth exposed to relatively fewer negative processes; [b]Higher scores reflect poorer mental health between T1 and T2; [c]Marijuana use coded 1, no marijuana use coded 0; [d]Alcohol use coded 1, no alcohol use coded 0; [e]Tobacco use coded 1, no tobacco use coded 0: Biological Parent, coded 1, Biologic Parent with Stepparent or Adoptive Parents coded 0; [f]Higher scores indicate more days of physical activity. [g]Higher scores indicate more fruit and vegetable consumption. All estimates are independent of maternal education, race, gender, family structure, health status T1, parental health status T1, BMI at Time 1, and Parental BMI at T1. O.R. = Odds Ratio. 95% C.I. = 95% Confidence Intervals. [+]Statistically significant mediation at the $p < 0.05$ level using the Sobel test.

the association between NPCP and risk for poor health in T2. The interaction term of NPCP and maternal education was not significantly associated with health status in T2 (not shown), therefore, maternal education did not moderate the association between NPCP and risk for poor health in T2.

NPCP in Time 3

NPCP is associated with elevated odds for being in poorer health status in T3 (as compared to youth who report excellent health) independent of the control variables. Specifically, there is a step function – NPCP is 1.16 (not significant), 1.41 and 1.98 times more likely to be in poorer health status. Though the association between NPCP and risk for very good health (compared to excellent health) is not significant in T3, it follows the same step function as the other categories of health status (O.R. 1.16, 95% C.I. 0.91-1.49) (Table 4). In sum, as hypothesized, NPCP is directly associated with elevated risk for poorer health status.

Table 4

Summary of Logistic Regression Analysis Predicting Health Status T3 from Negative Parent-Child Processes (n=1894)

		Health Status T3			
		Crude Model		Adjusted Model	
Predictor	Health Status	O.R.	95% C.I.	O.R.	95% C.I.
Negative Parent-Child Processes[a]	Excellent	1.00	---	1.00	----
	Very Good	1.22	0.96-1.55	1.16	0.91-1.49
	Good	1.61	1.24-2.08	1.41	1.07-1.85
	Fair/Poor	2.29	1.57-3.33	1.98	1.34-2.92
Maternal College or Graduate Education[b]	Excellent			1.00	----
	Very Good			0.83	0.65-1.06
	Good			0.57	0.43-0.75

	Fair/Poor	0.62	0.41-0.94
Black[c]	Excellent	1.00	----
	Very Good	0.85	0.60-1.21
	Good	0.98	0.66-1.43
	Fair/Poor	1.07	0.62-1.85
Hispanic/Other[c]	Excellent	1.00	----
	Very Good	0.99	0.69-1.43
	Good	0.85	0.56-1.28
	Fair/Poor	1.07	0.60-1.90
Gender[d]	Excellent	1.00	----
	Very Good	1.23	0.98-1.54
	Good	1.50	1.15-1.94
	Fair/Poor	1.47	0.99-2.18
Family Structure[e]	Excellent	1.00	----
	Very Good	0.85	0.62-1.18
	Good	0.77	0.54-1.09
	Fair/Poor	0.97	0.58-1.63
Youth Health Status T1[f]	Excellent	1.00	----
	Very Good	0.62	0.45-0.84
	Good	0.41	0.30-0.57
	Fair/Poor	0.35	0.23-0.55
Parental Health Status[g]	Excellent	1.00	----
	Very Good	0.98	0.75-1.28
	Good	0.92	0.68-1.23
	Fair/Poor	0.59	0.39-0.90
BMI Percentile T1	Excellent	1.00	----
	Very Good	0.97	0.96-0.99
	Good	0.98	0.96-1.00
	Fair/Poor	0.96	0.93-0.99
BMI Percentile T1[2]	Excellent	1.00	----
	Very Good	1.00	1.00-1.00
	Good	1.00	1.00-1.00
	Fair/Poor	1.00	1.00-1.01
Parental BMI at T1	Excellent	1.00	----
	Very Good	0.96	0.87-1.06
	Good	1.04	0.92-1.18
	Fair/Poor	0.99	0.86-1.15

Parental BMI[2]	Excellent	1.00	----
	Very Good	1.00	1.00-1.01
	Good	1.00	1.00-1.01
	Fair/Poor	1.00	1.00-1.01

Note: [a]Youth exposed to relatively higher negative parent-child processes were coded 1 and youth exposed to relatively fewer negative parent-child processes were coded 0; [b]Youth with a mother with a college or graduate education were coded 1, and youth with a mother with a high school education were coded 0; [c]Reference group is White; [d]Gender coded 1: female, 0: male; [e]Youth who live in the household with two biologic parents was coded 1, youth who live with a biologic parent and a stepparent or adoptive parents were coded 0; [f]Youth who reported excellent or very good health status in T1 was coded 1, Youth who reported good or poor health status in T1 were coded 0; [g]Respondents whose parent reported excellent or very good health status in T1 was coded 1, and respondents whose parent reported good or poor health status in T1 was coded 0. O.R. = Odds Ratio. 95% C.I. = 95% Confidence Intervals.

Mediation. The conditions for mediation by mental health were met and mental health significantly mediated the association between NPCP and health status in T3 (Sobel tests $p<0.01$). Being in poorer mental health reduced 6%, 22%, and 23% of the association between NPCP and risk for poorer health status as compared to excellent health (Table 5 model 2). As hypothesized, mental health mediates the association between NPCP and risk for poorer health status in T3.

The conditions for mediation by unhealthy behaviors were met for tobacco use, but not for marijuana or alcohol use in T3 – and mediation by tobacco use was significant (Sobal $p < 0.01$). Using marijuana or alcohol in T3 did not impact the association between NPCP and health status in T3 and are not directly associated with health status in T3. Once tobacco use was introduced into the model, the association between NPCP and poor health status in T3 decreased by 25%, 17% and 15%, respectively (Table 5 model 3). As hypothesized, tobacco mediates the association between NPCP and risk for poor health status in T3.

Table 5

Summary of Logistic Regression Analysis Predicting Health Status in T3 by Negative Parent-child Processes: Mediation Analyses, Independent of Control Variables (n=1894)

		Health Status T3							
		Model 1 Adjusted Model		Model 2 Mental Health Model[+]		Model 3 Unhealthy Behaviors Model[+]		Model 4 Healthy Behaviors Model	
Variable	Health Status	*O.R.*	*95% C.I.*	*O.R.*	*95% C.I.*	*O.R.*	*95% C.I.*	*O.R.*	*95% C.I.*
Negative Parent-Child Processes[a]	Excellent	1.00	----	1.00	----	1.00	----	1.00	----
	Very Good	1.16	0.91-1.49	1.15	0.89-1.47	1.12	0.87-1.44	1.17	0.91-1.51
	Good	1.41	1.07-1.85	1.32	1.00-1.73	1.34	1.02-1.77	1.43	1.09-1.89
	Poor	1.98	1.34-2.92	1.75	1.18-2.61	1.83	1.24-2.71	2.01	1.36-2.98
Mental Health[b]	Excellent			1.00	----				
	Very Good			1.02	0.97-1.08				
	Good			1.12	1.06-1.18				
	Poor			1.24	1.14-1.34				
MarijuanaT3[c]	Excellent					1.00	----		
	Very Good					1.20	0.86-1.66		
	Good					1.34	0.93-1.91		
	Poor					1.34	0.79-2.26		
Alcohol T3[d]	Excellent					1.00	----		
	Very Good					1.46	1.07-2.00		
	Good					1.29	0.91-1.83		
	Poor					0.91	0.56-1.47		
Tobacco T3e	Excellent					1.00	----		
	Very Good					1.32	1.02-1.70		
	Good					1.44	1.08-1.92		
	Poor					2.08	1.36-3.20		

Physical Activity T3[f]	Excellent	1.00	----
	Very Good	0.87	0.83-0.92
	Good	0.84	0.79-0.89
	Poor	0.82	0.74-0.91
Fruit & Vegetable Consumption T3[g]	Excellent	1.00	----
	Very Good	0.95	0.90-0.99
	Good	0.90	0.84-0.94
	Poor	0.87	0.79-0.95

Note: [a]Negative Parent-child Processes coded as 1 youth exposed to relatively higher negative processes, and 0 youth exposed to relatively fewer negative processes; [b]Higher scores reflect poorer mental health between T1 and T2; [c]Marijuana use coded 1, no marijuana use coded 0; [d]Alcohol use coded 1, no alcohol use coded 0; [e]Tobacco use coded 1, no tobacco use coded 0: Biological Parent, 0: Biologic Parent with Stepparent or Adoptive; [f]Higher scores indicate more days of physical activity.
[g]Higher scores indicate more fruit and vegetable consumption. All estimates are independent of maternal education, race, gender, family structure, health status T1, parental health status T1, BMI at Time 1, and Parental BMI at T1. O.R. = Odds Ratio. 95% C.I. = 95% Confidence Intervals. [+]Statistically significant mediation at the $p < 0.05$ level using the Sobel test.

Regarding the conditions for mediation, NPCP was associated with physical activity and FVC, respectively, and were also associated with poorer health status in T3, however, physical activity and FVC did not significantly mediate the association (Sobel $p > 0.05$) and the addition of these healthy behaviors did not reduce the association between NPCP and health status in T3. Therefore, the hypotheses were not supported for mediation by healthy behaviors in T3.

Moderation. The interaction variable of gender and NPCP was not significantly associated with health status in T3, nor was the interaction variable of maternal education and NPCP (now shown). Therefore, gender and maternal education did not moderate the association between NPCP and health status. The hypotheses were, therefore, not supported for moderation by gender or maternal education.

Negative Inter-parental Processes (NIPP)

NIPP at Time 2. As hypothesized, NIPP is associated with elevated odds for being in poorer health status (compared to youth who report excellent health status) independent of control variables. Specifically, there is a step function – youth who are exposed to NIPP are 1.28, 1.36 and 1.85 times more likely to be in poorer health status (Table 6).

Table 6

Summary of Logistic Regression Analysis Predicting Health Status T2 from Negative Inter-parental Processes (n=2189)

	Health Status T2	
	Crude Model	Adjusted Model

Predictor	Health Status	O.R.	95% C.I.	O.R.	95% C.I.
Negative Inter-Parental Processes[a]	Excellent	1.00	----	1.00	----
	Very Good	1.33	1.08-1.66	1.28	1.03-1.60
	Good	1.49	1.17-1.90	1.36	1.05-1.75
	Fair/Poor	2.17	1.47-3.21	1.85	1.23-2.79
Maternal College or Graduate Education[b]	Excellent			1.00	----
	Very Good			1.04	0.84-1.28
	Good			0.81	0.63-1.04
	Fair/Poor			0.64	0.42-0.99
Black[c]	Excellent			1.00	----
	Very Good			0.80	0.59-1.08
	Good			0.87	0.61-1.22
	Fair/Poor			1.40	0.84-2.33
Hispanic/Other[c]	Excellent			1.00	----
	Very Good			0.90	0.65-1.23
	Good			0.87	0.60-1.26
	Fair/Poor			0.93	0.51-1.68
Gender[d]	Excellent			1.00	----
	Very Good			1.55	1.26-1.91
	Good			1.88	1.47-2.40
	Fair/Poor			3.17	2.10-4.76
Family Structure[e]	Excellent			1.00	----
	Very Good			0.86	0.65-1.13
	Good			0.64	0.47-0.87
	Fair/Poor			0.82	0.48-1.38
Youth Health Status T1[f]	Excellent			1.00	----
	Very Good			0.66	0.50-0.88
	Good			0.40	0.29-0.54
	Fair/Poor			0.27	0.17-0.42
Parental Health Status[g]	Excellent			1.00	----
	Very Good			0.80	0.64-1.01
	Good			0.75	0.57-0.98
	Fair/Poor			0.60	0.39-0.92
BMI Percentile T1	Excellent			1.00	----
	Very Good			0.99	0.98-1.01

	Good	0.98	0.96-1.01
	Fair/Poor	0.98	0.94-1.03
BMI Percentile T1[2]	Excellent	1.00	----
	Very Good	1.00	1.00-1.00
	Good	1.00	1.00-1.00
	Fair/Poor	1.00	1.00-1.00
Parental BMI at T1	Excellent	1.00	----
	Very Good	1.12	0.96-1.30
	Good	1.08	0.98-1.19
	Fair/Poor	1.06	0.95-1.19
Parental BMI[2]	Excellent	1.00	----
	Very Good	0.99	0.99-1.00
	Good	0.99	0.99-1.00
	Fair/Poor	0.99	0.99-1.00

Note: [a]Youth exposed to relatively higher negative inter-parental processes were coded 1 and youth exposed to relatively fewer negative inter-parental processes were coded 0; [b]Youth with a mother with a college or graduate education were coded 1, and youth with a mother with a high school education were coded 0; [c]Reference group is White; [d]Gender coded 1: female, 0: male; [e]Youth who live in the household with two biologic Parents was coded 1, youth who live with a biologic parent and a stepparent or adoptive parents were coded 0; [f]Youth who reported excellent or very good health status in T1 was coded 1, Youth who reported good or poor health status in T1 were coded 0; [g]Respondents whose parent reported excellent or very good health status in T1 was coded 1, and respondents whose parent reported good or poor health status in T1 was coded 0. O.R. = Odds Ratio. 95% C.I. = 95% Confidence Intervals.

Mediation. The conditions for mediation by mental health were met and mental health significantly mediated the association between NIPP and health status in T2 (Sobel $p<0.01$). Specifically, mental health mediates 25%, 50%, and 35% of the association between NIPP and risk for poorer health status in T2 as compared to excellent health status (Table 7 model 2). In sum, as hypothesized mental health mediates the association between NIPP and health status in T2.

The conditions for mediation by unhealthy behaviors were met for each unhealthy behavior in T3 and alcohol use, marijuana use and tobacco use, respectively, significantly mediated the association between NIPP and health status (Sobel test $p < 0.05$). Engaging in these unhealthy behaviors mediated 18%, 22% and 11% of the association between NIPP and risk for poor health status in T2. As hypothesized, engaging in tobacco use, marijuana use and alcohol use in T2 mediated the association between NIPP and health status in T2.

Regarding the conditions for mediation by healthy behaviors, the conditions for mediation were met for physical activity but not for fruit and vegetable consumption in T2. Engaging in physical activity mediated the association between NPCP and health status at T2 (Sobel test $p < 0.05$) and reduced 11%, 14% and 8%, respectively, of the association between NIPP and poorer health status (Table 7 Model 4). As hypothesized, engaging in the healthy behavior of physical activity mediated the association between NIPP and risk for poor health in T2.

Moderation. In terms of the moderation analyses, the interaction variable of gender and NIPP was not significantly associated with health status in T2 (not shown). Therefore, gender did not moderate the association between NIPP and health status. The interaction variable of maternal education and NIPP was not significantly associated with health status in T2 (not shown). Therefore, maternal education did not moderate the association between NIPP and health status in T2. The hypotheses for moderation by gender and maternal education were not supported for NIPP in T2.

Table 7

Summary of Logistic Regression Analyses Predicting Health Status in T2 by Negative Inter-parental Processes: Mediation Analyses, Independent of Control Variables (n=2189)

		Model 1 Adjusted Model		Model 2 Mental Health Model[+]		Model 3 Unhealthy Behaviors Model[+]		Model 4 Healthy Behaviors Model[+]	
Variable	Health Status	O.R.	95% C.I.	O.R.	95% C.I.	O.R.	95% C.I.	O.R.	95% C.I.
Negative Inter-parental Processes[a]	Excellent	1.00	----	1.00	----	1.00	----	1.00	----
	Very Good	1.28	1.03-1.60	1.21	0.96-1.51	1.23	0.99-1.54	1.25	1.01-1.56
	Good	1.36	1.05-1.75	1.18	0.91-1.53	1.28	0.99-1.67	1.31	1.01-1.70
	Poor	1.85	1.23-2.79	1.55	1.02-2.35	1.76	1.16-2.66	1.78	1.17-2.70
Mental Health[b]	Excellent			1.00	----				
	Very Good			1.10	1.05-1.15				
	Good			1.24	1.17-1.31				
	Poor			1.31	1.21-1.42				
MarijuanaT2[c]	Excellent					1.00	----		
	Very Good					1.16	0.88-1.52		
	Good					1.39	1.01-1.91		
	Poor					1.29	0.76-2.18		
Alcohol T2[d]	Excellent					1.00	----		
	Very Good					1.12	0.88-1.43		
	Good					0.94	0.70-1.26		
	Poor					1.09	0.66-1.79		
Tobacco T2e	Excellent					1.00	----		
	Very Good					1.64	1.28-2.10		
	Good					2.24	1.69-2.98		

	Poor	1.97	1.21-3.20		
Physical Activity T2[f]	Excellent v			1.00	-----
	Very Good			0.91	0.87-0.95
	Good			0.85	0.81-0.91
	Poor			0.81	0.73-0.90
Fruit & Vegetable Consumption T2[g]	Excellent			1.00	----
	Very Good			0.96	0.92-1.01
	Good			0.92	0.87-0.97
	Poor			0.83	0.75-0.92

Note: [a]Negative Inter-parental Processes coded as 1 youth exposed to relatively higher negative processes, and 0 youth exposed to relatively fewer negative processes; [b]Higher scores reflect poorer mental health between T1 and T2; [c]Marijuana use coded 1, no marijuana use coded 0; [d]Alcohol use coded 1, no alcohol use coded 0; [e]Tobacco use coded 1, no tobacco use coded 0; [f]Higher scores indicate more days of physical activity. [g]Higher scores indicate more fruit and vegetable consumption. All estimates are independent of maternal education, race, gender, family structure, health status T1, parental health status T1, BMI at Time 1, and Parental BMI at T1. O.R. = Odds Ratio. 95% C.I. = 95% Confidence Intervals. [+]Statistically significant mediation at the $p < 0.05$ level using the Sobel test.

NIPP at Time 3. NIPP is only associated with 1.91 times elevated odds for being in poor health status in T3 (as compared to youth who report excellent health). NIPP is not associated with risk for very good health or good health status as compared to excellent health status in T3 (Table 8). Taken together, as hypothesized, exposure to NIPP elevates youth's risk for poor health status in T3.

Table 8

Summary of Logistic Regression Analysis Predicting Health Status 2007 from Negative Inter-parental Processes (n=1894)

		Health Status T3			
		Crude Model		Adjusted Model	
Predictor	Health Status	O.R.	95% C.I.	O.R.	95% C.I.
Negative Inter-Parental Processes[a]	Excellent	1.00	----	1.00	----
	Very Good	1.08	0.85-1.37	1.06	0.83-1.35
	Good	1.31	1.02-1.69	1.24	0.95-1.63
	Fair/Poor	2.05	1.41-3.00	1.91	1.29-2.83
Maternal College or Graduate Education[b]	Excellent			1.00	----
	Very Good			0.83	0.65-1.05
	Good			0.56	0.43-0.73
	Fair/Poor			0.60	0.40-0.91
Black[c]	Excellent			1.00	----
	Very Good			0.85	0.60-1.21
	Good			0.98	0.67-1.45
	Fair/Poor			1.10	0.64-1.90
Hispanic/Other[c]	Excellent			1.00	----
	Very Good			0.99	0.69-1.42
	Good			0.84	0.55-1.26
	Fair/Poor			1.04	0.59-1.85
Gender[d]	Excellent			1.00	----
	Very Good			1.23	0.98-1.54

	Good	1.48	1.14-1.93
	Fair/Poor	1.42	0.96-2.10
Family Structure[e]	Excellent	1.00	----
	Very Good	0.84	0.61-1.15
	Good	0.74	0.52-1.05
	Fair/Poor	0.91	0.54-1.53
Youth Health Status T1[f]	Excellent	1.00	----
	Very Good	0.61	0.45-0.84
	Good	0.41	0.29-0.56
	Fair/Poor	0.35	0.23-0.55
Parental Health Status[g]	Excellent	1.00	----
	Very Good	0.98	0.75-1.27
	Good	0.91	0.70-1.23
	Fair/Poor	0.59	0.39-0.90
BMI Percentile T1	Excellent	1.00	----
	Very Good	0.97	0.96-0.99
	Good	0.98	0.96-1.00
	Fair/Poor	0.96	0.93-0.99
BMI Percentile T1^2	Excellent	1.00	----
	Very Good	1.00	1.00-1.00
	Good	1.00	1.00-1.00
	Fair/Poor	1.00	1.00-1.00
Parental BMI at T1	Excellent	1.00	----
	Very Good	0.97	0.88-1.07
	Good	1.05	0.92-1.18
	Fair/Poor	1.00	0.86-1.16
Parental BMI^2	Excellent	1.00	----
	Very Good	1.00	0.99-1.00
	Good	1.00	0.99-1.00
	Fair/Poor	1.00	0.99-1.00

Note: [a]Youth exposed to relatively higher negative inter-parental processes were coded 1 and youth exposed to relatively fewer negative inter-parental processes were coded 0; [b]Youth with a mother with a college or graduate education were coded 1, and youth with a mother with a high school education were coded 0; [c]Reference group is White; [d]Gender coded 1: female, 0: male; [e]Youth who live in the household with two biologic parents was coded 1, youth who live with a biologic parent and a stepparent or adoptive parents were coded 0; [f]Youth who reported excellent or very good health status in T1 was coded 1,

Youth who reported good or poor health status in T1 were coded 0; [g]Respondents whose parent reported excellent or very good health status in T1 was coded 1, and respondents whose parent reported good or poor health status in T1 was coded 0. O.R. = Odds Ratio. 95% C.I. = 95% Confidence Intervals.

Mediation. The conditions for mediation by mental health were met and mediation by mental health was significant (Sobel $p<0.01$). Being in poorer mental health reduced 33%, 42%, and 29% of the association between NIPP and risk for poorer health status as compared to excellent health (Table 9 model 2). As hypothesized, mental health mediates the association between NIPP and risk for poorer health status in T3.

The conditions for mediation by unhealthy behaviors were not met in T3. For example, NIPP was not associated with alcohol use or marijuana use in T3 but NIPP was associated with tobacco use in T3; and tobacco use in T3 was associated with health status in T3 but was not significant ($p > 0.05$). Therefore, engagement in unhealthy behaviors does not mediate the association between NIPP and health status in T3, contrary to the hypothesis.

The conditions for mediation by healthy behaviors were not met for T3. NIPP was not associated with engagement in physical activity, nor FVC in T3. Therefore, contrary to the hypothesis, engaging in healthy behaviors (physical activity and FVC) does not mediate the association between NIPP and health status in T3 (Table 9 model 4).

Moderation. The interaction variable of gender and NIPP was significantly associated with health status in T2. Likewise, the interaction variable of maternal education and NIPP was associated with health status in T2. Therefore, gender and maternal education moderated the association between NIPP and risk for poor health status. Table 10 shows the direction of the moderation for gender (model 5) and maternal

education (model 6). Among males the association between NIPP and risk for poor health status was stronger than among females (Table 10 model 5). This association, though significant, is contrary to the hypothesized direction. Additionally, the association between NIPP and risk for poor health status was stronger among youth with a mother with a high school education than among youth with mothers who have a college or graduate education (Table 10 model 6) – consistent with the hypothesis.

Table 9

Summary of Logistic Regression Analyses Predicting Health Status in T3 by Negative Inter-parental Processes: Mediation Analyses, Independent of Control Variables (n=1894)

		Health Status T3							
		Model 1 Adjusted Model		Model 2 Mental Health Model[+]		Model 3 Unhealthy Behaviors Model		Model 4 Healthy Behaviors Model	
Variable	Health Status	O.R.	95% CI	O.R.	95% CI	O.R.	95% CI	O.R.	95% CI
Negative Inter-parental Processes[a]	Excellent	1.00	----	1.00	----	1.00	----	1.00	----
	Very Good	1.06	0.83-1.35	1.04	0.82-1.33	1.02	0.80-1.31	1.06	0.83-1.36
	Good	1.24	0.95-1.63	1.14	0.87-1.50	1.19	0.91-1.56	1.25	0.95-1.64
	Poor	1.91	1.29-2.83	1.65	1.11-2.47	1.80	1.21-2.68	1.90	1.27-2.83
Mental Health[b]	Excellent			1.00	----				
	Very Good			1.03	0.97-1.08				
	Good			1.13	1.07-1.19				
	Poor			1.23	1.14-1.34				
MarijuanaT3[c]	Excellent					1.00	----		
	Very Good					1.19	0.86-1.65		
	Good					1.33	0.93-1.90		
	Poor					1.36	0.80-2.29		
Alcohol T3[d]	Excellent					1.00	----		
	Very Good					1.47	1.07-2.00		
	Good					1.29	0.91-1.83		
	Poor					0.90	0.55-1.46		

Tobacco T3[e]	Excellent	1.00	----		
	Very Good	1.33	1.03-1.72		
	Good	1.46	1.10-1.95		
	Poor	2.13	1.38-3.27		
Physical Activity T3[f]	Excellent			1.00	----
	Very Good			0.87	0.83-0.92
	Good			0.84	0.79-0.89
	Poor			0.82	0.74-0.91
Fruit & Vegetable Consumption T3[g]	Excellent			1.00	----
	Very Good			0.95	0.91-0.99
	Good			0.89	0.84-0.95
	Poor			0.87	0.79-0.96

Note: [a]Negative Inter-parental Processes coded as 1 youth exposed to relatively higher negative processes, and 0 youth exposed to relatively fewer negative processes; [b]Higher scores reflect poorer mental health between T1 and T2; [c]Marijuana use coded 1, no marijuana use coded 0; [d]Alcohol use coded 1, no alcohol use coded 0; [e]Tobacco use coded 1, no tobacco use coded 0; [f]Higher scores indicate more days of physical activity. [g]Higher scores indicate more fruit and vegetable consumption. All estimates are independent of maternal education, race, gender, family structure, health status T1, parental health status T1, BMI at Time 1, and Parental BMI at T1. O.R. = Odds Ratio. 95% C.I. = 95% Confidence Intervals. [+]Statistically significant mediation at the $p < 0.05$ level using the Sobel test.

Table 10

Summary of Logistic Regression Analysis Predicting Health Status in T3 by Negative Inter-parental Processes: Moderating Effects of Gender and Maternal Education (n=1894)

		Model 5 Gender				Model 6 Maternal Education			
Variable	Health Status	O.R.	95% C.I.	O.R.	95% C.I.	O.R.	95% C.I.	O.R.	95% C.I.
		Female (n=929)		Male (n=965)		College/Graduate (n=912)		High School (n=982)	
Negative Inter-parental Processes	Excellent	1.00	----	1.00	----	1.00	----	1.00	----
	Very Good	0.91	0.63-1.28	1.23	0.87-1.74	0.86	0.62-1.21	1.42	0.98-2.06
	Good	0.95	0.65-1.40	1.62	1.10-2.38	1.16	0.78-1.72	1.45	0.98-2.12
	Poor	1.66	0.95-2.89	2.16	1.22-3.84	1.40	0.75-2.61	2.73	1.60-4.66

Note: [a]Negative Inter-parental Processes coded as 1 youth exposed to relatively higher negative processes, and 0 youth exposed to relatively fewer negative processes; Estimates are independent of race, family structure, health status at Time 1, parental health status, BMI at T1, parental BMI at T1 and Maternal Education for model 5, and gender for model 6. O.R. = Odds Ratio. 95% C.I. = 95% Confidence Intervals.

Comparing effect of negative family processes on health Status at T2 versus T3. To compare the results from T2 to T3, the analytic sample was restricted to respondents with responses for all variables in T1, T2 and T3. Then the models predicting health status in T2 from NPCP (Table 11a) and NIPP (Table 11b), respectively, were fit with the restricted sample. When comparing the results from the restricted sample to the all available sample, the point estimates and odds ratios for the restricted sample are similar in significance and direction for both NPCP and NIPP with the odds ratios reflecting step functions. The magnitude of some of these effects differ from T2 to T3, but overall the findings from the all available sample and the restricted sample are relatively similar.

Tables 11a

Summary of Logistic Regression Analyses with the Restricted Sample for Predicting Health Status in T2 from Negative Parent-child Processes and Health Status in Late Adolescence and Early Adulthood (n=1894)

		T2: Late Adolescence*		T3: Early Adulthood	
Variable	*Health Status*	*O.R.*	*95% C.I.*	*O.R.*	*95% C.I.*
Negative	Excellent	1.00	----	1.00	-----
Parent-Child	Very Good	1.27	1.00-1.61	1.16	0.91-1.49
Processes[a]	Good	1.65	1.25-2.17	1.41	1.07-1.85
	Poor	2.59	1.69-3.99	1.98	1.34-2.92

Table 11b

Summary of Logistic Regression Analyses with the restricted sample for Predicting Health Status in T2 from Negative Inter-parental Processes (14a) & Negative Inter-parental Processes (14b) (n=1894)

		T2: Late Adolescence*		T3: Early Adulthood	
Variable	*Hlth Cat*	*O.R.*	*95% CI*	*O.R.*	*95% C.I.*
Negative	Excellent	1.00	----	1.00	------
Inter-parental	Very Good	1.25	0.98-1.58	1.06	0.83-1.35
Processes[b]	Good	1.28	0.97-1.69	1.24	0.95-1.63
	Poor	1.94	1.26-2.98	1.91	1.29-2.83

Note: *Late Adolescence sample is restricted to only those respondents who have nonmissing responses for T3. [a]Negative Parent-child Processes coded as 1 youth exposed to relatively higher negative processes, and 0 youth exposed to relatively fewer negative processes; [b]Negative Inter-parental Processes coded as 1 youth exposed to relatively higher negative processes, and 0 youth exposed to relatively fewer negative processes. Estimates are independent of race, gender, maternal education, family structure, health status at Time 1, parental health status, BMI at T1, and parental BMI at T1. O.R. = Odds Ratio. 95% C.I. = 95% Confidence Intervals.

NPCP in adolescence elevates risk for poorer health in late adolescence as well as in early adulthood. However, the effect attenuated from late adolescence to early adulthood. For example, compared to excellent health, the odds ratio for the association of NPCP and risk for very good health status is 1.27 in T2 and 1.16 in T3; risk for good health status is 1.65 in T2 and 1.41 in T3; and risk for poor health is 2.59 in T2 and 1.98 in T3. Additionally, NIPP in adolescence elevates risk for poorer health in late adolescence as well as early adulthood - but only for the poorest health category. The effect of NIPP on health status slightly attenuates over time – youth exposed to NIPP in early adolescence are 1.94 times more likely to be in poor health status in late adolescence versus 1.91 times more likely to be in poor health status in early adulthood as compared to excellent health status. Taken together, exposure to NPCP and NIPP in early adolescence elevates individual's risk for poor health status in late adolescence, and though diminished, the influence lasts through early adulthood as hypothesized. Of note

is that the longitudinal impact is greater for NPCP than for NIPP on risk for poor health over time.

The Association of Negative Family Processes and BMI

Negative Parent-child Processes

NPCP at T2. NPCP is not associated with BMI in the crude model (t= 0.44, p=0.66) (F = 0.19, R^2 = 0.00) and in the model controlling for demographic variables (t=-1.19, p=0.23) (F = 167.79, R^2 = 0.46) (Table 12). Since there is no direct association, we did not test for mediation of mental health, unhealthy behaviors and health behaviors. But given that there could be an association within each moderator level, we tested for moderation. No association was found.

Table 12

Summary of Multiple Regression Analyses Predicting Body Mass Index Percentile in T2 by Negative Parent-Child Processes (n=2052)

	Crude Model				Adjusted Model			
Variable	B	SE B	t-value	p value	B	SE B	t-value	p value
Negative Parent-Child Processes[a]	0.57	1.30	0.44	0.66	-1.17	0.99	-1.19	0.23
Maternal Education[b]					0.41	0.94	0.43	0.66
Black[c]					-0.41	1.30	-0.31	0.75
Hispanic/Other[c]					0.15	1.34	0.12	0.91
Female[d]					0.09	0.92	0.09	0.93
Family Structure[e]					2.10	1.28	1.64	0.10
BMI Percentile T1					0.25	0.09	2.96	<0.01**

BMI Percentile T1[2f]		0.01	0.01	5.53	<0.01**
Parental BMI T1		0.62	0.34	1.82	0.07
Parental BMI T1[2g]		-0.01	0.01	-0.99	0.32
Healthy at T1[h]		-0.54	1.15	-0.47	0.64
Parent Healthy T1[i]		-0.92	0.99	-0.92	0.36
R^2	0.00	0.46			
F	0.19	167.79**			

Note: [a]Negative Parent-child Processes coded as 1 youth exposed to relatively higher negative processes, and 0 youth exposed to relatively fewer negative processes; [b]Maternal education coded as 1 youth with a mother with a college or graduate education, and 0 youth with a mother with a high school education; [c]Reference group is White; [d]Gender coded 1: female, 0: male; [e]Family Structure coded 1: Biological Parent, 0: Biologic Parent with Stepparent or Adoptive; [f]Quadratic term for nonlinear BMI T1 for youth; [g]Quadratic term for nonlinear BMI for parent; [h]Youth Health Status T1 coded 1: Respondent reports excellent or very good health status in T1, 0: Respondent reports good or poor health status in T1; [i]Parental Health Status in T1 coded 1: Respondents parent report excellent or very good health status in T1, 0: Respondents report good or poor health status in T1. * p <0.05, ** p<0.01.

NPCP at Time 3. NPCP is not associated with BMI at T3 in either the crude model (t=0.16, p=0.58) (F = 0.30, R^2 = 0.00) or when including control variables (t=-0.81, p = 0.42) (F = 84.35, R^2 = 0.45) (Table 13). Since there is no direct association, we did not test for mediation of mental health, unhealthy behaviors and health behaviors. But given that there could be an association within each moderator level, we tested for moderation. No association was found.

Table 13

Summary of Multiple Regression Analyses Predicting Body Mass Index in T3 (n=1753)

	Crude Model	Adjusted Model

Variable	B	SE B	t-value	p value	B	SE B	t-value	p value
Negative Parent-Child Processes	0.16	0.30	0.55	0.58	-0.18	0.22	-0.81	0.42
Maternal Education[b]					-0.16	0.23	-0.72	0.47
Black[c]					0.29	0.38	0.75	0.45
Hispanic/Other[c]					-0.10	0.30	-0.32	0.75
Female[d]					0.20	0.22	0.89	0.37
Family Structure[e]					0.15	0.30	0.49	0.62
BMI Percentile T1					-0.11	0.02	-6.37	<0.01**
BMI Percentile T1[2f]					0.01	0.01	12.77	<0.01**
Parental BMI T1					-0.06	0.12	-0.48	0.63
Parental BMI T1[2g]					0.01	0.01	1.38	0.17
Healthy at T1[h]					-0.63	0.28	-2.20	0.03*
Parent Healthy T1[i]					-0.09	0.24	0.36	0.72
R^2		0.00				0.45		
F		0.30				84.35**		

Note: [a]Negative Parent-child Processes coded as 1 youth exposed to relatively higher negative processes, and 0 youth exposed to relatively fewer negative processes; [b]Maternal education coded as 1 youth with a mother with a college or graduate education, and 0 youth with a mother with a high school education; [c]Reference group is White; [d]Gender coded 1: female, 0: male; [e]Family Structure coded 1: Biological Parent, 0: Biologic Parent with Stepparent or Adoptive; [f]Quadratic term for nonlinear BMI T1 for youth; [g]Quadratic term for nonlinear BMI for parent; [h]Youth Health Status T1 coded 1: Respondent reports excellent or very good health status in T1, 0: Respondent reports good or poor health status in T1; [i]Parental Health Status in T1 coded 1: Respondents parent report excellent or very good health status in T1, 0: Respondents report good or poor health status in T1. * p <0.05, ** p<0.01.

Negative Inter-parental Processes and BMI

NIPP at T2. NIPP are not associated with BMI at T2 (t= 0.39, p=0.69) (F=0.16, R^2 = 0.01) for the crude model, and remains insignificant (t=0.05, p=0.96) (F=167.57, R^2 = 0.46) when the control variables are added to the model (Table 14). Since there is no direct association, we did not test for mediation of mental health, unhealthy behaviors and health behaviors. But given that there could be an association within each moderator level, we tested for moderation. No association was found.

Table 14

Summary of Multiple Regression Analyses Predicting Body Mass Index Percentile in T2 (n=2052)

	Crude Model				Adjusted Model			
Variable	B	SE B	t-value	p value	B	SE B	t-value	p value
Negative Inter-parental Processes[a]	0.51	1.29	0.39	0.69	0.05	0.96	0.05	0.96
Maternal College[b]					0.46	0.94	0.48	0.63
Black[c]					-0.45	1.31	-0.34	0.73
Hispanic & Other[c]					0.19	1.31	0.14	0.89
Female[d]					-0.09	0.92	0.09	0.92
Family Structure[e]					2.28	1.26	1.80	0.07
BMI Percentile T1					0.25	0.08	2.94	<0.01**
BMI Percentile T1[2f]					0.01	0.01	5.56	<0.01**
Parental BMI T1					0.62	0.34	1.81	0.07
Parental BMI T1[2g]					-0.01	0.01	-0.98	0.33

Healthy T1[h]		-0.43	1.15	-0.38	0.71
Parent Healthy T1[i]		-0.88	1.00	-0.88	0.38
R^2	0.01		0.46		
F	0.16		167.57**		

Note: [a]Negative Inter-parental Processes coded as 1 youth exposed to relatively higher negative processes, and 0 youth exposed to relatively fewer negative processes; [b]Maternal education coded as 1 youth with a mother with a college or graduate education, and 0 youth with a mother with a high school education; [c]Reference group is White; [d]Gender coded 1: female, 0: male; [e]Family Structure coded 1: Biological Parent, 0: Biologic Parent with Stepparent or Adoptive; [f]Quadratic term for nonlinear BMI T1 for youth; [g]Quadratic term for nonlinear BMI for parent; [h]Youth Health Status T1 coded 1: Respondent reports excellent or very good health status in T1, 0: Respondent reports good or poor health status in T1; [i]Parental Health Status in T1 coded 1: Respondents parent report excellent or very good health status in T1, 0: Respondents report good or poor health status in T1. * p <0.05, ** p<0.01.

NIPP at T3. NIPP are not associated with BMI at T2 (t=-0.29, p=0.77) (F= 0.08, R^2 = 0.01) for the crude model, and remains insignificant (t= -0.41, p= 0.68) (F= 84.60, R^2 = 0.45) when the control variables are added to the model (Table 15). Since there is no direct association, we did not test for mediation of mental health, unhealthy behaviors and health behaviors. But given that there could be an association within each moderator level, we tested for moderation. No association was found.

Table 15

Summary of Multiple Regressions Predicting Body Mass Index at T3 (n=1753)

	Crude Model				Adjusted Model			
Variable	B	SE B	t-value	p value	B	SE B	t-value	P value
Negative Inter-parental Processes[a]	-0.09	0.30	-0.29	0.77	-0.09	0.22	0.02	0.68
Maternal Education[b]					-0.15	0.26	-0.68	0.50

Black[c]		0.28	0.39	0.73	0.47
Hispanic/Other[c]		-0.09	0.30	-0.31	0.76
Female[d]		-0.20	0.22	0.92	0.36
Family Structure[e]		0.17	0.30	0.56	0.57
BMI Percentile T1		-0.12	0.02	-6.37	<0.01**
BMI Percentile[2f]		0.01	0.01	12.77	<0.01**
Parental BMI T1		-0.06	0.12	-0.50	0.62
Parent BMI[2g]		0.00	0.00	1.39	0.16
Healthy T1[h]		-0.62	0.28	-2.19	0.03
Parent Healthy T1[i]		0.09	0.24	0.38	0.71
R^2	0.01		0.45		
F	0.08		84.60**		

Note: [a]Negative Inter-parental Processes coded as 1 youth exposed to relatively higher negative processes, and 0 youth exposed to relatively fewer negative processes; [b]Maternal education coded as 1 youth with a mother with a college or graduate education, and 0 youth with a mother with a high school education; [c]Reference group is White; [d]Gender coded 1: female, 0: male; [e]Family Structure coded 1: Biological Parent, 0: Biologic Parent with Stepparent or Adoptive; [f]Quadratic term for nonlinear BMI T1 for youth; [g]Quadratic term for nonlinear BMI for parent; [h]Youth Health Status T1 coded 1: Respondent reports excellent or very good health status in T1, 0: Respondent reports good or poor health status in T1; [i]Parental Health Status in T1 coded 1: Respondents parent report excellent or very good health status in T1, 0: Respondents report good or poor health status in T1. * p <0.05, ** p<0.01.

Table 16

Summary of Results

Summary of Results Table	
Hypotheses	Results
Hypotheses: Health Status	
Question #1: What is the association between negative family processes and health status independent of control variables?	
Late Adolescence (T2):	
NPCP will be associated with poorer health status in T2. a) Mediated by poor mental health? b) Mediated by unhealthy behaviors? c) Mediated by healthy behaviors? d) Moderated by maternal education? e) Moderated by gender?	**This hypothesis was supported**. NPCP O.R.: 1.31, 1.70 & 2.47 times more likely to be in poorer health status. Step Effect. **Hypothesis supported:** Poor mental health explains 19%, 26%, and 24% of the association. **a) Hypothesis supported:** Using tobacco and marijuana explains 13%, 13% and 7% of the association. **b) Hypothesis supported:** Physical activity explains 6%, 7% and 7% of the association. c) Hypothesis not supported. d) Hypothesis not supported.
NIPP will be associated with poorer health status in (T2). a) Mediated by poor mental health? b) Mediated by unhealthy behaviors? c) Mediated by healthy behaviors? d) Moderated by maternal education? e) Moderated by gender?	**This hypothesis was supported.** NIPP 1.28, 1.36 & 1.85 more likely to be in poorer health status (as compared to excellent health). Step Effect. **a) Hypothesis supported:** Poor mental health explains 25%, 50% & 35% of the association. b) **Hypothesis supported:** Using tobacco, alcohol and marijuana reduces 18%, 22% & 11% of the association. **c) Hypothesis supported**: Engaging in physical activity reduces 11%, 14% & 8% of the association. d) Hypothesis not supported. e) Hypothesis not supported.
Early Adulthood:	
NPCP will be associated with poorer health status in early adulthood (T3). a) Mediated by poor mental health? b) Mediated by unhealthy behaviors? c) Mediated by healthy behaviors? d) Moderated by maternal education? e) Moderated by gender?	**Hypothesis supported.** O.R.: 1.16 (NS), 1.41, 1.98 more likely to be in poorer health. Step Effect. a) **Hypothesis supported:** Poor mental health explained 6%, 22% and 23% of the association. b) **Hypothesis supported:** Using tobacco explained 25%, 17%, 15% of the association. c) Hypothesis not supported. d) Hypothesis not supported. e) Hypothesis not supported.

NIPP will be associated with poorer health status in early adulthood (T3). a) Mediated by poor mental health? b) Mediated by unhealthy behaviors? c) Mediated by healthy behaviors? d) Moderated by maternal education? e) Moderated by gender?	**This hypothesis was supported** only for risk for poor health status (O.R.: 1.91). Only significant for poor health category, but step effect for each category (1.06, 1.24, 1.91). **a) Hypothesis supported:** Poor mental health explained 33%, 42% & 29% of the association. b) Hypothesis not supported. c) Hypothesis not supported. **d) Hypothesis supported.** Among adolescents with mothers with a college/graduate education, there is no association. Among adolescents with mothers with a high school education, NIPP elevates risk for poorer health**.** **e) Hypothesis not supported (direction flipped).** Among males, NIPP is associated with elevated odds for being in poorer health compared to excellent health (across all categories). No association among females.
Comparison of Late Adolescence to Early Adulthood	
The association between NPCP & NIPP, respectively, and health status will attenuate from late adolescence (T2) to early adulthood (T3).	**Hypothesis supported.** NPCP & NIPP elevates risk for poorer health in T2 and T3, but the effect attenuates over time (O.R. NPCP: 1.27 v. 1.16; 1.65 v. 1.41; 2.59 v. 1.98; O.R. NIPP: 1.25 v. 1.06; 1.28 v. 1.24; 1.94 v. 1.91). Step effect remains but attenuates over time.
Hypotheses: Body Mass Index	
Question #2: What is the association between negative family processes and BMI independent of control variables?	
NPCP will be positively associated with BMI in T2. a) Mediated by poor mental health? b) Mediated by unhealthy behaviors? c) Mediated by healthy behaviors? d) Moderated by maternal education? e) Moderated by gender?	Hypothesis not supported. a) Hypothesis not supported. b) Hypothesis not supported. c) Hypothesis not supported. d) Hypothesis not supported. e) Hypothesis not supported.
NIPP will be positively associated with BMI in T2. a) Mediated by poor mental health? b) Mediated by unhealthy behaviors? c) Mediated by healthy	Hypothesis not supported. a) Hypothesis not supported. b) Hypothesis not supported. c) Hypothesis not supported. d) Hypothesis not supported. e) Hypothesis not supported.

behaviors? d) Moderated by maternal education? e) Moderated by gender?	
NPCP will be positively associated with BMI in T3. a) Mediated by poor mental health? b) Mediated by unhealthy behaviors? c) Mediated by healthy behaviors? d) Moderated by maternal education? e) Moderated by gender? NIPP will be positively associated with BMI in T3. a) Mediated by poor mental health? b) Mediated by unhealthy behaviors? c) Mediated by healthy behaviors? d) Moderated by maternal education? e) Moderated by gender?	Hypothesis not supported. a) Hypothesis not supported. b) Hypothesis not supported. c) Hypothesis not supported. d) Hypothesis not supported. e) Hypothesis not supported. Hypothesis not supported. a) Hypothesis not supported. b) Hypothesis not supported. c) Hypothesis not supported. d) Hypothesis not supported. e) Hypothesis not supported.

Chapter 6: Discussion

Informed by family systems theory and the biopsychosocial perspective, this study examined, over a ten year period, the relationship between negative family processes (i.e., inter-parental and parent-child processes) experienced during early adolescence and perceived health status and body mass index during late adolescence as well as early adulthood. We found that adolescents who experience negative parent-child processes (NPCP) and negative inter-parental processes (NIPP) have a greater chance of being in poorer health status but are not associated with body mass index (BMI). The following pathways from negative family processes to perceived poor health status were examined:

1. the association between exposure to NPCP and NIPP during adolescence and health status during late adolescence and early adulthood;
2. mediation of the association between NPCP and NIPP and health status by adolescent mental health; engagement in unhealthy behaviors; or engagement in healthy behaviors; and
3. moderation of the association between NPCP and NIPP and health status by gender or maternal education.

Below we will describe these pathways and discuss the findings related to the link between NPCP and NIPP, respectively, and BMI. The implications of these findings, therapeutic and programmatic applications, directions for future research and the limitations and strengths of this study will be discussed.

Health Status Findings

Hypothesis #1: Negative family processes in early adolescence are associated with elevated risk of poorer health status during late adolescence and early adulthood.

This hypothesis was supported for both NPCP and NIPP. Adolescents who experienced relatively higher levels of NPCP and NIPP, compared to adolescents who experienced relatively fewer negative processes, had a greater chance of perceiving themselves to be in poorer health in late adolescence as well as in early adulthood. Our findings support both cross-sectional and longitudinal studies which have linked experiencing negative family processes in late adolescence to self-reported poor health status and clinical conditions in early adulthood (Anderson, Holmbeck et al., 2009; Campbell, 2005; Fabricius & Luecken 2007; Gil et al., 1992; Kiecolt-Glaser & Newton, 2001; Logan & Scharff, 2005; Paradis et al., 2009).

Furthermore, youth who experienced negative family processes appear to have a greater chance for poorer health across all categories of health status – with the risk increasing at each poorer health status category. This substantial step function for both NPCP and NIPP underscores previous research concluding that negative family processes induce stress in personal relationships (Gottman & Katz, 1989; Kiecolt-Glaser & Newton, 2001; Luecken, Kraft & Hagan, 2009). Our findings suggest that this experience of negativity elevates the chance for poorer health status over time – though to different degrees depending on NPCP and NIPP. For example, adolescents who experience NPCP have a greater chance of perceiving themselves to be in poorer health status across all health status categories in late adolescence, but in early adulthood, experience of negativity increases the chance for perceiving themselves to be in the lowest two health

status categories. Additionally, a similar effect pattern occurs for NIPP – experiencing NIPP increases the chance for poorer health status across all categories in late adolescence but only for the poorest health status in early adulthood. These findings suggest that experiencing negative family processes in early adolescence influence all health status outcomes while the youth are still in adolescence. But as the youth enters adulthood, the influence of the negative family processes in early adolescence appears to diminish such that greater risk remains for only those in the poorest health status categories. Taken together, these findings suggest that family processes in adolescence exert an influence on health status in adolescence and into early adulthood.

Hypothesis #2: Exposure to negative family processes is associated with poorer health status through poorer mental health.

Consistent with the hypothesis, poorer mental health partially mediated the association between exposure to relatively higher levels of negative family processes, compared to adolescents experiencing relatively fewer negative processes, and poorer health status. Findings from our study are consistent with works which suggest that experiencing negative family processes in adolescence is linked to poor mental health in adolescence (Mclaughlin & Hatzenbuchler, 2009), in later adolescence (Chung, Flook & Fuligni, 2009; Cole & McPherson, 1993; Jewell & Stark, 2003; Michael, Torres & Seemann, 2007) and adulthood (DeCarlo Santiago & Wadsworth, 2009; Herrenkohl, Kosterman, Hawkins & Mason, 2009). Additionally, though our study only measures mental health at one time period (in mid adolescence), our findings suggest that reports of poorer mental health in mid-adolescence could represent more than just a snapshot in time. Since mental health mediated the association between family processes and health

status in both late adolescence and early adulthood, it appears that the pathway through mental health remains relevant through early adulthood. This is consistent with other studies that have found that physical violence and arguments in the home in early adolescence were associated with elevated odds for poor mental health in early adulthood (Herrenkohl, Kosterman, Hawkins, & Mason, 2009) as well as elevated odds for poor health status by age 30 (Paradis et al., 2009).

Hypotheses #3: Negative family processes are associated with poorer health through unhealthy behaviors (i.e., alcohol, marijuana and tobacco use).

Engaging in unhealthy behaviors partially mediated the association between NPCP and NIPP and health status in late adolescence. This association remained only for NPCP in early adulthood. Findings from our study suggest that the link between negative family processes and poor health status in late adolescence can be partially explained by engagement in unhealthy behaviors. Specifically, in accord with previous works (Turner, Irwin, & Millstein, 1991; Kulbok & Cox, 2002), we found that tobacco use and marijuana use partially mediated the association between both NPCP and NIPP and risk for poorer health in late adolescence. Additionally, marijuana use also partially mediated the association between NIPP and health status in T2. Previous research has found that negative family processes are associated with greater risk for experimenting with tobacco, alcohol, marijuana, cocaine and other drugs in adolescence (Turner, Irwin, & Millstein, 1991). Findings from our study suggest that tobacco use, marijuana use and alcohol use was linked with negative family processes and poor health status in adolescence – though the link between negative family processes and tobacco use impacting health status in early adulthood

only remained for youth reporting NPCP. This is consistent with Kulbok & Cox (2002) findings that the effects of tobacco use differed from the effects of marijuana use and alcohol use in late adolescence and early adulthood. These findings could suggest that exposure to negativity within the family may have different impacts on engagement in unhealthy behaviors in early adulthood, that in turn would influence health status.

Additionally, other studies have found that stressful/negative family processes in adolescence can increase engagement in unhealthy behaviors since youth may initially use tobacco, marijuana or alcohol as stress reducing behaviors (Scales, Monahan, Rhodes, Roskos-Ewoldsen, & Johnson-Turbes, 2009). For example, negative processes within the family have been reported as one of the primary reasons for smoking among adolescents (Scales et. al., 2009). Therefore, it is plausible that, engagement in tobacco use, marijuana use or alcohol use could be an attempt by youth to manage the stress they experience from negative processes within their families. Therefore, experiencing negative processes with their parents and between their parents is linked to unhealthy behaviors, that in turn elevates adolescents risk for poor health.

Hypothesis #4: Negative family processes are associated with poorer health through disruption of healthy behaviors (e.g., fruit and vegetable consumption, and physical activity).

As hypothesized, engaging in healthy behaviors partially mediated the association between negative family processes and health status in late adolescence. We also hypothesized that engagement in healthy behaviors would also mediate the association

between negative family processes and health status in early adulthood – but this hypothesis was not supported. The association between negative family processes and risk for poor health for both NPCP and NIPP in late adolescence was reduced by adding physical activity into the model. This finding seems to support previous findings that negative family processes can disrupt parents' ability to support health-enhancing behaviors (Gregory et al., 2006) – but only in adolescence. This link does not extend to early adulthood. Assuming that many adolescents in early adulthood are no longer being given frequent health promoting messages at home, as they did in adolescence, this could imply that the disruption of negative family processes may only occur when adolescents are more likely to be given health promoting messages by their parents (i.e. in adolescence).

Additionally, only physical activity mediated the association between negative family processes and health status – not fruit and vegetable consumption. Interestingly, NPCP was associated with FVC, and FVC was associated with health status – however, the mediation was not significant. This could be due to the low levels of FVC reported by our sample. For example, in both late adolescence and early adulthood, the majority of respondents reported eating substantially fewer than the recommended five servings of fruits and vegetables daily as more than half of respondents averaged fewer than two fruits and vegetable servings daily. Though these findings are consistent with national averages that the majority of youth do not eat recommended servings of fruits and vegetables (CDC, 2010; DHHS, 2009), our findings could reflect a possible cohort effect. The healthy behaviors in adolescence were assessed in our study in 2002. Given the increasing focus on nutrition education and increasing youth's FVC in today's context, it

is possible that our findings could be different in a cohort that is going through adolescence with today's social marketing and program funding that focuses on health promotion in adolescence or in a future cohort.

Hypothesis #5: Maternal education moderates the association between negative family processes and health status.

In the current study, maternal education was used as a proxy for the effect that socioeconomic status has on family processes and health outcomes (Gibson, Byrne, Davis, Blair, Jacoby, & Zubrick, 2007; Kantomaa et al., 2010). The association between NPCP and NIPP, respectively, and health status was hypothesized to be different for each level of maternal education. The findings partially support this hypothesis. The association between youth who reported experiencing NIPP and health status differed by level of maternal education in the hypothesized direction, but not for NPCP. For example, adolescents experiencing NIPP had a greater chance of being in poorer health status among those whose mothers had a high school education compared to adolescents whose mothers had a college or graduate education, but the association between NPCP and health status did not differ by maternal education level.

Hypothesis # 6: Gender moderates the association between negative family processes and risk for poorer health status.

Contrary to the hypothesis, gender did not moderate the association between NPCP and NIPP and health status in late adolescence or early adulthood. This could indeed be true or we might not have found an effect due to how we measured family processes. According to family systems theory, we grouped mother and father

processes together to represent an average of negative family processes within each subsystem. Other studies have found that the impact of gender on negative family processes may depend on whether it is mother negativity versus father (i.e. adolescents tend to report more negative processes with their mothers than with their fathers) (Chung, Flook, & Fuligni, 2009). The current study averaged the level of negative mother-adolescent processes with father-adolescent processes, potentially masking a gender interaction.

Body Mass Index Findings

We hypothesized that NPCP and NIPP would be positively associated with BMI; that poor mental health, engagement in unhealthy behaviors, and engagement in healthy behaviors would mediate the association; and that gender and maternal education would moderate the association. We did not find support for any of these hypotheses.

Among our sample, addition of either family process variable did not explain any additional variance than did the control variables of race, gender, maternal education, BMI, health status, parental health and BMI in early adolescence. The control variables included in the models explained half of the variance in BMI over time consistent with extensive literature documenting the link between early adolescent BMI and later BMI (Whitaker et al, 1997; Moens, Braet, & Winckel, 2010; Berge et al., 2010). For example, 80% of youth with a BMI percentile in the overweight category in early adolescence (12-15 years old) were categorized as obese when they were 25 years old (Whitaker et al., 1997). BMI in early adolescence is on the causal pathway to later BMI, and therefore, understandably, greatly impacts

later BMI. Other studies who found an association between family factors, like parenting styles, and BMI, controlled for socioeconomic status, age and race but did not control for earlier BMI of the youth (Berge et al., 2010). Therefore, the amount of variables that we controlled for could have masked a possible association of negative family processes and health status.

Our findings may also reflect the specific family process variables measured in our study. It is possible that the negative family processes examined in our study might not adequately capture the family processes, such as parenting style, that may be most related to BMI (Berge et al., 2010). For example, a study by Berge, Wall, Loth, and Neumark-Sztainer (2010) examined parenting style and adolescent BMI over a 5 year period (from early adolescence to late adolescence) and concluded that parenting style interacted with gender of both the parent and the youth and was associated with adolescent BMI. Specifically, among daughters, maternal authoritative parenting was linked to lower BMI while maternal neglectful parenting was linked to higher BMI five years later. Among sons, maternal authoritative parenting was linked to lower BMI and maternal authoritarian parenting was linked to higher BMI (Berge et al., 2010). Paternal parenting style was not associated with youth BMI (Berge et al., 2010). Additionally, Crossman, Sullivan, and Benin (2006) found that another family process – family closeness/support – was associated with body weight over time. Specifically, they found that females who felt cared for by their parents in adolescence were at reduced risk for high body weight six years later in early adulthood, while males who reported low levels of closeness with their parents in adolescence were more likely to have high body weight six years later in

young adulthood (Crossman et al., 2006). Taken together, the negative family processes examined in our study might not fully capture the family processes that are most related to BMI.

Lastly, other studies have detailed gender differences both in parental processes, as well as adolescent processes (Berge et al. 2010). For example, the study described above by Berge et al. (2010) highlights gender differences both in parental processes, as well as youth processes. However, according to family systems theory, we averaged negative processes across the parental subsystem and the parent-child subsystem. Averaging the processes across the subsystems could have masked a potential association between negative family processes and BMI. For example, mothers with an authoritarian parenting style were more likely to have daughters with lower BMI, whereas, neglectful parenting was linked to higher BMI five years later (Berge et al., 2010). All in all, the differences in our findings compared to the hypothesized associations could be due to a number of factors that warrant further exploration.

Overall Summary: Effects of Family Processes on Health Status and BMI

This study contributes to the body of literature addressing family processes and adolescent health behaviors and outcomes, as the findings 1) fill a gap in the literature by examining multiple family processes; 2) underscore the influence of family processes on adolescent health and development; 3) provide a systemic understanding of relational processes, mental health, health behaviors and health outcomes; and 4) present opportunities for further research. First, the majority of family process research focuses on only one construct, limiting our understanding of

multiple family processes within the same family. Therefore, our examination of four different family processes (mother to father, father to mother, mother-child, father-child) in two important subsystems (parental and parent-child) contribute to our understanding of multiple family processes within the same family system (Day et al, 2009), which matters because we can gain a better understanding of the impact of each type of family process on adolescent health and development.

Second, in keeping with the biopsychosocial perspective and family systems theory, our findings suggest that individual health and development do not happen in isolation. Adolescents – for many reasons that are largely developmental – are primed to be sensitized to the environment around them (McGoldrick, Carter, & Garcia-Preto, 2011). The independent association between negative family processes and perceived health could be due to our natural physiologic response to stress. Experiencing negativity within the family can be interpreted through our cognitions as a stressful event creating a physiologic stress response that can erode physical health over time (Glass & McAtee, 2006; Kiecolt-Glaser & Newton, 2001; Michael, Torres & Seemann, 2000; Skeer, McCormick, Normand, Buka, & Gilman, 2009). Though our findings suggest that negative family processes are associated with poorer perceived health, it is likely that these associations may be observed for objective physical health outcomes as well, given the demonstrated link between cognitions, stress, and physical health. This link is consistent with other research that has found that experiencing relational negativity as adults is linked to a myriad of poorer health outcomes (e.g., elevated blood pressure and fasting glucose) for each partner (Kiecolt-Glaser & Newton, 2001; Whisman, Uebelacker, & Settles, 2010).

Taken together, relational processes can exert a significant influence on individual health in adolescence and adulthood.

Furthermore, it appears that the impact of negative family processes lasts into adulthood for youth who perceive their health as good (only for NPCP), fair or poor. Youth in our study reported relatively low levels of parent-child and inter-parental negativity on average, but even moderate reports of negativity produced statistically significant differences in health status/health behaviors – that lasted into adulthood. This is of concern. However, our findings do not necessarily imply that negative outcomes are stable over time; other studies have found that for some individuals, the negative influence of adolescent environments can be offset through individual positive behaviors in adulthood (Rutter, 1993; Werner, 1993).

Third, we have historically been an individualistic society that attributes - particularly in regards to physical health. This worldview has the consequence of compartmentalizing physical health, mental health, health behaviors and family processes as distinct areas and has understated the influence of family and environmental factors on physical health. The examination of adolescent health outcomes using public health and family systems lenses underscores the importance of assessing the system of individual, family and environmental factors as key parts of a thorough understanding of mental and physical health. The inclusion of many of these distinct areas in one study of adolescents examined over a ten year period allows us to understand how these factors operate interdependently. Because these factors were found to be influential over a ten year period, this study firmly demonstrates the linkages espoused by family systems theory and the biopsychosocial

perspective. In sum, our findings suggest that family processes can impact individuals' cognitions and emotions (mental health), their engagement in behaviors (healthy and unhealthy) and their overall physical health perception.

Lastly, our findings suggest different associations for the impact of negative family processes on health status versus BMI. Our lack of findings presents an opportunity for further research examining what, if any, family processes (outside of the ones examined in this study) are associated with BMI. We conceptualized both health status and BMI as aspects of adolescent health linked to adulthood health. Our findings for the association between negative family processes and risk for poor perceived health suggest an underlying stress response that elevates risk, but this stress response does not seem to be relevant for BMI. This could suggest that other factors are more influential in predicting BMI in today's context than family processes. Further examination is needed.

Implications

The results from this study support findings from previous research which found a link between family processes and adolescent health and development (Campbell, 2004; Day et al., 2009; Skeer, 2009; Troost & Filsinger, 2004). Consistent with family systems theory and the biopsychosocial perspective, negative family processes in early adolescence impact health status in late adolescence as well as early adulthood. More broadly, our findings underscore the tenets set forth in family process research that emphasize the influence family interactions and the family system itself exert on adolescent health and development (Day et al., 2009).

The association between each family process and risk for poorer health status supports our hypotheses that exposure to family negativity are associated with elevated risk of poorer health status. In fact, the substantial step function suggests that being exposed to negativity increases the odds for each category of health status – the greater the odds, the poorer the perceived health status. This step function, though attenuated, remains into adulthood. As evidenced by these findings, adolescence represents an important period for promoting health as an adult (Flynn et al., 2006; Glass & McAtee, 2006). Our findings suggest that the seeds for poor health status can be sown in adolescence and can follow adolescents into adulthood (Flynn et al., 2006). Therefore, negative family processes belong on the list of risk factors in adolescence that may "explain trajectories of health in adulthood, decades later" (Flynn et al., 2006; Glass & McAtee, 2006).

Furthermore, since negative family processes are associated with a greater chance that adolescents will perceive themselves in poorer health, our findings suggest that negative family processes ultimately could have a negative impact on public health. Self-reported health status can be an indicator of global health, mortality in adulthood (Allen & Armstrong, 2006; Fabricius & Luecken, 2007), and a myriad of diseases in adulthood (CDC, 2010; Freedman, Zuguo, Srinivasan, Berenson & Dietz, 2007; Greenblatt, 2005; Ogden, Carroll, & Curtin, 2010). Thus, our findings suggest that negative family processes could increase the chance not only for health status but also for other physical health outcomes, as well, and underscores the importance of approaching family studies from a public health perspective.

Family systems theory and the biopsychosocial perspective were utilized for this study's integration of family science with public health. Family systems theory and the biopsychosocial perspective appeared to create a sound theoretical framework to examine the association of family processes and health. For example, negative interactions can have a ripple effect and tend to influence everyone exposed within the family system to varying degrees. Utilizing family systems theory's division of subsystems into the parent-child and parental subsystem, we were able to examine the effect of directly experiencing negativity within the parent-child subsystem and the effect of exposure to negativity from the parental subsystem. Youth who reported a more negative relationship *with their* parents were at much greater risk for poorer health status than youth who reported exposure to negative processes *between* their parents. Consistent with Glass & McAtee's (2006) description of 'embodiment', exposure to NPCP and/or NIPP seem to sculpt internal biologic systems into 'getting under the skin' that elevates risk for poor health status over time (Kiecolt-Glaser & Newton, 2001). Our findings appear to suggest that directly participating in the negativity has a greater effect than seeing the negativity between parents but not being directly involved in it. Therefore, adolescence does appear to be a period where youth have a heightened sensitivity to influences around them (Conger & Conger, 2002; Eccles et al., 1993; Ge, Lorenz, Conger, Elder, & Simons, 1994; Kaye et al., 2009; Moffitt, 1993) but that this sensitivity could depend on the degree of involvement in the negativity. Taken together, negative family processes impact everyone within the family – the greater the impact, the greater the involvement in the negativity.

Therapeutic Implications

Our findings highlight the need to examine the intersection of family processes and adolescent health in therapeutic settings. Questions on perception of health status could be wise additions to traditional family therapy assessments. Additionally, treatment that targets enhancing adolescent health would benefit from including/assessing how the family interacts with each other. Consistent with Campbell's (2005) statements, our findings support that negative family processes (coupled with low levels of positive processes) significantly deteriorate health (Campbell, 2005). Bolstering family processes to decrease negative processes could have an impact that is twofold: it could enhance positive family functioning and also could enhance individual and family health over the long run. Helping educate clients about the influence of family relationship processes on individual health – both now and in the future – could provide valuable information for not only relationship enhancement, but also health improvement.

Indeed, this approach could be helpful even for those adolescents not yet in poor health. All families can benefit from decreasing negative family processes and enhancing positive family processes (e.g., Katz & Gottman, 1995; 1997; Gottman, 1999), such as screaming, criticizing and blaming, and enhancing positive family processes, such as affection, praise and encouragement. This is consistent with years of research from John Gottman who has found that behaviors like criticism, withdrawal, contempt and ignoring - all negative family processes – significantly deteriorate relationship quality over time (Katz & Gottman, 1995; 1997; Gottman, 1999).

Furthermore, our findings suggest that the parent-child relationship and the inter-parental relationship are important subsystems that can influence health outcomes and should remain a focus in clinical treatment (Diamond & Liddle, 1999). Our findings support family systems therapy models that highlight the importance of clinicians assessing the parent-child subsystem and the inter-parental subsystem separately as well as in concert – recognizing the systemic nature of families. Our findings also suggest that processes within these subsystems are associated with mental health, engagement in healthy and unhealthy behaviors, and health status outcomes. This is consistent with myriad other studies that highlight the importance of parent-child and inter-parental processes on adolescent outcomes as adults (McLaughlin et al., 2010; Skeer, McCormick, Normand, Buka, & Gilman, 2009).

To assess parent-child and inter-parental processes effectively, clinicians need specific processes to assess. The processes that were examined in this study as parent-child processes were: whether the adolescent's parents criticized, blamed, helped, cancelled plans; and whether the adolescent thought highly of, wanted to be like, or enjoyed spending time with his/her parents. The inter-parental processes specifically examined were whether parents are angry, critical or blaming toward each other; compromise with each other; are affectionate or encourage their child. Taken together, these processes create a family environment that can either be health-enhancing or health-deteriorating. Identifying the specific behaviors that make up positive versus negative family processes that are linked to health status could help clinicians develop evidenced based assessment plans.

Additionally, the findings that NPCP and NIPP in early adolescence are linked to unhealthy behaviors in late adolescence can also help clinicians craft their assessment questions for adolescents to specifically include engagement in unhealthy behaviors as a possible consequence of exposure to NIPP and NPCP. As discussed earlier, engagement in tobacco use, marijuana use or alcohol use could be an attempt by youth to manage the stress they experience from negative processes within their families. Therefore, our findings suggest that interventions targeted at reducing the stress caused by negative family processes could have both health outcomes (i.e. health status) and health behavior benefits for the adolescents. Specifically, clinicians could target interventions aimed at decreasing the stress caused by NPCP and NIPP and teach youth, in particular, how to manage their physiologic reactions to stress (Katz & Gottman, 1997). This enhanced ability to manage stress could diminish the effect that negative family processes have on poor health immediately as well as over time. Therefore, clinical interventions aimed at emotion management surrounding negative family processes could have long-term benefits.

Programmatic Implications

Our results have programmatic implications. First, our findings suggest that programs targeted at enhancing health would benefit from including/assessing how the family interacts with each other – particularly, the youth's amount of exposure to negativity. Targeting the reduction of negative family processes in programs aimed at enhancing adolescent health and wellness could decrease youth's risk for poor health status over time.

Second, our findings that NPCP and NIPP in early adolescence are linked to unhealthy behaviors in late adolescence also have programmatic implications. As discussed above, engagement in tobacco use, marijuana use or alcohol use could be an attempt by youth to manage the stress they experience from exposure to negative family processes. However, given the health consequences of engagement in alcohol use, marijuana use, and tobacco use, these short-term strategies could have long-term ramifications for poorer health. Therefore, programs that focus on family processes, health promotion, tobacco cessation and/or substance abuse prevention might benefit from discussion of stress management strategies that teach reduction of stress through engagement in positive/healthy behaviors.

Third, another finding that may have programmatic implications are our findings for BMI. Even though our study did not find that negative family processes impact BMI, our auxiliary findings are consistent with other studies that have found that BMI in adolescence is a significant predictor of BMI in late adolescence as well as adulthood. This suggests that programs targeting BMI would benefit from starting young and attempting to head off higher BMI percentiles in adolescence. For example, one study found that by the age of 12, over 40% of youth already had one risk factor for cardiovascular disease (Richter, Harris, Paine-Andrews et al., 2000). Additionally, youth in our study perceived themselves to be in poorer health and reported higher BMIs, on average, over the ten years examined in this study. Since the youth in our study are 12 or over, these findings could suggest that programmatic interventions would be best served to start in childhood. This warrants further exploration.

Lastly, the levels of physical activity and FVC reported in our study are consistent with national findings that suggest that programs aimed at adolescent health would benefit by focusing on increasing physical activity and FVC. For example, respondents reported physical activity and FVC substantially below the current national recommendations for good health (i.e., that persons under 18 years old should participate in an hour of physical activity daily and consume at least five servings of fruits and vegetables daily (DHHS, 2009). Only 12% of respondents in our study reported exercising daily for 30 minutes – not the recommended hour. More than one-quarter of respondents reported never exercising. Additionally, in both late adolescence and early adulthood, the majority of respondents in the current study reported eating substantially fewer than the recommended five servings of fruits and vegetables daily. More than half of respondents averaged fewer than two fruits and vegetable servings daily. These findings are consistent with national findings where 65% of youth do not engage in the recommended hour of physical activity daily nor eat recommended servings of fruits and vegetables (CDC, 2010; DHHS, 2009) – and have programming implications.

Therefore, in sum, our findings suggests that programs aimed at promoting adolescent health over time could benefit from including: 1) the impact of negative family processes on individual health status over time, 2) teach stress management techniques to possibly buffer the impact of the stressful processes on health status over time, 3) intervene in childhood for BMI-related effects, and 4) include physical activity and FVC promotion to increase levels of activity and consumption.

Directions for Future Research

The current study focused on the impact of negative family processes on adolescent health as measured by adolescent perception. Our research question can be expanded to include a broader systems view of each member of the family. The model used for this study can also be expanded to include parental report data, to examine how parents' perception of the parent-child relationship and of their marital relationship is associated with their health. For example, Steinberg (2001) reports that parents report more sensitivity to negative interactions with their children than their adolescents report. This expanded model can provide a more comprehensive understanding of the pathways through which negative family processes can impact parental health.

Limitations

There are some limitations to our study. First, the sample size of those who reported negative family process variables could have been larger (i.e. not restricted to just the 12-14 year olds in the study). Second, our study only measured mental health at one point in time (i.e. mid adolescence), therefore, reports of mental health in our study represent a snapshot in time. Third, negative family processes are assessed at only one point in time. The negative family process variables could have been asked every year such that our measure of negative family processes could be an average of adolescents' exposure to negative family processes throughout adolescence. It is unknown if the amount of negative family processes reported is emblematic of typical negative family processes over the adolescent's adolescence. However, given the lasting impact of negative family processes on increasing

adolescent's risk for poor health status, our results seem to suggest that it is plausible that the exposure to negativity in adolescence can continue through the rest of adolescence. Results from other studies that followed family processes over adolescence found that, for the most part, adolescents report low levels of negative processes toward their mother and father in early adolescence, that reports of negative processes slightly increase through adolescence from age 12-13 to 16-17 (Moore et al., 2004), and that negative family processes steadily increase through age 18 (Herrenkohl et al., 2009). Therefore, it is plausible that the amount of negative family processes that adolescents in our study report in early adolescence, will either continue or increase steadily through adolescence.

Fourth, ideally, given the association between income and BMI and health status, income would have been used in the current study. But similar to other studies where income had significant missing number of values, maternal education was used as a proxy for the effect of socioeconomic status (Wang, Chyen, Lee, & Lowry, 2008). Finally, and perhaps most importantly, a significant limitation of this study is that it only assessed adolescents living in two parent households. However, 66% of children in the United States live in two-parent households (Census, 2010). Therefore, while our findings might not be generalized broadly, there is still a significant section of the population that would benefit from these findings.

Strengths

This study fills an important gap in our understanding of the intersection of family processes in adolescence with health status over a ten year period into early adulthood. Consistent with family systems theory and the biopsychosocial

perspective, negative family processes in adolescence have a lasting impact on perceived health status. Utilizing family systems theory and the biopsychosocial perspective enabled us to understand how family processes impact individual mental and physical health. Consistent with the biopsychosocial framework, our findings support that health status is not just a physical construct, but has psychological and social determinants as well. Using a longitudinal design increased the strength of our findings so that causal associations could be examined and pathways identified. Additionally, much of family process research focuses on only one construct, called "topic silo" (Day et al., 2009; Lindahl, 1998; Vandewater & Lansford, 2005). Our examination of multiple family processes in two important subsystems contributes to our understanding of multiple intra-family processes (Day et al, 2009). We used measures that were previously established, and showed high levels of correlation between reported perceptions and objective findings. For example, self-reported height and body weight are highly correlated (0.92) with objective body weight and height measurements (Crossman, Sullivan & Benin, 2006). Additionally, health status is a commonly used measure of overall health (Allen & Armstrong, 2006; Fabricius & Luecken, 2007; Manor, Matthews & Power, 2001) that is highly correlated with poor health in adulthood (Ferraro & Yo, 1995).

Conclusions

This study examined the association of negative family processes during adolescence and perceived health and BMI over a ten year period into early adulthood. Our study did not find an association between negative family processes in early adolescence and BMI over the ten year period of our study. Further research is

warranted. Consistent with family systems theory and the biopsychosocial perspective, negative parent-child and negative inter-parental processes during early adolescence had a lasting impact on overall perceived health. We found pathways from negative family processes to poorer perceived health status through mental health, engagement in unhealthy behaviors and engagement in physical activity. Our findings have clinical and programmatic implications. Treatment targeting adolescent health might benefit from approaching adolescent health from a biopsychosocial and systems perspective. Bolstering positive family processes to decrease negative processes could enhance positive family functioning as well as adolescent health over time. Additionally, focusing on decreasing negative family processes could also impact adolescent mental health, engagement in unhealthy behaviors and engagement in physical activity. Overall, this study combines family science with public health and discovers associations that could direct programming, therapy and future research.

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