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# Parent-Adolescent Discrepancies In Parental Knowledge: Understanding Their Relationship To Adolescent Risk-Taking

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# Parent-Adolescent Discrepancies in Parental Knowledge: Understanding Their Relationship to Adolescent Risk-Taking

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Abstract

PARENT-ADOLESCENT REPORTING DISCREPANCIES IN PARENTAL KNOWLEDGE: UNDERSTANDING THEIR RELATIONSHIP TO ADOLESCENT RISK-TAKING. Whitney L. McG. Kress, Michael J. Crowley, and Linda C. Mayes. Yale Child Study Center, Yale University, School of Medicine, New Haven, CT. This study examined discrepancies in parent and adolescent reports of parental knowledge (PK) in order to better define the relationship of such discrepancies to adolescent risk-taking and to further explore the significance of discrepancies. Subjects included 164 adolescent-parent dyads (*M* age =14.9, *SD* 0.96). Adolescent and parent reports of PK both independently negatively correlated with degree of adolescent risk-taking. Discrepancy scores were generated by subtracting adolescent-reported PK from parent-reported PK. The relationship of discrepancy scores to adolescent risk-taking was examined in the context of three models: (1) A continuous model utilizing the absolute magnitude of the discrepancy score; (2) A three-group model consisting of a minimal discrepancy group, a group in which the parent reported higher levels of PK than the adolescent, and a group in which the adolescent reported higher levels of PK than the parent; and (3) A four-group model in which the minimal discrepancy group was further separated into two groups consisting of those reporting high levels of PK and those reporting low levels of PK. All three models significantly related to adolescent risk-taking. Models 1 and 2 both demonstrated that higher levels of discrepancies between parent and adolescent reports of PK corresponded to higher levels of risk-taking. The four-group model had the strongest correlation with risk-taking and demonstrated that the group consisting of subjects in whom there was minimal discrepancy with agreement on high levels of PK had significantly lower levels of adolescent risk-taking than any of the other discrepancy categories. Discrepancy groups also differed significently from eachother with respect to adolescent impulsivity and percieved stress. Findings suggest that discrepancy scores in PK are most highly related to risk-taking when interpreted in the context of their magnitude, directionality, and degree of PK. Specifically, low levels of discrepancies with high levels of PK appears to be protective of risk-taking and also associated with lower levels of impulsivity and percieved stress.

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# INTRODUCTION

## *Risk-taking in Adolescents*

Risk-taking is commonly defined as "behaviors that are associated with some probability of undesirable results" (Boyer 2006, pg. 291). Consistent with this definition are activities such as truancy, substance use, reckless driving, fighting, and unprotected sexual intercourse. Adolescence is a period of particularly high rates of risk-taking[1] (Boyer 2006). According to the Center for Disease Control and Prevention (2011), by twelfth grade 54.5% of adolescents in the US have smoked a cigarette, 31.5% have engaged in binge drinking, and only 56.3% report using condoms during intercourse. It is also notable that the rates of many risky behaviors such as substance use are initiated during adolescence and progressively increase throughout high school. Substance use in particular has the potential during adolescence to transition from occasional experimentation to substance abuse, a much more harmful behavior with serious long-term implications. In addition to the association between increasing age and increasing levels of risk-taking, male adolescents also generally tend to be more involved in high-risk behavior (Hoeve et al. 2009, Center for Disease Control and Prevention 2011). The decision to take a risk involves several processes including negative reinforcement, positive reinforcement, and consequence appraisal. When an adolescent decides to engage in a risky behavior he/she is deciding that the benefits of the behavior, whether it be escape from something negative (as in negative reinforcement) or attainment of

[1] This paper will focus solely on negative risk-taking as opposed to positive risk-taking, which addresses the constructive and beneficial aspects of risk-taking.

something positive (as in positive reinforcement) outweigh his/her perception of the consequences of that behavior. Unfortunately, the consequences are often serious and underestimated by the adolescent. By far the leading causes of death in adolescents, accounting for 48.0% of all deaths from age 11 through 18, are unintentional injuries. About three quarters of those are related to motor vehicle crashes, of which many involve adolescent drivers who speed, have been drinking, and are not wearing seatbelts (Minino 2010, National Highway Traffic Safety Administration May, 2012, National Highway Traffic Safety Administration August, 2012). Arrests are also rampant during adolescence and by age 18, the percent of adolescents who have ever been arrested lies between 15.9% and 26.8% and the percentages continue to increase with age. While one could simply attribute these increasing numbers to increasing number of years during which to be arrested, it is important to recognize that the fastest growth in prevalence rate of arrests occurs in late adolescence and early adulthood (Brame et al. 2012). Understanding the factors contributing to risk-taking in adolescents will be beneficial in developing interventions.

Clearly there is something unique about the adolescent years that predisposes to risk-taking behavior. During adolescence, individuals are attempting to establish independence by thinking and acting separately from the family unit. A certain degree of exploratory risk-taking is likely advantageous for the adolescent, but many adolescents take more serious risks, such as those mentioned above, that have long-term negative implications. Boyer (2006) presents a review of four main perspectives taken to understand the high propensity for risk-taking in this age group: the cognitive development perspective, the emotional development perspective, the psychobiological

perspective, and the social development perspective. Boyer argues that while cognitive risk appreciation and affective regulation actually mature throughout adolescence and counteract the tendency to take risks, neurological and physical maturation during the same period and a changing social context may counteract such positive effects, leading to risk-taking. Chambers, Taylor and Potenza (2003) present a neurobiological perspective that explains the high rates of adolescent risk-taking as a product of a lag in maturation of the inhibitory neural pathways in the prefrontal cortex, which is largely involved in executive functioning, behind the subcortical reward-seeking pathways. As a result of this lag, adolescents seek rewards as adults would but lack the ability that adults have to inhibit dangerous or overly risky behavior. Variations in risk-taking, therefore, likely correspond to variations between adolescents in degrees of maturation of the two systems in addition to external social and situational influences.

Given the high levels of risk-taking in adolescents as well as the serious potential consequences, significant time and resources have been focused on better understanding the reasons for risk-taking as well as ways in which to identify at-risk adolescents. The results of such studies will hopefully help in developing novel interventions to reduce risky-behavior in adolescents.

*Parenting Practices and their Relationship to Adolescent Risk-taking*

Parenting practices have long been shown to relate to child[2] risk-taking (Baumrind 1991, Racz and McMahon 2011). The impact of different parenting styles on adolescent risk-behavior, for example, is established. Generally parenting styles are

[2] "Child" and "adolescent" will be used interchangeably as the vast majority of the literature spans the range from children to adolescents seamlessly.

grouped into four main groups (authortative, authoritarian, permissive, and neglectful) as well as several subgroups via ratings along two continuums: (1) demandingness, also described as strictness/supervision and (2) responsiveness or acceptance/involvement (Baumrind 1991, Lamborn et al. 1991, Steinberg et al. 1994). Children of authoritative parents (highly demanding and highly responsive) and democratic parents (moderately demanding and highly responsive) were demonstrated by Baumrind (1991) to be more socially, cognitively, and emotionally competent as well as to have lower rates of substance use. This was supported by Steinberg et al. (1994) who further found that over time children with authoritative families maintained the same high levels of competence whereas those from neglectful families (minimally demanding and minimally responsive) continued to drop lower and lower with respect to their competency ratings. Clearly parenting styles have serious positive and negative consequences for children. While these are broad grouping categories, more specific aspects of parenting behaviors have also been studied as they relate to adolescent risk-taking.

Parental monitoring, in particular, has been the focus of much research and has been consistently shown to significantly relate to child risk-taking and problem behavior (Crouter and Head 2002, Kerr, Stattin and Burk 2010, Li, Feigelman and Stanton 2000). Parental monitoring as defined by Dishion and McMahon (1998) is "a set of correlated parenting behaviors involving attention to and tracking of the child's whereabouts, activities, and adaptations." While a significant number of papers have used the term parental monitoring, it is now commonly accepted that the majority of these studies were actually looking at parental knowledge rather than parental monitoring, a concept introduced by Stattin and Kerr (2000). Stattin and Kerr argued that parental monitoring

refers to the *active* efforts made by a parent to know the whereabouts and activities of their child, whereas most studies actually assessed the degree to which parents knew about their child's activities as opposed to the active efforts made by the parents. The two central active monitoring efforts include the solicitation of information from the child and the exertion of control over the child's life through setting limits and consequences. Solicitation refers specifically to the active attempts by parents to engage and communicate with their child, for example through direct questioning. Control also requires active effort on the part of the parents to establish and adhere to rules, such as curfews or requiring a child to report where and with whom he is going out on weekends. Parental knowledge, on the other hand, encompasses what could be considered the end goal of parental monitoring. This consists of the degree to which parents know where and with whom their child is at any given time as well as the activities of their child. The source of parental knowledge includes active parenting behaviors such as solicitation and control but also child disclosure of information. In their study, Stattin and Kerr (2010) found that parental solicitation, parental control, and child disclosure were all positively correlated with parental knowledge. Child disclosure, however, was the most strongly correlated with parental knowledge, and subsequent studies confirmed that child disclosure appears to be the major factor determining the degree of parental knowledge (Kerr et al. 2010, Willoughby and Hamza 2011).

Parental knowledge, specifically, and adolescent risk-taking have been linked in a bidirectional fashion (Pardini 2008, Collins et al. 2000, Pettit and Arsiwalla 2008, Willoughby and Hamza 2011, Laird et al. 2003, Kerr et al. 2010, Keijsers et al. 2010). Higher parental knowledge predicts lower adolescent risk-taking behavior over time, and

higher adolescent problem behavior predicts lower levels of parental knowledge over time. Kerr et al. (2010) and Keijsers et al. (2010) conducted two longitudinal studies in Europe that confirmed the reciprocal relationship. They also found that child disclosure was the main longitudinal predictor of both parental knowledge and risk behavior. Parental monitoring efforts, including solicitation and control, were not strongly predictive of either parental knowledge or risk behavior. Solicitation, in fact, was positively correlated with delinquency such that higher levels of solicitation resulted in higher levels of delinquency. Kerr et al. (2010) hypothesized that higher levels of parental solicitation may actually be considered by the child as intrusive and cause them to withdraw. Willoughby and Hamza (2011) subsequently conducted a large longitudinal study to examine the interrelationships between adolescent risk behavior, parental knowledge, parental solicitation, parental control, and adolescent disclosure. In addition to supporting the findings of Kerr et al. (2010) and Keijsers et al. (2010), their results demonstrated that child disclosure and adolescent risk behavior were indirectly related through the mediator of parental knowledge and that this pathway is also bidirectional in nature.

Parental knowledge is a particularly complex measure as it represents the product of both a child-driven process (child disclosure) and parent-driven processes (parental solicitation and control). Given that parental knowledge, child disclosure, parental solicitation, and parental control are all significantly related to adolescent risk-taking, this suggests a family-driven process in the prediction of risk-taking in the adolescent. Supporting this family-driven model is evidence that increased amounts of time engaged in fun family time also leads to increased adolescent disclosure and indirectly decreased

adolescent risk-taking (Willoughby and Hamza 2011). Family connectedness is also a protective factor for adolescents with respect to risk-taking (Resnick, Harris and Blum 1993). Parental knowledge, therefore, is useful to study because it incorporates elements that make up this family-driven model. Understanding parental knowledge, however, is complicated by variations in perspectives, as children and parents often have differing views on the degree of parental knowledge (Reynolds et al. 2011).

*Informant Discrepancies*

Discrepancies between different informants' reports of child, parent, or family factors are a well-documented phenomenon (De Los Reyes and Kazdin 2005, Kerr et al. 2010, Weissman et al. 1987, Achenbach, McConaughy and Howell 1987). In the child-oriented literature, different informants include such people in a child's life as parents, teachers, clinicians, peers, as well as the child himself. Informants differ both in their relationship to the child and in the context in which they observe and interact with the child. As a result of these different perspectives, different informants often have highly discrepant views on what is normal and what is pathologic and on the nature of various related constructs, such as parent-child relationships, parenting practices, or parental knowledge. In an early meta-analysis performed to assess differences between informants in reports of a child's emotional or behavioral problems, Achenbach et al. (1987) derived several mean correlation coefficients for pairs of informants. Between similar informants, such as between two parents, the mean *R* was 0.60. Between different informants, such as a parent and a teacher, the mean *R* was lower at 0.28, indicating increasing levels of discrepancy. Between the child and another informant such as the

parent, the mean *R* was even lower at 0.22. Correlations also tended to be lower for adolescent subjects than for young child subjects. Grills and Ollendick (2003) found similarly low correlation coefficients ranging from 0.09 to 0.37 between parent and child reports of psychopathologies including phobias, anxiety, depression, and attention deficit hyperactive disorder. The informant discrepancies implied by these low correlations are not thought to be simply a result of measurement error, but rather they are thought to represent clinically useful information (De Los Reyes 2011). The value of informant discrepancies has been further confirmed in studies correlating them with adverse outcomes, such as child delinquency (Reynolds et al. 2011, De Los Reyes et al. 2010, Ferdinand, van der Ende and Verhulst 2004, Beck, Boyle and Boekeloo 2003).

The study of informant discrepancies began with a focus on their role in identifying and treating childhood psychopathology. Differences in informant perspectives and attributions of behavior lead to significant discrepancies in the diagnosis and management of psychopathology in the clinical setting (Achenbach et al. 1987, Grills and Ollendick 2002, Chi and Hinshaw 2002, Ferdinand et al. 2004). De Los Reyes and Kazdin (2005) proposed the Attribution Bias Context model (ABC model) to better understand discrepancies in the clinical research environment. The ABC model is based on several different factors that may contribute to discrepancies between child and parent reports of child behavioral or emotional problems. The attribution portion of the model refers to differences due to the actor-observer phenomenon that understands children as "actors" who tend to see their actions as more of a product of environmental and external factors in contrast to parents and teachers who as "observers" tend to interpret a child's action as a result of the child's disposition or factors intrinsic to the child's being. A

child's negative behavior, therefore, may be perceived in two very different ways: the child may believe it is purely due to an adverse event that should be changed whereas the parent or teacher may believe it is a pathologic behavior originating from within the child and in need of treatment. The bias portion of the ABC model refers to the biases different informants carry with respect to what level of behavioral problems actually constitutes disease and require treatment. Finally, the ABC model refers to the importance of the different contexts in which different informants observe the child and behavior. For example, behavior at home in a quiet environment may be very different than behavior at school in a busy, stimulating classroom. This ABC construct suggests the inevitable nature of discrepancies. Thus, it is important to use different informants in the assessment of child psychopathology, because examining the differences in reports can help obtain a fuller picture of the child's problematic behavior as well as better identify potential triggers or environmental factors that may contribute to the behavior. The importance of different informants, therefore, in identifying psychopathology is well defined.

Informant discrepancies are also found in reports of parenting behaviors, including parental knowledge (De Los Reyes et al. 2010, Reynolds et al. 2011). While previous research has identified significant relationships between adolescent risk-taking and both child reports of parental monitoring and parent reports of parental monitoring, it has also repeatedly been demonstrated that child reports tend to correlate more highly with levels of risk-taking than do parent reports (Cottrell et al. 2003, Kerr et al. 2010, Reynolds et al. 2011, Stattin and Kerr 2000, Yu et al. 2006). In fact, Cottrell et al. (2003) demonstrated that parent reports of parental monitoring significantly related to only

adolescent smoking, whereas adolescent reports of parental monitoring were associated with smoking, alcohol use, marijuana use, and sexual involvement. This demonstartes the presence of discrepancies and points naturally to the question of whether the discrepancies themselves also relate to risk-taking. With respect to parental knowledge specifically, De Los Reyes et al. (2010) and Reynolds et al. (2011) have both demonstrated in longitudinal studies the significant role of parent-child discrepancies in the prediction of adolescent risk behavior. In both studies, higher degrees of discrepancies predicted higher levels of adolescent risk-taking.

One of the challenges in examining the relationship between discrepancies and outcomes is how to best analyze discrepancy scores. Discrepancies have been analyzed along a continuum from low levels of discrepancy between informants indicating agreement to high levels of discrepancy (Sood et al. 2012, Reynolds et al. 2011, Kazdin, French and Unis 1983). They have also been separated into groups based on direction of discrepancy in addition to magnitude of discrepancy. Using latent profile analysis, De Los Reyes et al. (2011a) identified four discrepancy groups including parents who reported much higher levels of child problem behavior than the child, parents who reported somewhat higher levels of child problem behavior than the child, children who reported much higher levels of problem behavior than the parent, and children who reported somewhat higher levels of problem behavior than the parent. In a later study, De Los Reyes et al. (2011b) reduced the number of groups to two: parent's report of a behavior greater than the child's report and child's report of a behavior greater than parent's. The two group concept was also used by Kazdin et al. (1983). Other studies have grouped parent-child dyads based on three groups: parent's report greater than

child's, parent's and child's reports the same, and child's report greater than the parent's (De Los Reyes et al. 2010). All of these constructs demonstrated significant relationships to risk-taking but to varying degrees. The question remains as to what is the best model to use to analyze discrepancy scores in the identification of risk-taking adolescents.

Another important aspect of discrepancies that has not been extensively researched is the actual meaning of a discrepancy score. Understanding the mechanism by which discrepancies in reports of parental knowledge are generated is important when attempting to use discrepancy scores to identify points of intervention to reduce adolescent risk-taking. The literature focused on understanding such mechanisms remains in its preliminary stages, though the ABC model discussed previously presents some theoretical possibilities (De Los Reyes and Kazdin 2005). While the ABC model suggests that attributions, biases, and contexts differ between children and their parents, it is also likely that the relationship between the parent and child also plays a significant role in the generation of discrepancies. For example, families in which there are low levels of conflict have lower degrees of discrepancies with respect to reports of child psychopathology than families in which there are high levels of conflict (Grills and Ollendick 2003). This is likely especially true for parental knowledge, which depends heavily on child disclosure and interactions between the child and parent. Possible contributors to the generation of discrepancies between parent and child reports generally fall under the categories of parent factors, child factors, and environmental factors.

With respect to child factors such as age, gender, race, depression, and stress levels, results have been mixed and often contradictory. As mentioned previously, Achenbach et al. (1987) found that younger children had less discrepant reports with their

parents than did adolescents. Verhulst and Vanderende (1992) also found increasing discrepancies with increasing child age. There are likely numerous overlapping explanations for differences in discrepancies between ages. For example, as children age, they spend more time out of the home and with their peers instead of with parents, thereby disrupting communication between them and their parents. Contrary to this, Grills and Ollendick (2003) found that reports of psychopathologic symptoms by older children and adolescents were more highly correlated with parental reports than were those of younger children, though the statistical significance of this varied depending on the symptoms. The relationship between gender and discrepancies also has some inconsistencies in the literature. Even within one study, findings related to gender and discrepancies were mixed (Grills and Ollendick 2003). In some studies, gender was unrelated to discrepancies (Ines and Sacco 1992, Jensen et al. 1988). In another study, there was less discrepancy in reports of depressive symptoms between girls and their parents than between boys and their parents (Kazdin et al. 1983). Another study found that boys were more in agreement with parents with respect to reports of depressive symptoms than were girls (Angold et al. 1987). These inconsistencies regarding age and gender are likely related to differences in the samples and methodology. For example, Kazdin et al. (1983) focused on children with an average age of 9.8 years who were hospitalized in a psychiatric ward for depression. Angold et al. (1987), however, looked at non-depressed children who were on average 17 years of age.

There is less data on the relationship between a child's race and discrepancies. Kazdin et al. (1983) performed a study in which parents and children currently residing in psychiatric inpatient wards were asked to evaluate the child's depression. While race and

welfare status did not relate to the absolute magnitude of differences between parent and child reports of depression, black parents and those on welfare tended to underestimate their children's depressive symptoms whereas white parents and those not on welfare overestimated their children's symptoms. Black youth also had more discrepant reports of externalizing behavior with their teachers than did other racial groups. In general, reports by informants such as teachers, parents, and independent evaluators also were more discrepant for black children than for white children (Kaufman, Swan and Wood 1980). The role of racial differences in discrepancy scores appears significant but remains poorly defined or understood.

The relationship of child depression and stress levels to discrepancy scores has been more consistent. For example, De Los Reyes et al. (2008) demonstrated that increasing depressive symptoms of both the child and mother correlated with greater discrepancies in reports of parental monitoring. The relationship between higher levels of maternal depression and lower degrees of agreement between mothers and children was also supported by Berg-Nielsen, Vika and Dahl (2003) and Youngstrom, Loeber and Stouthamer-Loeber (2000). The role of an informant's depression may be due to the effects depression has on information recall or it may be due to the effects depression has on the relationship and communication between the informants. Recent stress and family stress in general were also significantly related to discrepancies (Kolko and Kazdin 1993). Perhaps in part related to stress, socioeconomic status has also been linked to discrepancies. As mentioned previously, parents on welfare were more likely to underreport their children's depressive symptoms and those not on welfare were more likely to over report (Kazdin et al. 1983).

Factors related to discrepancies have not yet been studied in depth, and even when studied, results have been inconsistent. They have also focused mainly on discrepancies in reports of psychopathology and not on parenting measures. With a better understanding of the meaning of discrepancies comes the possibility that discrepancies could be used to identify problematic aspects of the parent, child, or family environment as points of intervention. In order to explore these interactions, it is important to first identify factors related to and contributing to discrepancy scores.

*Specific Aims and Hypotheses of the Current Study*

The current study had three main goals. First, it looked to replicate the results of prior studies and demonstrate that adolescent reports of parental knowledge and parent reports of parental knowledge both were independently correlated with adolescent risk-taking behavior.

Second, the study looked to determine whether discrepancies in adolescent and parent reports of parental knowledge (hereafter referred to as discrepancy scores) correlated with adolescent risk-taking. To do so, we compared three different models for interpreting discrepancy scores in order to determine the one most predictive of risk-taking behavior. The first model involved looking at the magnitude of the discrepancy along a continuum. We hypothesized that those subjects with high discrepancies regardless of the directionality would have higher levels of risk-taking than those in which there were minimal discrepancies.

The second model involved separating the discrepancy scores into three groups such that both the magnitude and directionality of the discrepancy scores were taken into

account. The three groups included: a group in which the parent reported higher levels of parental knowledge than the adolescent; a group in which the parent and adolescent reported similar levels of parental knowledge; and a group in which the parent reported less parental knowledge than the adolescent. We reasoned that the directionality of discrepancies would be important as the directionality likely represents different behavioral or parent-child relational factors. In the case of the parent reporting less knowledge than the child, we reasoned that the parent may not be paying sufficient attention to the child or perhaps that the child believes the parent is more attentive than is actually the case. In the case of the parent reporting more knowledge than the child, however, the child could be more secretive and devious in their behaviors, thereby sneaking below the parent's radar. We hypothesized that the dyads with discrepancies could be further subdivided into these two more meaningful groups that would further refine our understanding of the relationship between discrepancies and risk-taking.

The third model for interpreting discrepancy scores involved separating the subjects into four groups. We suspected that the group with minimal or no discrepancies between parent and child reports actually consisted of two discrete groups – those who agreed that there were high levels of parental knowledge and those who agreed that there were low levels of parental knowledge. While the two groups in which significant discrepancies existed remained the same, the group in which there was minimal discrepancy was split into two based on whether agreed upon reports of parental knowledge were high or low. In this way, we took into account the level of parental knowledge in addition to the discrepancy score to see how they predicted risk-taking when combined. We hypothesized that of the three discrepancy models, the four-group

model would be most strongly correlated with risk-taking given that it takes into account the magnitude of the discrepancy score, the directionality of the discrepancy score, and also the actual level of parental knowledge.

The final main goal of our study was to further investigate other factors related to discrepancies in reports between parents and adolescents. In this analysis, we included mainly adolescent factors that the literature has shown or that we believed might affect the quality of the parent-adolescent relationship and the quality of communication between the two individuals. These included age, gender, race/ethnicity, household annual income, anxiety, depression, perceived stress, and impulsivity. We included impulsivity due to the strength of the relationship between impulsivity and risk-taking as well as the possibility that an impulsive child has less predictable behavior. We hypothesized that all of these factors may be related to discrepancies in reports of parental knowledge. Through this study, we hoped to provide information regarding the implications of identifying discrepancies in a clinical setting. While discrepancies in the clinical environment may not be evaluated quantitatively as they are in this study, it may be possible for clinicians to use knowledge surrounding general classifications of discrepancies to identify family or adolescent dynamics suggestive of negative outcomes.

## METHODS

### Participants

The cohort for this study was drawn from a community sample consisting of adolescents ranging from 13-17 years of age. The participants were part of a larger study

examining behavioral measures of risk-taking. They were drawn from New Haven County and were recruited over two years from two main sources: community-wide mailings to families with children of the appropriate ages and eligible adolescents from a previously established cohort who were enrolled at birth by mothers seeking prenatal or postpartum care at Yale New Haven Hospital (Mayes et al. 1996). Participants were excluded if the subject or guardian did not speak English or if the subject had a history of head injury, loss of consciousness, or seizures due to exclusion criteria for a separate but simultaneous study involving electroencephalography (EEG).

Table 1

*Demographics*

| | Value |
|---|---|
| Age (*M, SD*) | 14.9 (0.96) |
| Gender (% Male) | 50.0 |
| Race/Ethnicity (%) | |
| White, non-Hispanic | 49.4 |
| Black, non-Hispanic | 29.8 |
| Hispanic | 8.3 |
| Other (includes Mixed Background) | 12.5 |
| Annual Family Income (%) | |
| <15,000 USD | 12.8 |
| 15,000-14,999 USD | 11.3 |
| 25,000-34,999 USD | 7.5 |
| 35,0000-44,999 USD | 5.3 |
| 45,000-59,999 USD | 12.0 |
| 60,000-74,999 USD | 15.0 |
| >75,000 USD | 36.1 |
| Grade (%) | |
| Elementary School (grades 1-5) | 0.6 |
| Middle School (grades 6-8) | 12.1 |
| High School (grades 9-12) | 87.3 |

Data were collected on 185 eligible adolescents, and 21 subjects were further excluded due to incomplete data collection. Those excluded from the study did not differ significantly from participants included with respect to gender, age, race/ethnicity, risk-taking, parent-report of parenting behaviors, or child-report of parenting behaviors. A total of 164 adolescents were included in our final analyses. These participants were on average 14.9 years of age (SD = 0.96) and were in grades 5-12, with 84.1% in grades 9-11. 50.0% of participants were female. 49.4% self-identified as White, non-Hispanic, 29.8% self-identified as Black, non-Hispanic, 8.3% self-identified as Hispanic, and the remaining 12.5% self-identified as another race/ethnicity or mixed race/ethnicity. The average maternal age was 45.7 (SD = 7.70) and the average paternal age was 47.7 (SD 8.00). Average annual income was in the range of 35,000.00 - 44,999.00 US dollars. Demographics are presented in Table 1.

**Procedures**

The Yale Institutional Review Board approved the research protocol. Participants were recruited as described above. Families that expressed interest were scheduled over the phone for a 3-3.5 hour visit at the Yale Child Study Center at a time convenient for them. At the appointed time, the parent and adolescent were greeted at the entrance to the Yale Child Study Center and were brought to a private room. The parent and adolescent were then briefed on the procedures, the minimal risks involved in completing the study, and the confidentiality of their responses. They were also asked to sign consent and assent forms, respectively. The adolescent was taken to a separate room, and the parent was asked to remain and complete the parental packet of questionnaires. After

leaving the parent, the adolescent was asked to complete his/her packet of adolescent questionnaires and also underwent three computer tasks with EEG monitoring (procedure for a separate study). In interpreting the data, all statistical analyses were performed using SPSS Version 19.0.

**Measures**

Statistics on the scores from the measures in our study are presented in Table 2.

*Demographics*

The parent completed a standard demographics form that included information about the family and child. Questions asked about annual household income; household family structure; parent age, education, and employment; and child age, race/ethnicity, education, and employment.

*Adolescent Risk-Taking*

The adolescent completed a self-report of risk-taking behaviors. This consisted of a modified version of the Youth Risk Behavioral Survey (YRBS), version 2007 (Center for Disease Control and Prevention 2007). It included questions regarding (1) past year engagement in riding a bicycle without a helmet, (2) riding as a passenger in a car without a seatbelt, (3) carrying a weapon to school, (4) engaging in a fight, (5) trying a cigarette, (6) drinking alcohol, (7) trying any illicit drug (including marijuana, cocaine, sniffed substance like glue or paint, heroin, methamphetamines, MDMA, or any injection drug use), and (8) engaging in sexual intercourse without a condom. Answer options were formatted according to a Likert-type scale with responses ranging from

dichotomous (for example: (a) Participated in behavior, (b) Did not participate in behavior) to multiple response options (for example: (a) 0 times, (b) 1 or 2 times, (c) 3 to 9 times, (d) 10 to 19 times, (e) 20 to 39 times, (f) 40 or more times). Using results from the questionnaire, a composite risk-taking score was created in accordance with prior research (MacPherson et al. 2010, Lejuez et al. 2007, Aklin et al. 2005). Reverse-scored items were taken into account such that for all of the questions a higher score indicated more risky behavior. Of the eight assessed risk behaviors, seven had less than 45.0% of subjects reporting engaging in risk behavior. These seven scores were all dichotomized so that each subject was labeled as either having participated in the risk behavior or not. Non-participation in a risky behavior was indicated with a '0' and participation was indicated with a '1'. The remaining behavior was helmet use. Helmet use was treated separately as it had 17.9% of participant reporting that they had not ridden a bicycle in the past year, therefore indicating that they did not have the opportunity to participate in the behavior in a risky or non-risky fashion. These subjects were therefore given a score equal to the average score of all the subjects who had participated in bicycle riding. Helmet use therefore had three scores: '0' for those who rode a bicycle and wore a helmet, '0.45' for those did not ride a bicycle, and '1' for those who rode a bicycle and did not wear a helmet.

An initial principal factor analysis on the eight risk behavior scores indicated that intercourse without condoms, in which only nine subjects reported participating in, actually loaded negatively to the dominant first factor. This was likely related to the rarity of the reported event. It was therefore excluded. The remaining seven risk behavior scores underwent principal factor analysis. This resulted in a dominant first

component that had an eigenvalue of 2.24 and accounted for 32.0% of the total variance. The loadings of the seven risk behaviors on the first component ranged from 0.20 (seatbelt use) to 0.76 (tried cigarette). Reliability analysis revealed a Cronbach's alpha of 0.60, indicating acceptable internal consistency. Summing the modified scores from the seven questions created the final composite sore. Higher values indicated higher levels of reported risk-taking. This score was used to represent adolescent risk-taking in all further analyses as appropriate.

*Reports of Parental Knowledge*

The parent and child each completed separate questionnaires on parenting factors. The parent completed a 20-item questionnaire about parenting practices derived from Stattin and Kerr (2000). The questionnaire had three subscales: (1) Parental Knowledge/Monitoring, (2) Parental Solicitation, and (3) Parental Control. The child completed a 24-item questionnaire containing two subscales: Parental Warmth/Involvement and Parental Strictness/Supervision (Lamborn et al. 1991). In the original paper, these subscales were used to classify families into four groups of parenting styles: authoritarian (high warmth and demanding), authoritative (low warmth and demanding), indulgent (high warmth and permissive), and neglectful (low warmth and permissive).

Given that different questionnaires were used for the child and parent, a new Parental Knowledge (PK) subscale was created for each that consisted of four items that were essentially identical between the two questionnaires. The remaining questions were excluded from this analysis as they did not have parallel structures or assessed

significantly different aspects of parenting behaviors. The four items used on the two questionnaires differed only in minor wording and in answer choices. The parent-reported items included: "Do you know what your child does during his/her free time?", "Do you know who your child has as friends during his/her free time?", "Do you know where your child goes when he/she is out with friends at night?" and "Do you know where your child goes and what he/she does after school?". These parent-report questions were all answered according to a five-point Likert scale ranging from (1) Never to (5) Always. The child-reported items included: "How much do your parents really know what you do with your free time?", "How much do your parents really know who your friends are?", "How much do your parents really know where you go at night?" and "How much do your parents know where you are most afternoons after school?". The child-report questions were all answered according to a three-point Likert scale ranging from (1) Don't know to (3) Know a lot. By summing the four questions for each questionnaire, two total PK scores were created, one from the child's report and one from the parent's report.

The parent-reported PK subscale had good internal consistency with an alpha coefficient of 0.79. Factor analysis revealed a dominant first component with an eigenvalue of 2.47 and accounting for 61.7% of total variance. The child-reported PK subscale also had good internal consistency with an alpha coefficient of 0.66. Factor analysis for this subscale revealed a dominant first component with an eigenvalue of 2.04 and explaining 50.9% of the total variance.

*Barratt Impulsiveness Scale 11 (BIS-11)*

The BIS-11 was a self-report measure completed by the adolescent that assessed impulsive personality traits (Patton, Stanford and Barratt 1995). Impulsivity was measured as a summary score as well as subdivided into three subscales: motor impulsiveness, attentional impulsiveness, and nonplanning impulsiveness. The BIS-11 was a revision of the original BIS and was validated based on trials with college students, psychiatric inpatients, and male prison inmates (Barratt 1959, Patton et al. 1995). There were thirty items describing impulsive or non-impulsive behaviors that are scored on a 4-point Likert scale (including: (1) Rarely/never, (2) Occasionally, (3) Often, and (4) Almost Always/Always). Examples of items include: "I do things without thinking," "I more interested in the present than in the future," and "My thoughts are racing too fast." Higher scores indicated greater impulsivity. In our sample, alpha coefficients for the three subscales, attentional, motor, and nonplanning, were 0.71, 0.49, and 0.60, respectively. The BIS summary score had an alpha coefficient of 0.77. The summary score was used for all calculations in this study as we were interested in the effect of impulsivity as a general character trait and its relationship to parent-child discrepancies.

*Child Symptom Inventory 4 (CSI-4)*

The CSI-4 was a parent-completed measure that evaluated a range of symptoms reflective of diagnoses outlined in the Diagnostic and Statistical Manual IV(Gadow and Sprafkin 1994). In addition to the parent-completed version used in this study, a teacher-completed version also exists. The parent-completed version consisted of 97 items that screen for 13 childhood disorders including attention deficit and hyperactivity disorder (inattentive, hyperactive-impulsive, and combined subtypes), oppositional defiant

disorder, conduct disorder, generalized anxiety disorder, social phobia, separation anxiety disorder, major depressive disorder, dysthymic disorder, schizophrenia, Autistic disorder, and Asperger's disorder as well as several other symptoms including simple phobias, obsessions, compulsion, motor and vocal tics, enuresis, and encopresis. In our analysis, we used the subscales for generalized anxiety disorder, major depressive disorder, and dysthymic disorder. Two scoring procedures existed for the questions: Symptom Severity scores (including: (0) Never, (1) Sometimes, (2) Often, and (3) Very often) and Symptom Count scores (including: (0) Never or Sometimes and (1) Often or Very often). The Symptom Count scores are typically used for diagnostic purposes according to DSM-IV. We used the Symptom Severity scores for our analyses as we hoped to capture a spectrum of symptom severity in our subjects. In all cases, a higher number indicated a higher degree of symptoms. There was very good internal consistency for the three subscales we used. In our sample, the generalized anxiety subscale had an alpha of 0.784, the major depression subscale had an alpha coefficient of 0.801, and the dysthymic subscale had an alpha of 0.745.

*Perceived Stress Scale (PSS)*

The PSS was a 14-item questionnaire completed by the adolescent and designed to assess the degree to which "respondents found their lives unpredictable, uncontrollable, and overloading" (Cohen, Kamarck and Mermelstein 1983). Examples of items include "In the last month how often have you felt that you were unable to control the important things in your life?" and "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?". Items were

scored on a five-point Likert scale (including: (0) Never, (1) Almost never, (2) Sometimes, (3) Fairly often, and (4) Very often). Reverse-scored items were taken into account so that a higher summation score indicated higher levels of perceived stress. The measure was originally validated with samples consisting of college students and adults enrolled in a smoking-cessation program. Internal consistency for our sample was good with an alpha coefficient of 0.74.

Table 2

*Questionnaire Statistics*

| | Mean | Std. Deviation | Minimum | Maximum | Possible Range |
|---|---|---|---|---|---|
| Adolescent Risk-Taking | 2.15 | 1.71 | 0.00 | 7.00 | 0.00-7.00 |
| Parent Report of Parental Knowledge | 17.98 | 2.04 | 9.00 | 20.00 | 4.00-20.00 |
| Child Report of Parental Knowledge | 10.19 | 1.62 | 4.00 | 12.00 | 4.00-12.00 |
| Barrett Impulsiveness Scale-11: Summary Score | 67.71 | 9.50 | 43.00 | 95.00 | 30.00-120.00 |
| Child Symptom Inventory-4: Generalized Anxiety Disorder Subscale | 3.39 | 3.21 | 0.00 | 15.00 | 0.00-24.00 |
| Child Symptom Inventory-4: Major Depressive Disorder Subscale | 4.41 | 3.19 | 2.50 | 19.50 | 0.00-30.00 |
| Child Symptom Inventory-4: Dysthymia Subscale | 4.21 | 2.93 | 2.00 | 16.00 | 0.00-24.00 |
| Perceived Stress Scale: Summary Score | 24.60 | 7.39 | 4.00 | 44.15 | 0.00-56.00 |

## ANALYSIS AND RESULTS

### Initial Data Analysis

*Discrepancy Scores*

Discrepancy scores were generated based on methods outlined in De Los Reyes and Kazdin (2004). Parent-reported Parental Knowledge (PK) scores and adolescent-reported PK scores were first standardized into z-scores. The adolescent's z-score was

then subtracted from the parent's z-score. Our discrepancy scores therefore all had a mean of zero and a standard deviation of one. As expected, the discrepancy score was significantly correlated with both parent- and adolescent-reported PK ($R=0.62$, $p<0.001$ and $R=-0.61$, $p<0.001$, respectively). Parent-reported PK and adolescent-reported PK were significantly correlated with each other ($R=0.24$, $p=0.002$). Discrepancy scores close to or equal to zero indicated low discrepancy between parent and adolescent reports. Negative discrepancy scores indicated greater discrepancy in which the adolescent reported higher levels of PK than the parent. Positive discrepancy scores indicated greater discrepancy as well but with parents reporting higher levels of PK than the adolescent.

*Modeling Discrepancy Scores*

Three separate models were created for interpreting and analyzing discrepancy scores in order to determine the best method for understanding and using discrepancy scores in a clinical setting.

The first model involved taking the magnitude of the discrepancy along a continuous scale. The absolute value of each discrepancy score was taken and used in analyses. Higher values indicated more discrepancy with either the parent or adolescent reporting higher levels of PK. Lower values indicated less discrepancy and more agreement between the adolescent and parent reports of PK.

The second model involved grouping the subjects into three groups based on discrepancy score: negative discrepancy (adolescent-reported PK greater than parent-reported PK), minimal discrepancy (adolescent-reported PK equal to parent-report PK),

and positive discrepancy (adolescent-reported PK less than parent-reported PK). These groups were formed based on K-means cluster analysis. The reliability of the three clusters was assessed by splitting the data into two halves and re-running the cluster analysis. The two resulting cluster centroids were very similar to the original, indicating good stability in the clustering. The three groups were all compared against each other using independent sample t-tests, and they were all significantly different from each other ($p<0.001$ for all comparisons), thus confirming the validity of the clusters. The first group (P<C) consisted of subjects in which adolescent-reported PK was greater than parent-reported PK. This group contained 24 subjects, had a mean discrepancy score of -2.02 with a standard deviation of 0.76. The second group (P=C) consisted of subjects in which parent- and adolescent-reported PK were similar. There were 76 subjects in this group with a mean discrepancy score of -0.39 and a standard deviation of 0.40. The final group (P>C) included subjects in which the parent-reported PK was greater than the adolescent-reported PK. 65 subjects fell within this group with a mean discrepancy score of 1.17 and a standard deviation of 0.64. Table 3 presents an overview of the Three-Group Model.

Table 3

*Overview of Three-Group Model of Discrepancy Scores*

| Discrepancy Group | N | Mean Raw Discrepancy Score | SD of Raw Discrepancy Scores |
|---|---|---|---|
| P<C (parent-reported PK < adolescent-reported PK) | 24 | -2.02 | 0.76 |
| P=C (parent-reported PK = adolescent-reported PK) | 75 | -0.39 | 0.40 |
| P>C (parent-reported PK > adolescent-reported PK) | 65 | 1.17 | 0.64 |

*Note.* PK = Parental Knowledge, SD = Standard Deviation.

The third model for interpreting discrepancy scores involved grouping the subjects into four groups. The rationale behind four groups was that the group including subjects with minimal discrepancy between adolescent and parent reports actually was composed of two distinct groups: those in which the adolescent and parent agreed PK was low and those in which they agreed that PK was high. The subjects of group P=C, therefore, were split into two groups (high PK and low PK) based on adolescent-reported PK and parent-reported PK using K-means cluster analysis. The reliability of the two clusters was assessed by splitting the data into two halves and re-running the cluster analysis. The two resulting cluster centroids were very similar to the original, indicating good stability in the clustering. The two groups were significantly different from each other when compared using an independent sample t-test ($p<0.001$), thus confirming the validity of the clusters. Subjects in P=C with high PK (P=C_High) included 51 subjects that had minimal discrepancy in adolescent- and parent-reported PK and agreed that the level of PK was generally high. Subjects in P=C with low PK (P=C_Low) included 25 subjects that also had minimal discrepancy in adolescent- and parent-reported PK but agreed that the level of PK was generally low. These two groups were not significantly different with respect to discrepancy scores, but were significantly different with respect to both adolescent-reported PK and parent-reported PK ($p<0.001$). The two high discrepancy groups defined in the three-group model (P<C and P>C) remained the same for this four-group model. Table 4 presents an overview of the Four-Group Model.

Table 4

*Overview of Four-Group Model of Discrepancy Scores Groupings*

| Discrepancy Group | N | Mean Raw Discrepancy Score | SD of Raw Discrepancy Scores |
|---|---|---|---|
| P<C (parent-reported PK < adolescent-reported PK) | 24 | -2.02 | 0.76 |
| P=C_High (parent-reported PK = adolescent-reported PK; both high PK) | 50 | -0.40 | 0.38 |
| P=C_Low (parent-reported PK = adolescent-reported PK; both low PK) | 25 | -0.37 | 0.44 |
| P>C (parent-reported PK > adolescent-reported PK) | 65 | 1.17 | 0.64 |

*Note.* PK = Parental Knowledge, SD = Standard Deviation.

*Covariates*

Potential covariates in this study included the subject's gender, subject's age, subject's race/ethnicity, and annual household income. A simple independent samples t-test was used to compare levels of risk-taking between males and females. Male subjects were found to have significantly higher levels of risk-taking than females (for males, N=82, mean 2.52, and SD 1.78; for females, N=82, mean 1.80 and SD 1.57; t(162)= -2.76). Gender was therefore included as a covariate and controlled for in subsequent analyses.

A Pearson correlation showed no significant correlation between age and adolescent risk-taking (R = 0.13, p = 0.09). Two analyses of variance (ANOVAs) were conducted to assess the relationship between income and risk-taking and race/ethnicity and risk-taking. No significant differences were found in risk-taking between income groups or between race/ethnicity groups (p=0.90 and p=0.69, respectively). Age, income, and race/ethnicity were therefore not included in subsequent analyses.

**Final Analysis and Results**

*Adolescent Report of Parental Knowledge Predicting Adolescent Risk-Taking Behavior*

A linear regression was performed to examine the relationship between adolescent-reported PK and risk-taking. The adolescent risk-taking composite score derived from the YRBS was entered as the dependent variable into the regression model. Gender was entered in the first block and adolescent-reported PK was entered in the second. Controlling for the effects of gender on risk-taking, adolescent-reported PK and risk-taking were significantly negatively correlated (N=164, R= -0.35, $p<0.001$), indicating that increasing levels of adolescent-reported PK corresponded with decreasing levels of risk-taking (Figure 1; Table 5).

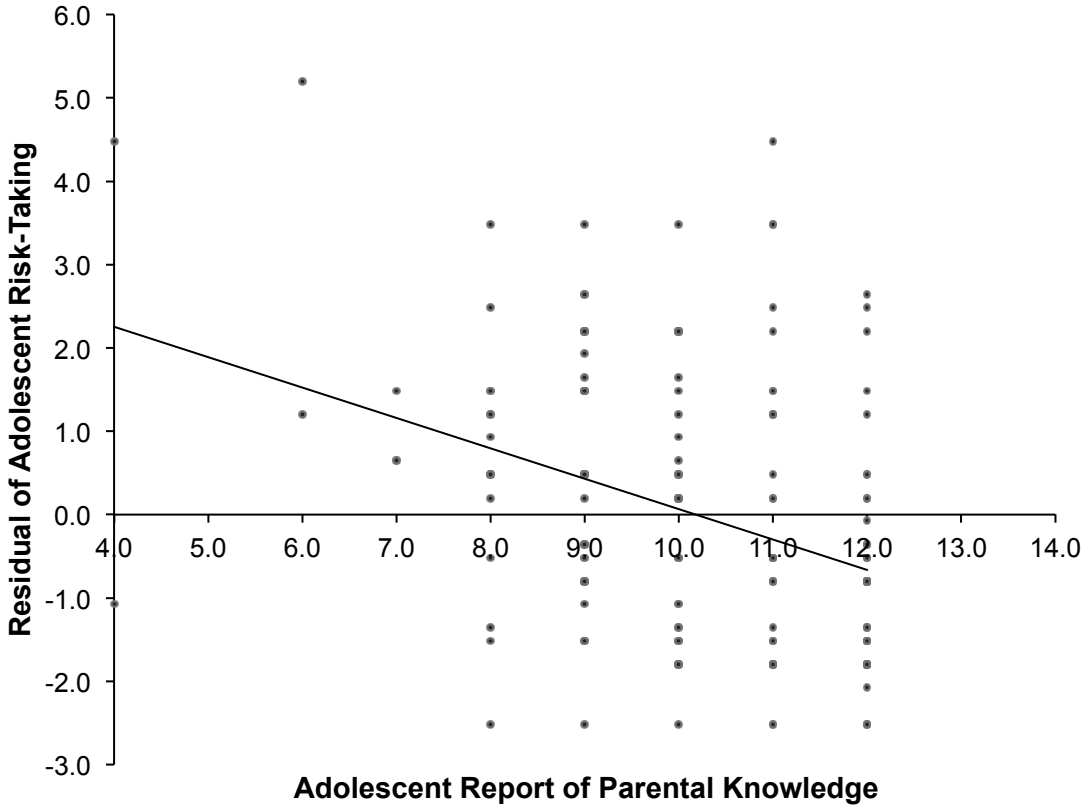


*Figure 1.* Relationship Between Adolescent Report of Parental Knowledge and Risk-Taking. With the effects of gender controlled for in a linear regression, the adolescent-reported parental knowledge score and adolescent risk-taking are significantly negatively related.

*Parent Report of Parental Knowledge Predicting Adolescent Risk-Taking Behavior*

Linear regression was used to examine the relationship between parent-reported PK and adolescent risk-taking while excluding the effects of gender on risk-taking. The model was constructed as described above except for parent-reported PK in place of adolescent-reported PK as an independent variable. A significant negative relationship was revealed with increasing levels of parent-reported PK correlating with decreasing levels of adolescent risk-taking (N=164, R= - 0.33, $p<0.001$; Figure 2; Table 5).

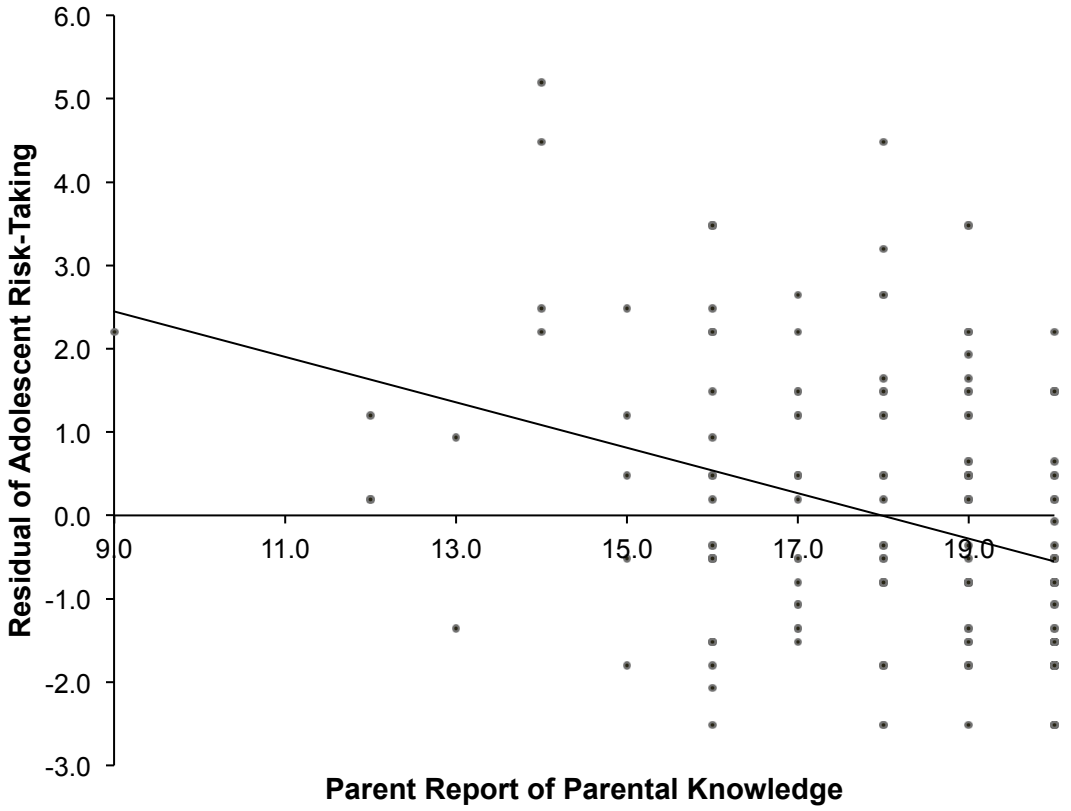


*Figure 2.* Relationship Between Parent Report of Parental Knowledge and Risk-Taking. With the effects of gender controlled for in a linear regression, the parent-reported parental knowledge score and adolescent risk-taking are significantly negatively related.

*Absolute Magnitude of Discrepancies between Adolescent and Parent Reports of Parental Knowledge Predicting Adolescent Risk-Taking Behavior*

To study the effects of the absolute value of the discrepancy score on adolescent risk-taking, a linear regression was performed. Gender was entered in the first block, the absolute magnitude of discrepancy scores in PK was entered in the second block, and adolescent risk-taking was entered as the dependent variable. The results of the regression demonstrated that independent of the effects of gender on risk-taking, the absolute value of discrepancy between adolescent- and parent-reported PK was significantly positively related to adolescent risk-taking (N=164, R= 0.22, p=0.004; Table 5; Figure 3). The more discrepant the reports of PK were, the higher the degree of reported adolescent risk-taking.

Table 5

*Regression of continuous discrepancy models and levels of adolescent risk-taking*

| Primary Variable | β | SE | $R^2$ | $R^2\Delta$ | P |
|---|---|---|---|---|---|
| Adolescent Report Only | | | | | |
| Gender | 0.23 | 0.26 | 0.05 | _ | 0.01 |
| Adolescent-reported PK | -0.351 | 0.123 | 0.174 | 0.121 | <0.001 |
| Parent Report Only | | | | | |
| Gender | 0.21 | 0.26 | 0.44 | _ | 0.004 |
| Parent-reported PK | -0.33 | 0.12 | 0.15 | 0.11 | <0.001 |
| Absolute Magnitude of Discrepancy | | | | | |
| Gender | 0.23 | 0.26 | 0.05 | _ | 0.002 |
| Absolute Value of Discrepancy Score | 0.22 | 0.16 | 0.09 | 0.05 | 0.004 |

*Note.* PK= Parental Knowledge. N=164 for all of the above.

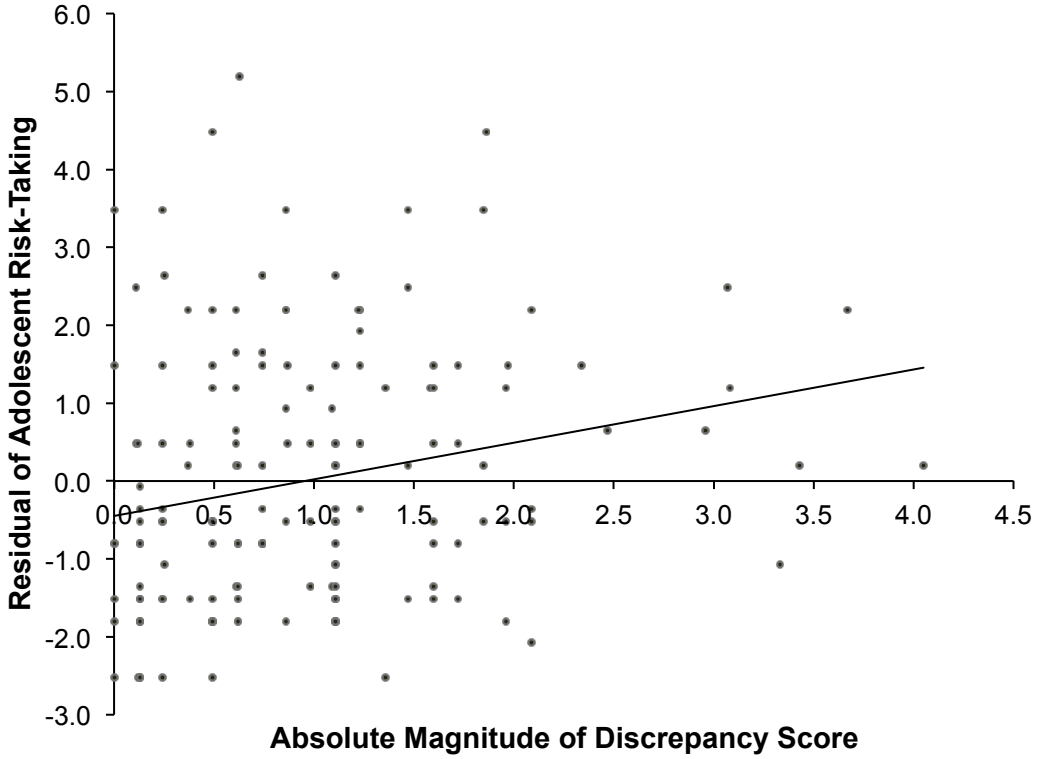


*Figure 3.* Relationship Between Absolute Magnitude of Discrepancy Score and Risk-Taking. With the effects of gender controlled for in a linear regression, the absolute magnitude of the discrepancy score and adolescent risk-taking are significantly positively related.

*Three-Group Model of Discrepancies between Adolescent and Parent Reports of Parental Knowledge Predicting Adolescent Risk-Taking Behavior*

A one-way analysis of covariance (ANCOVA) was performed to evaluate the differences in adolescent risk-taking behavior among and between the three discrepancy groups. The independent variable was the discrepancy group membership within the three-group model: the negative discrepancy score group (P<C; adolescents reporting higher levels of PK than parents), the equivalent discrepancy score group (P=C; adolescents and parents reporting the same or very similar levels of PK), and the positive discrepancy score group (P>C; adolescents reporting lower levels of PK than parents).

Adolescent risk-taking behavior was the dependent variable and gender was included as a covariate. In preliminary analyses, it was confirmed that the groups did not violate the assumption of homogeneity of regression (p=0.73), indicating that the interaction between gender and group membership was not significant in the prediction of risk-taking. The underlying assumption of homogeneity of variance was also not violated according to Levene's test (p=0.98). Given these initial findings, the use of ANCOVA was justified.

The ANCOVA was significant (N=164, $F(2,160) = 3.56$, $\eta^2 = 0.04$, p=0.03; Table 6), indicating differences in reported risk-taking among groups. Estimated marginal means (SE) for the groups were as follows: P<C was 2.59 (0.33), P=C was 1.80 (0.19), and P>C was 2.43 (0.20). Higher numbers indicated higher levels of risk-taking (Figure 4). Post-hoc analysis was performed using Bonferroni adjustments to reduce Type 1 error. No significant differences were found in adolescent risk-taking using pairwise comparisons between the three groups. Inspecting the estimated marginal means, however, the average amount of risk-taking behavior in group P=C, in which adolescent- and parent-reported levels of PK are similar, appears lower than the other two groups. Independent samples t-tests revealed that while the P<C and P>C were not significantly different with respect to risk-taking ($t(87)=0.35$, p=0.73), a comparison of P<C and P=C approached statistical significance ($t(98)=1.91$, p=0.06) and a comparison of P>C and P=C was significant ($t(139)=-2.18$, p=0.03). Finally, consistent with the findings in the absolute magnitude model above, comparison of adolescent risk-taking in P=C with the combination of the two discrepancy groups (P<C and P>C) revealed significantly higher

risk-taking when discrepancies are present than when discrepancies are minimal ($t(162)=2.52$, $p=0.01$).

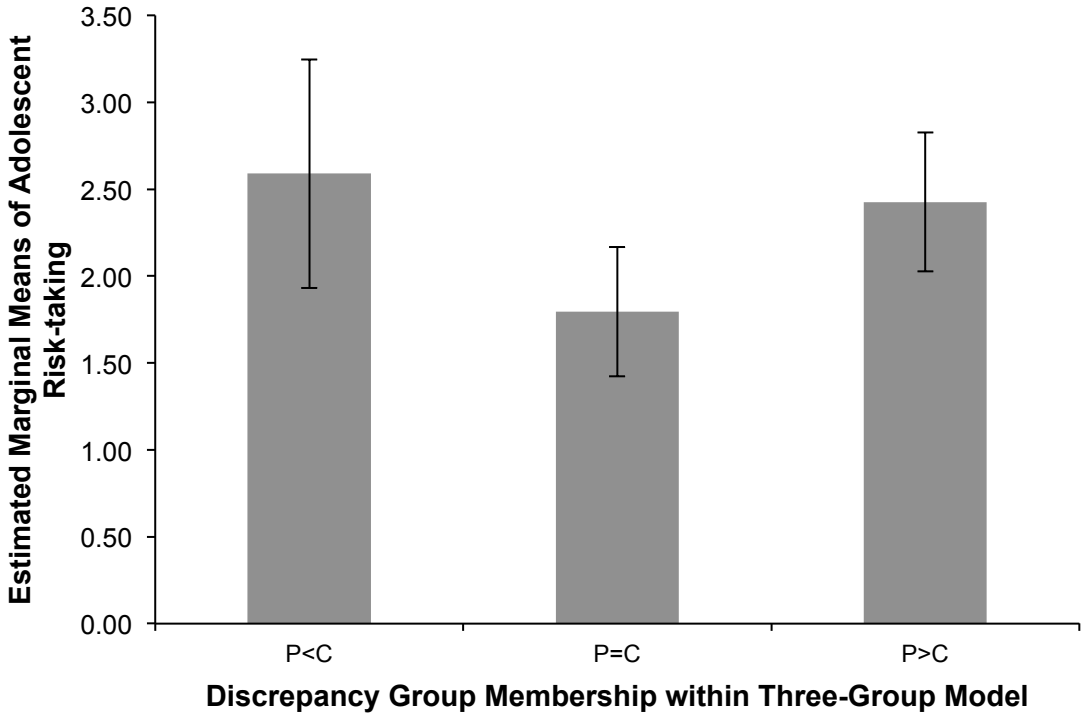


*Figure 4.* Relationship Between Discrepancy Group Membership within the Three-Group Model and Adolescent Risk-Taking. Estimated marginal means of adolescent risk-taking for each of the three discrepancy groups were generated using ANCOVA after the effects of gender were controlled for. Error bars reflect 95% confidence intervals.

*Four-Group Model of Discrepancies*

As was done for the three-group discrepancy model, a one-way ANCOVA was performed for the four-group discrepancy model. In creating the 4-group model we retained the P<C group and the P>C group. The equivalent discrepancy score group (P=C) was further split into two groups: the equivalent discrepancy score group with low PK (P=C_Low; both parent and adolescent report low levels of PK) and the equivalent

discrepancy score group with high PK (P=C_High; both parent and adolescent report high levels of PK). Group membership was the independent variable, risk-taking was entered in as the dependent variable, and gender was included as a covariate. As before, preliminary analysis confirmed that the data did not violate the assumption of homogeneity of regression (p=0.81) and did not violate the assumption of homogeneity of variance as established by Levene's Test (p=0.31).

ANCOVA was significant (N=164, $F(3,160) = 5.46$, $\eta^2 = 0.09$, p=0.001; Table 6), again indicating that there were differences among the groups with respect to risk-taking after controlling for gender. Estimated marginal means (SE) for the groups were: 2.59 (0.33) for P<C; 2.58 (0.32) for P=C_Low; 1.40 (0.23) for P=C_High; and 2.43 (0.20) for P>C, again with higher numbers indicating higher levels of adolescent risk-taking (Figure 5). Post-hoc pairwise comparisons with Bonferroni adjustments revealed that P=C_High had a significantly lower level of adolescent risk-taking than all of the other groups (P=C_High compared with: P<C $t(73)=-3.11$; P=C_Low $t(74)=-3.45$, p=0.001); P>C $t(114)=-3.55$, p=0.001). The other groups were not significantly different from each other.

Table 6

*Analysis of covariance contrasting discrepancy group models on levels of adolescent risk-taking*

| Model | df | F | $\eta^2$ | p |
|---|---|---|---|---|
| Three-Group Model for Discrepancy Scores | | | | |
| Gender (covariate) | 1 | 9.90 | 0.06 | 0.002 |
| Group | 2 | 3.56 | 0.04 | 0.03 |
| Four-Group Model for Discrepancy Scores | | | | |
| Gender (covariate) | 1 | 7.44 | 0.05 | 0.007 |
| Group | 3 | 5.46 | 0.09 | 0.001 |

*Note.* N=164 for all of the above.

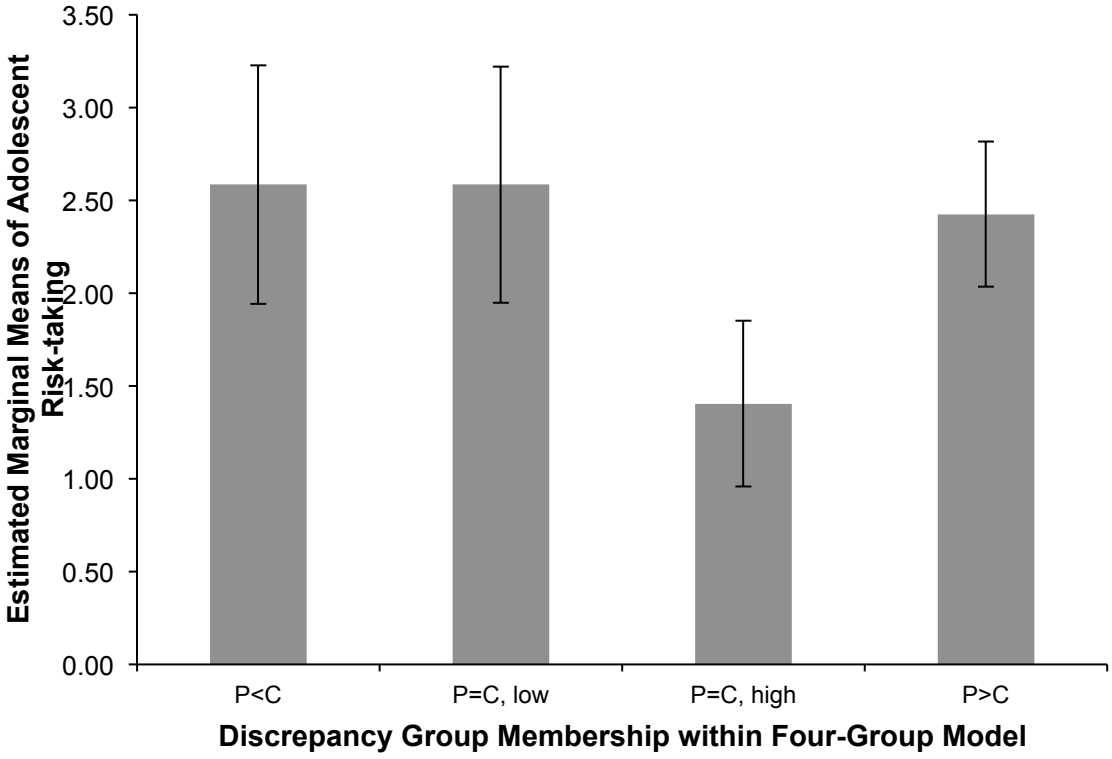


*Figure 5.* Relationship Between Discrepancy Group Membership within the Four-Group Model and Adolescent Risk-Taking. Estimated marginal means of adolescent risk-taking for each of the four discrepancy groups were generated using ANCOVA after the effects of gender were controlled for. Error bars reflect 95% confidence intervals.

*Other Factors Related to Discrepancy Groups*

In an attempt to better characterize the four discrepancy groups, exploratory analyses were conducted to compare the groups on factors known or suspected to be related to the presence of discrepancies. These factors included annual household income as well as adolescent age, gender, race/ethnicity, anxiety, depression, impulsivity, and perceived stress. Annual household income, race/ethnicity, and adolescent impulsivity were found to be significantly related to discrepancy groups as modeled in the four-group model (Figure 6).

An ANOVA was performed to assess differences in income among and between the four discrepancy groups. The ANOVA was significant (N=164, $F(3,160) = 5.84$, $\eta^2 = 0.12$, $p=0.001$) and post-hoc Bonferroni revealed that the average income of P<C was significantly lower than the average income of P=C_Low ($p=0.001$) and than the average income of P>C ($p=0.046$). Given that income was on an ordinal scale, limited conclusions can be made regarding magnitudes of the relationships between income and discrepancy scores. A second ANOVA was used to assess differences in age among and between the four groups. No significant differences were found ($p= 0.86$). Cross-tabulation and chi-squared analysis was performed to assess difference in gender between the four groups and did not reveal any significant differences ($p=0.25$). Males and females were statistically equally represented in all four groups. Cross-tabulation and chi-squared analysis was again performed to assess for differences in race/ethnicity (White, non-Hispanic; Black, non-Hispanic; and Other) between the four groups and did reveal a significant difference ($p=0.001$). In the overall sample, 49.1% were White, non-Hispanic; 29.7% were Black, non-Hispanic; and 21.2% fell in the Other category. In the P<C group: 33.3% were White, 62.5% were Black, and 4.2% were Other. In the P=C_Low group: 40.0% were White, 40.0% were Black, and 20% were Other. In the P=C_High group: 56.9% were White, 13.7% were Black, and 29.4% were Other. Finally, in the P>C group: 52.3% were White, 26.2% were Black, and 21.5% were Other.

ANOVAs were performed to assess for differences among the four discrepancy groups in adolescent anxiety and adolescent depression as assessed by the parent via the generalized anxiety, major depressive, and dysthymia subscales of the Child Symptom Inventory-4 (CSI-4); in adolescent impulsivity as reported by the adolescent on the

Barratt Impulsivity Scale-11 (BIS-11); and in adolescent perceived stress level as measured by the adolescent-completed Perceived Stress Scale (PSS). No significant differences were found for adolescent generalized anxiety, major depression, or dysthymia ($p=0.84$, $p=0.89$, and $p=0.85$, respectively). The ANOVA assessing differences in impulsivity, however, was significant ($N=164$, $F(3,160)=3.90$, $\eta^2=0.07$, $p=0.01$). Post-hoc analysis with Bonferroni adjustments and with independent samples t-tests revealed that adolescent's within the discrepancy group P=C_High had significantly lower levels of impulsivity than those adolescents in P>C ($t(103)=-2.79$, $p=0.006$). Perceived stress by the adolescent was also found to be significantly different in an ANOVA comparing the four discrepancy groups ($N=164$, $F(3, 160)=7.31$, $\eta^2=0.12$, $p<0.001$). Post-hoc analysis with Bonferroni adjustments revealed many significant differences between groups in pairwise comparisons. P<C and P=C_High both had significantly lower mean levels of perceived stress than P=C_Low and P>C (P<C vs. P=C_Low $t(47)=-3.81$, $p=0.003$; P<C vs. P>C $t(87)=-2.71$, $p=0.008$; P=C_High vs. P=C_Low $t(74)=3.70$, $p<0.001$; P=C_High vs. P>C $t(114)=-3.57$, $p=0.001$). P<C and P=C_High were not significantly different from each other, and P=C_Low and P>C were also not significantly different from each other.

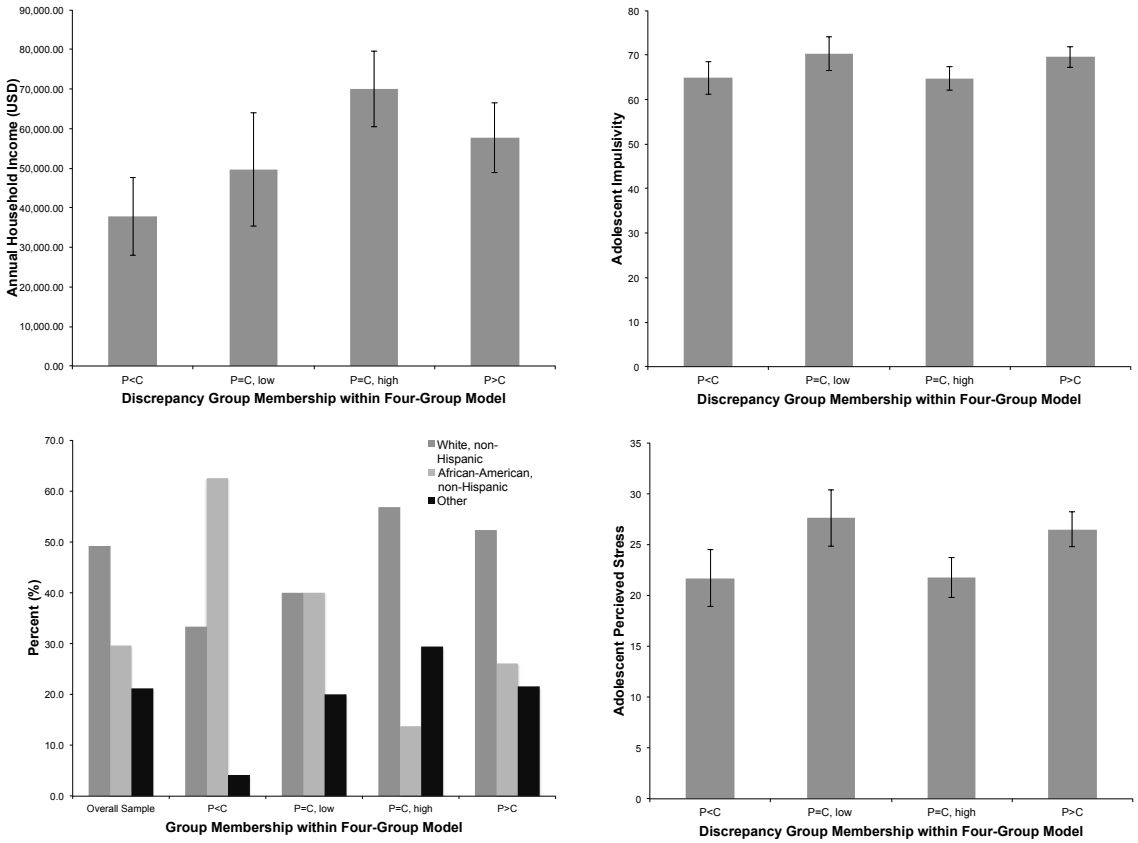


*Figure 6.* Exploratory Analysis of the Relationship Between Discrepancy Group Membership within the Four-Group Model and Annual Household Income, Race/ethnicity, Adolescent Impulsivity, and Adolescent Perceived Stress. Error bars reflect 95% confidence intervals where included.

## DISCUSSION

The main focus of this study was to further explore and define the relationship of discrepancy in parent and adolescent reports of parental knowledge to adolescent risk-taking behavior. We confirmed the results of prior studies by showing that discrepancies in reports of parental knowledge were indeed significantly related to adolescent risk-taking. Our study, however, further defined this relationship by creating and contrasting three models to use in relating discrepancies between informants to risk-taking. To do so,

we examined differences between informant reports of parental knowledge (also known as the discrepancy scores) by taking their absolute value to create a continuous discrepancy score, by splitting the discrepancy scores into three groups based on magnitude and directionality of the score, and by splitting it into four groups based on magnitude and directionality of the discrepancy score as well as level of parental knowledge. We also examined factors related to the discrepancy scores in the hopes of better understanding what the discrepancy score truly represents. The results of these analyses provided information suggestive of a better method by which to use discrepancy scores to predict risk-taking as well as information regarding the nature of discrepancy scores and their potential role in interventions aimed at the reduction of adolescent risk-taking.

Independent of each other, adolescent- and parent-reported parental knowledge were each significantly correlated with adolescent risk-taking with a moderately strong correlation. This is consistent with our hypothesis as well as with the literature, though reasons for the relationship between parental knowledge and risk-taking remain poorly defined (Racz and McMahon 2011). In our results, adolescent-reported parental knowledge was more highly correlated with risk-taking than parent-reported parental knowledge, which is also consistent with prior studies (Stattin and Kerr 2000, Reynolds et al. 2011). 12.1% of the variation in risk-taking was accounted for by adolescent reports of parental knowledge after controlling for the effects of gender. Results of several studies have indicated that parental knowledge is largely a function of adolescent disclosure of information and suggest that the adolescent appears to be the main driver of parental knowledge, as opposed to parent-driven behaviors such as solicitation of

information from the child or setting in place measures to control the child (Racz and McMahon 2011, Stattin and Kerr 2000). The relationship between parental knowledge and risk-taking is therefore likely dependent mainly on the adolescent and how much the adolescent engages his parents. This supports the higher degree of correlation between adolescent-reported parental knowledge and risk-taking, though the parental and home environment certainly may influence how willing the adolescent is to disclose information.

In addition to the information provided by parent and child reports, the discrepancy between the two reports has emerged in the literature as containing unique information in and of itself (De Los Reyes and Kazdin 2005, Kerr et al. 2010, Weissman et al. 1987). While parent and child reports of parental knowledge were significantly correlated with each other in our study, the correlation was weak at best. Discrepancies existed in our sample and given prior literature supporting the significant relationship between discrepancies and risk-taking, we pursued our investigation of discrepancy scores.

In the first discrepancy model, the absolute magnitude of the discrepancies between adolescent and parent reports of parental knowledge did demonstrate a significant but weak correlation with adolescent risk-taking behavior. Increasing levels of discrepancy were related to increasing levels of risky behavior in the adolescents. This supports the significance of discrepancies beyond simply measurement error and is also consistent with our hypothesis that discrepancy scores are related to risk-taking behavior.

In an effort to reveal a better way of interpreting discrepancy scores, we next separated the discrepancy scores into three groups by dividing the subjects with high

discrepancy scores into those in which the child reported higher levels of parental knowledge and those in which the parent reported higher levels. While univariate analysis of variance did indicate significant differences in risk-taking between the three groups, the two groups on either end of the spectrum in which notable discrepancies existed did *not* differ significantly in post-hoc tests with respect to risk-taking. They both had levels of adolescent risk-taking that were much higher than that in the minimal discrepancy group. This does not discredit the possibility of discrepancy in the two groups relating to risk-taking via two different mechanisms, but it does suggest that the discrepancy is related to risk-taking regardless of whether the parent or child reports higher levels of parental knowledge. In other words, the absolute value and three-group models both indicate that it is the impact of a difference between parents' assessment or understanding of their child and their child's understanding that is associated with the adolescent's risk-taking behavior regardless of the direction of that discrepancy.

In the third discrepancy model, we further divided the subjects into four groups by also including the level of parental knowledge to the minimal discrepancy group. The minimal discrepancy group was split into two: one with agreement on high levels of parental knowledge and one with agreement on low levels of parental knowledge. The univariate analysis of covariance was significant. It is interesting to note, however, that post-hoc analyses identified only one uniquely different group with respect to risk-taking. The minimal discrepancy group with agreement on high levels of parental knowledge had significantly lower levels of adolescent risk-taking than all of the other groups. The other groups, on the other hand, were not significantly different from each other and all had similar higher levels of risk-taking. This suggests that discrepancies cannot be

interpreted as simply present or absent. Rather, the absence of discrepancy *with* agreement about high levels of parental knowledge is related to lower risk-taking. The effects of parents' increased knowledge about their child had a positive effect on adolescent behavior beyond that of simple agreement with their adolescent. This also suggests that there is something protective not only about agreement between a parent and child but also about the nature of the agreement, as in agreeing on high levels of parental knowledge.

This four-group model also demonstrated the strongest relationship between discrepancy scores and risk-taking out of all three discrepancy models examined. Taken together with the fact that the three-group model was stronger than the absolute magnitude model, it appears that discrepancy scores are most valuable and significant when understood in the context of their magnitude, their directionality, and the level of reported parental knowledge. However, even in the four-group model, the strength of their relationship to adolescent risk-taking was weaker than that of either parent or adolescent reports of parental knowledge.

The importance of discrepancies may lie more in what they represent clinically as opposed to in directly identifying at-risk adolescents. It is likely that discrepancies between child and parent reports correspond to some contentious or dysfunctional aspect of the relationship between the two individuals. Factors relating to discrepancies could be grouped according to parent factors, such as lack of involvement, depression, or lack of free time; child factors, such as impulsivity, depression, or stress; and external factors, such as low resource availability. We chose several factors as likely candidates for

contributing to discrepancies and compared these factors between the groups of the four-group model.

Annual household income, which can be understood to represent at its most basic level resource availability, was significantly related to the four discrepancy groups. Income in the minimal discrepancy group with high scores was significantly higher than in the other three groups. Income is a factor with multiple potential reasons for affecting parent-child relations. The "good parent theories" suggest that higher incomes allow parents to invest more time, resources, and stress-free attention into their relationships with their children (Mayer 2002). It follows, then, that higher income may help improve parent-child communication and so lower discrepancies and raise levels of parental knowledge. In other words, the relationship of financial resources and discrepancies may be mediated by diminishing family stress.

With respect to adolescent factors, we looked at demographics, anxiety, depression, dysthymia, impulsivity, and perceived stress. Age and gender were not significantly different between the four discrepancy groups. Age was likely not significant mainly due to the fact that there was a very small range with low variation in age in our sample. The lack of gender effects was interesting and suggests that the interpretation and use of discrepancies can be generalizable to both genders. Race/ethnicity, however, did differ significantly between the four groups. As demonstrated in Figure 6, the racial/ethnic composition of the four groups varied widely. Looking specifically at group P=C_High, the group associated with lowest rates of risk-taking, we can see that subjects identifying as Black, non-Hispanic appear underrepresented. This could be related to differences in parenting practices or family

relationships between racial/ethnic groups or it could be confounded by another factor such as income. There are a variety of possibilities for this finding.

Contrary to a study by De Los Reyes et al. (2008), child depression, as assessed via scores on a major depression scale and dysthymia scale, was not significantly related to discrepancy scores. Anxiety was also not significantly related. The subjects in our study had relatively low levels of depression and anxiety, which could have reduced the power to identify differences between groups. Future studies with higher rates of affective symptoms and disorders may reveal more meaningful results.

Univariate analysis of variance revealed significant differences in levels of adolescent impulsivity between groups in the four-group discrepancy model. Specifically, adolescents in the minimal discrepancy with high parental knowledge group had lower impulsive behavior than those in the high discrepancy group where parents report more knowledge than the children. Given that the relationship between impulsivity and risk-taking has been firmly established in the literature, it is possible that the relationship between discrepancy and risk-taking is somehow mediated or moderated by impulsivity (Butler and Montgomery 2004, Petry 2001, Stanford et al. 1996). The connection between the three items (discrepancies, impulsivity, and risk-taking) is supported by the finding that the minimal discrepancy with high parental knowledge group is distinct from the other three groups both in its low level of adolescent risk-taking and in its low level of adolescent impulsivity. Less impulsive children likely have a better sense of where, when, and with whom they will be in the future and so could be able to better communicate such information more effectively to their parents leading to high levels of parental knowledge with little discrepancy. On the other hand, impulsivity

could indicate a less predictable child, which could impair a parent's ability to keep up with their whereabouts, friends, and activities as well as impair a child's ability to inform their parents accurately about their future activities. This could result in high discrepancies with the parent believing they know more than they do.

Univariate analysis of the relationship between the four-group model of discrepancy scores and adolescent-reported perceived stress was also significant. Adolescents in which the parent reported lower levels of parental knowledge than the child and in which the parent and child both reported high levels of parent knowledge perceived significantly lower levels of stress than those subjects in the other two groups. As noted in the original paper, the perceived stress scale can both reveal an individual's experience of stress as well as, in young people, the number of recent stressful life events (Cohen et al. 1983). Higher levels of perceived stress, therefore, may indicate a more stress-intolerant child or a greater number of stressful events. Whether perceived stress is directly related to discrepancies or whether some third factor leads to both is unclear. In the former case, a high level of perceived stress may indicate a more stress-prone child, which could both impair child-parent relations as well as make the child more susceptible to risk-taking as an escape mechanism. In the latter case, a stressful home environment may lead to higher levels of perceived stress by the adolescent in addition to contributing to poor parent-child relationships and discrepancies. Again, however, we see the pattern of the low discrepancy with high parental knowledge group having low levels of perceived stress, low levels of impulsivity, and low levels of risk-taking. The connections between these factors are likely significant but require further elucidation.

**Limitations**

The limitations of this study should be kept in mind when drawing conclusion from the results. Our study had adequate generalizability as it was drawn from an age group known to have higher rates of risk-taking with equal numbers of males and females and generally good racial diversity. However, Hispanics were somewhat underrepresented and blacks somewhat overrepresented in our sample compared to the broader New Haven County population (U. S. Census Bureau December 6, 2012). The subjects were also not derived from a random sample due to recruitment constraints. In addition, our subjects on average reported taking fewer risks than the national average according to the Center for Disease Control and Prevention (2011). As our subjects were not differentiated based on urban or suburban upbringing, this could be due to a larger portion of them being from in suburban environments. It could also be related to the subjects not reporting risk behaviors due to concerns about confidentiality. Regardless, the low rates of risk taking could decrease the statistical power of our study. Overall, however, we believe our sample size and subject characteristics to be sufficiently representative of adolescents at this age.

With respect to the methods, our study was limited by the self-report nature of all of the measures. For example, the risk-taking composite score was solely derived from a self-report measure and so is subject to the potential for underreporting or over reporting depending, for example, on concerns about confidentiality or on the ability to self-reflect. Despite the self-report nature of our measures, they all had adequate to excellent internal consistency. The composite parental knowledge measures, while derived from well-established measures, were unique to this study and had limited validation history in the

literature. However, the questions used for the parental knowledge scores were nearly identical between the child and parent questionnaires and both had good internal consistency. Using identical parental knowledge measures as well as measures assessing other aspects of parental knowledge or involvement may further refine the construct relating discrepancies in monitoring with adolescent risk-taking. Finally, in our data analysis we were statistically limited in our ability to evaluate the effects of discrepancy in parental knowledge after controlling for parent- and adolescent-reported parental knowledge. This was due to the discrepancy scores themselves being derived completely from the individual reports of parental knowledge. Regression models are currently being explored in the literature as an alternate way to interpret discrepancy scores that would allow for the determination of whether discrepancy scores provide information relating to risk-taking that is distinct from individual reports (Laird and De Los Reyes 2012).

**Implications and Future Directions**

From the results in this study, discrepancy scores emerge as having several potential applications to clinical practice. The first involves the use of discrepancy scores in identifying high and low risk-taking adolescents. Our results confirm those of prior studies by demonstrating the significant relationship between discrepancies in parent and adolescent reports of parental knowledge and adolescent risk-taking. Our data suggest that of the three methods used to interpret discrepancy scores, the four-group model is the best with respect to predicting risk-taking. Individual parent or adolescent reports of parental knowledge, however, still appear to be the most strongly related to risk-taking and so may be considered to have the best clinical utility in identifying at-risk

adolescents. Our study focused on the negative aspects of risk-taking in adolescents and did not take into account the developmentally beneficial aspects of some degree of exploratory risk-taking. It is likely that levels of parental knowledge and discrepancy scores may also relate to positive health-related behaviors, another future direction for research.

The second potential application of the results in this study is to identify and further analyze the significance and meaning of discrepancies in adolescent and parent reports of parental knowledge. Through the comparison of three models of interpreting discrepancy scores, we found that out of the three models the four-group model had the best correlation with adolescent risk-taking. Discrepancy scores, therefore, are best understood not just by looking at the magnitude and directionality but also by taking into account the degree of parent and child reports of parental knowledge. Specifically, using the four-group model for discrepancy scores allowed us to identify a distinct low-risk group characterized by low levels of discrepancy with agreement on high levels of parental knowledge.

This study also aimed at identifying factors underlying discrepancies in the parent-child dyad that could be targeted by interventions to reduce risk-taking in adolescents. While it is clear that an adolescent's impulsivity and perceived stress relate to discrepancies, it would be beneficial to determine the directionality of this relationship. Do impulsivity and stress result in discrepancies as we suspect or do discrepancies result in more impulsive and stressed adolescents? A longitudinal study would aid in determining the directionality as well as better understand the relationship between risk-taking, discrepancies, and factors such as impulsivity and perceived stress. Future studies

should also further hone in on the role of the parent-child relationship, especially with respect to trust and communication, in discrepancies in parental knowledge. Family connectedness and caring have both been found to serve as protective factors against adolescent risk-taking (Resnick et al. 1993). While our study did not include measures of parent-child relationships, it appears likely that discrepancies may reflect some aspect of the quality of the relationship. Including measures that assess the quality of the parent-child relationship, the amount of time the adolescent spends away from home, or communication skills between the parent and adolescent could further refine our understanding of the significance and implications of discrepancies. It may be possible to reduce risk-taking through interventions that reduce discrepancies between parent and child. The nature of these interventions, however, depends on further defining what discrepancy scores actually represent with respect to the parent, child, and/or relationship between the two. We have identified several factors that may be worthwhile to pursue, including adolescent impulsivity and perceived stress.

Our study has also added support to the importance of discrepancies in the clinical environment. First, it confirms the value of gathering data from multiple different informants during clinical assessments. Second, it encourages clinicians to be aware of discrepancies between informants as the presence of discrepancies may have health and safety implications. While quantitative evaluation of discrepancies may not occur in the clinical setting, it may still be possible to assess the quality of a parent-child relationship with respect to concordance or lack of concordance between them and degree of parental knowledge. In other words, the basic concept of the four discrepancy groups can still be assessed clinically. The presence of agreement with high parental knowledge could be

understood clinically as a protective factor, just as the absence of agreement or the presence of low levels of parental knowledge can be seen as potential risk factors. Through the investigation of discrepancies in parent and child reports and their relationship to risk-taking, we may be able to better identify at-risk adolescents and intervene to keep them safe. While our study focused on adolescents and parents, there may be parallels for other dyads, such as the caregiver and geriatric patient. Additional studies will be required to concretely establish the clinical utility of discrepancy scores, but our results help further direct the analysis and interpretation of discrepancy scores.

**Conclusions**

In this paper, we aimed to further define the relationship of discrepancies in parent- and adolescent-reports of parental knowledge to adolescent risk-taking. We found that separating subjects into four groups based on a model taking into account the magnitude and directionality of the discrepancy as well as the level of parental knowledge when agreed upon was the most highly related to adolescent risk-taking. Specifically, adolescents in which there were minimal levels of discrepancy and high levels of parental knowledge had the lowest rates of risk-taking. The four-group model also aided in further defining the significance of discrepancy scores by identifying factors related to them, most significantly income, adolescent impulsivity and adolescent perceived stress. While this study has identified a valuable way for analyzing discrepancy scores as well as several factors assocaited with discrepancy scores, future research should focus on further defining the clinical utility of discrepancies in identifying high risk adolescent and points of intervention.

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