



Published in final edited form as:

*Prev Sci.* 2014 December ; 15(6): 869–878. doi:10.1007/s11121-013-0443-1.

## Investigating the Potential Causal Relationship between Parental Knowledge and Youth Risky Behavior: A Propensity Score Analysis

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### Abstract

This longitudinal study aims to explore the potential causal relationship between parental knowledge and youth risky behavior among a sample of rural, early adolescents (84% White, 47% male). Using Inverse Propensity Weighting, the sample was adjusted by controlling for 33 potential confounding variables. Confounding variables include other aspects of the parent-child relationship, parental monitoring, demographic variables and earlier levels of problem behavior. The effect of parental knowledge was significant for youth substance and polysubstance use initiation, alcohol and cigarette use, attitudes towards substance use, and delinquency. Our results suggest that parental knowledge may be causally related to substance use during middle school, as the relationship between knowledge and youth outcomes remained after controlling for 33 different confounding variables. The discussion focuses on understanding issues of causality in parenting and intervention implications.

### Keywords

parental knowledge; propensity scores; substance use; delinquency

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Correlational studies have found that youth whose parents have high levels of knowledge about youth activities are less likely to engage in a host of problem behaviors, such as substance use and delinquency (for a review see Crouter & Head, 2002). Although the literature has confirmed a strong relationship between parental knowledge and youth outcomes, it is not clear if parental knowledge causes lower levels of risky behavior or if it is a reflection of other characteristics of the parent-child relationship. This longitudinal study aims to explore the potential causal relationship between parental knowledge and youth risky behavior among early adolescents using Inverse Propensity Weighting (IPW; Hirano & Imbens, 2001), a propensity score technique. Using IPW allows researchers to control for a much larger number of potential confounders than traditional regression based methods, thereby strengthening our ability to draw causal inferences. Understanding whether or not

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parental knowledge may be related to youth outcomes after controlling for confounders has important intervention implications, because if an effect is identified, parental knowledge is likely an effective mediator to target in interventions.

## Correlational Studies on Parental Knowledge

A strong, consistent link has been established between parental knowledge and youth risky behaviors (Crouter & Head, 2002). Parents who are knowledgeable about youth activities may have the information necessary to provide structure, supervision, and discipline necessary to monitor peer relationships and subsequently, to reduce youth deviant behavior (Crouter & Head, 2002). Several studies have suggested that youth who have parents with high levels of knowledge are less likely to engage in delinquency, to select antisocial peers, and be influenced by antisocial peers (Laird et al., 2008; Veronneau & Dishion, 2010). Yet, whether or not the link between knowledge and risky behavior holds once researchers account for many other aspects of the parent-child relationship has not yet been tested.

## Parental Knowledge vs. Parental Monitoring

Measurement issues in the literature have clouded the distinction between parental knowledge of youth activities and parental attempts to monitor youth. Measures of knowledge have often been combined with measures of parent efforts to solicit information, the use of behavioral control strategies such as setting rules about behavior, and parental supervision (Crouter & Head, 2002). The lack of specificity in these constructs has made it difficult to discern the effects of knowledge alone on youth behaviors apart from parent efforts to monitor and other behaviors, such as youth disclosure of information.

This study specifically addresses whether or not parental knowledge is related to youth outcomes once we control for a broad range of confounding variables. We chose to focus on the role of parental knowledge rather than parental monitoring because knowledge is a central construct that links other monitoring-related behaviors to youth outcomes. Several studies suggest that the effects of parent efforts to monitor and child disclosure on youth outcomes depend on whether or not they lead to increases in parental knowledge (Fletcher, Steinberg, & Williams-Wheeler, 2004; Lippold et al., in press; Vieno et al., 2010).

By using propensity scores, this analysis explores if the relationship between knowledge and youth outcomes holds regardless of how parents obtain that information and regardless of other aspects of the parent-child relationship. In this framework, we view other behaviors that may lead to knowledge, such as parental monitoring, child disclosure, and supervision as potential confounders. Using propensity score methods increases our confidence that parental knowledge may be causally related to youth outcomes and that increases in knowledge will likely lead to changes in child behavior across different family contexts. Research questions that explore relationships between knowledge and other behaviors, such as parental monitoring, are fruitful areas for future research but are beyond the scope of the current paper.

## Confounder Variables

Despite the strong correlational evidence that parental knowledge is linked to youth outcomes, researchers have yet to determine if having greater parental knowledge is linked to risky behavior once a broad range of potential confounders are accounted for. There may be other systematic differences between families with different levels of parental knowledge that are also related to youth outcomes. These confounder variables make it difficult to discern if it is high levels of parental knowledge that are protective against problem behavior, or if the association is driven by other aspects of the parent-child relationship, other aspects of the monitoring process, or pre-existing youth behavior.

Issues of statistical power make it difficult to control for a broad array of confounders using traditional regression or structural equation methods. Although recent correlational studies have included measures of various behaviors related to monitoring in their models (e.g., parental solicitation, disclosure), they typically have not had the power to include a wide array of other parenting and parent-child relationship variables that may relate to knowledge. Further, even though many studies include earlier measures of a particular youth problem behavior as a control variable, few studies have included measures of multiple problem behaviors. Because behaviors tend to cluster (Jessor, 1993), it may be important to account for a wide range of youth problem behaviors, rather than one specific behavior. In this study, we control for 33 confounder variables including aspects of the monitoring process, other aspects of the parent-child relationship, and pre-existing problem behaviors.

Research suggests there may be several confounding variables that are related to both parental knowledge and youth outcomes. Some studies suggest that parent attempts to monitor youth and set rules about youth behavior may lead to parental knowledge and subsequently, youth outcomes (Soenens et al., 2006; Fletcher et al., 2004). Recent studies suggest that parental knowledge may be gained through youth disclosure and youth decisions to share information with their parents (Stattin & Kerr, 2000). In fact, some researchers argue that the protective effects of parental knowledge may solely be due to youth disclosure (Kerr, Stattin, & Burk, 2010). It is difficult to discern from these studies if knowledge itself has a causal effect on youth outcomes, or if it reflects parent attempts to solicit information or high levels of parent-child communication and youth disclosure, as these studies only control for a very limited number of potential confounders.

Other studies have found links between parental knowledge and other parenting characteristics. Parents who are supportive and have warm parent-child relationships are more likely to have high levels of knowledge and lower levels of youth problem behavior (Soenens et al., 2006; Fletcher et al., 2004). A warm and positive parent-child relationship, characterized by mutual trust has also been associated with increased adolescent disclosure (Kerr, Stattin, & Trost, 1999; Smetana et al., 2006; Soenens et al., 2006). Thus, it is possible that warm, trusting relationships between parents and youth may explain the association between parental knowledge and youth outcomes.

Lastly, there are several studies that suggest that earlier levels of youth problem behavior can influence both later levels of problem behavior and parental knowledge (Jang & Smith,

1997; Laird et al., 2003; Kerr, Stattin, & Burk, 2010). Reciprocal relationships have been found between knowledge and delinquency, suggesting that parental knowledge influences and is influenced by youth behaviors (Laird et al., 2003; Keijsers, Frijns, Branje, & Meeus, 2010). Thus, another confounder may be earlier engagement in risky behavior. Youth with problem behavior may also have low levels of knowledge, making it difficult to discern whether knowledge is a causal mechanism that protects youth from later antisocial behavior.

## The Benefits and Limits of A Propensity Score Approach

To understand causality it is necessary to account for potential confounders by considering the counterfactual—that is, to understand how youth would fare if their parents had a different level of knowledge given their score on a broad range of potential confounder variables (Guo & Fraser, 2010; Rubin, 2005). Random assignment controls for confounders in experimental studies by evenly distributing them on average between treatment groups. However, in observational studies it is not possible to randomize parents into different levels of knowledge. Propensity score techniques, such as IPW, allow researchers to adjust the data for confounding variables in the absence of randomization assuming that all confounders are measured (Rosenbaum & Rubin, 1983). Conceptually, propensity score techniques allow researchers to estimate the causal effect of knowledge on youth risky behavior as if families were randomly assigned to different levels of knowledge. These models allow researchers to control for a larger, more diverse array of potential confounders than traditional regression methods and the ability to control for these confounders increases our confidence in drawing causal inferences. In addition, propensity score techniques, unlike traditional regression methods, do not assume that the relationship between the confounders and youth risky behavior is linear and/or that there are no interactions between the confounders and parental knowledge.

However, propensity score techniques have some limitations. Like traditional regression methods, these methods assume that there are no unmeasured confounders. This is a strong assumption that cannot be tested in practice. However, the more potential confounders that are included in the propensity model, the more plausible the assumption becomes. Thus, it is imperative that researchers measure as many potential confounders as possible. In addition, the impact of an unmeasured confounder is mitigated if a measured potential confounder is highly correlated with the unmeasured confounder. In addition, a sensitivity analysis (see e.g. Rosenbaum, 2002) can be conducted, which attempts to determine how influential an unmeasured confounder would need to be in order to change the estimate in a meaningful way (e.g., change the significance or sign of the estimate). Sensitivity analysis is still being developed for continuous exposures, thus we are unable to do one. In summary, propensity scores may be particularly useful in situations where one cannot use randomization, such as this study, and may strengthen our ability to infer a causal relationship, particularly when they include a large number of confounding variables. However, propensity scores cannot replace randomization and randomized trials are considered the gold standard for drawing causal inferences.

## Intervention Implications

Understanding the potential role of parental knowledge on youth risky behavior has important intervention implications (Dishion & Patterson, 1999). Preventive interventions are likely to be most effective at reducing youth problem behavior if they target causal mechanisms as mediators. Thus, identifying if parental knowledge is a causal mechanism may shed light on the extent to which intervention models should specifically aim to improve parental knowledge.

Two intervention studies have explored the mediating effect of parental monitoring on youth outcomes (Dishion, Nelson, & Kavanagh, 2003; Spoth, Redmond, & Shin, 1998). These studies suggest that changes in parent efforts to monitor youth may mediate the effects of family based interventions on youth outcomes. However, it should be noted that neither of these studies specifically measured parental knowledge as a mediator of intervention effects. Dishion et al. (2003) used observational measures of parental monitoring, while Spoth, Redmond, & Shin, (1998) combined items tapping into parental monitoring with other constructs such as discipline to form an overall latent variable for general child management. Although these studies certainly suggest that there may be causal processes at work, whether or not changes in parental knowledge are causally related to youth outcomes has not been addressed in prior literature.

## This Study

Here we investigate the relationship between parental knowledge of youth activities and youth delinquency, substance use, attitudes towards substance use, and antisocial peer relationships once we account for a broad range of confounders, thereby strengthening our ability to draw causal inferences. We use IPW, a propensity score technique. Our propensity models include 33 confounder variables measured when youth are in the Fall Grade 6. These confounders include other aspects of parental monitoring, parent-child communication, other aspects of the parent-child relationship, demographic variables, and initial levels of youth problem behaviors.

## Method

### Study Participants

Participants were a randomly-selected subset of 6<sup>th</sup> graders participating in the PROSPER project (Promoting School-Community-University Partnerships to Enhance Resilience), a large scale effectiveness trial of preventive interventions aimed at reducing substance use initiation among rural adolescents (Spoth, Greenberg, Bierman, & Redmond, 2004). Participants resided in 28 rural communities and small towns in Iowa and Pennsylvania. Initial eligibility requirements for communities considered for the studies were (a) school district enrollment from 1,300 to 5,200, and (b) at least 15% of the student population eligible for free or reduced-cost lunches (For more information see Spoth, Greenberg, Bierman & Redmond, 2007).

The PROSPER project involved youth from two successive cohorts of sixth graders. Students in each of these cohorts completed in-school questionnaires. Data were collected in the Fall and Spring of 6<sup>th</sup> grade, and annually thereafter. On average, 88% of all eligible students completed in-school assessments at each data collection point. In addition, families of students in the second cohort were randomly selected for participation in in-home assessments with their sixth grade child. A total of 2,267 families from the in-school assessment sample were recruited for in-home family assessments; of those recruited for the in-home sample 979 (43%) completed the in-home assessments. The in-home assessments included a family composition interview, written questionnaires completed independently by the youth, mother, and if present, father.

The current study includes three waves of data from youth and their mothers; Wave 1 (the intervention pre-test) when the youth were in the Fall of 6<sup>th</sup> grade, Wave 2, when youth were in the Spring of 6<sup>th</sup> grade, and Wave 3, when youth were in the Spring of 7<sup>th</sup> grade. At Wave 1, 977 families completed the in-home questionnaire. By Wave 3, the sample had decreased to 801 cases (83% of those at Wave 1). The mean sample age at Wave 1: youth ( $M = 11.3$  years,  $SD = .49$ ); mothers ( $M = 38.7$ ,  $SD = 6.05$ ); and fathers ( $M = 41.2$ ,  $SD = 7.14$ ). Sixty-one percent of youth resided in Iowa and 39% lived in Pennsylvania and 47% were male. The average household income was \$51,000 (in 2003) and 62% of youth had parents with some postsecondary education. Most of the youth in our sample were living in two-parent homes; 80% were living with a parent who was married and 54% were living with both biological parents. The vast majority of youth were White (84%); 6% were Hispanic, 3% African American, 2% were Native American/American Indian, 1% Asian and 4% identified as Other.

To test for selection bias in the in-home sample, youth in the in-home sample were compared to youth in the total sample assessed at school (e.g., youth in the in-school sample that did and did not participate in the in-home assessments;  $N = 4,400$ ) on a series of demographic and behavioral outcomes. Youth in the in-home sample were not different from the total sample at Wave 1 on receipt of free or reduced lunch (33.6% versus 33.0% respectively), living with two biological parents (59.3% versus 62.5%), race (88.6% White versus 86.5% White), or gender (49.5% vs. 46.8% male). In addition, no differences were found between the samples in substance use initiation. However, youth that received in-home assessments were less likely to engage in delinquent behavior than youth in the total sample ( $M = .58$ ,  $SE = .06$  versus  $M = .82$ ,  $SE = .04$ ):  $F(1, 27) = 18.32$ ,  $p < .01$ . Youth in the in-home sample also perceived fewer benefits from using substances ( $M = 4.77$ ,  $SE = .01$  versus  $M = 4.71$ ,  $SE = .02$ ):  $F(1, 27) = 12.36$ ,  $p < .01$ . There were no differences between samples on demographic variables.

## Measures

All measures of parenting are youth report and were gathered from the PROSPER inhome data. We use PROSPER in-school data for our measures of youth delinquency and substance use (Redmond, Schainker, Shin, & Spoth, 2007). Items were adapted from the Iowa Youth and Families Project (Conger, 1989; McMahan & Metzler, 1998; Spoth, Redmond, & Shin, 1998). Measures of our confounding variables were collected when youth were in the Fall of

6<sup>th</sup> grade, our predictor variable parental knowledge was measured at Wave 2, when youth were in the Spring of 6<sup>th</sup> grade, and our youth outcome variables were measured at Wave 3, when youth were in the Spring of 7<sup>th</sup> grade. To capture both mother and youth perspectives, confounding variables include youth and mother reports of all constructs (Lippold, Greenberg, & Collins, in press). The predictor variable, parental knowledge at Wave 2 is a composite measure that averages youth and mother reports. Youth outcome variables are based on youth reports, as mother reports were not available for these items.

### Predictor variable

**Maternal knowledge of youth activity**—Youth and mother perceptions of maternal knowledge were measured using five Likert-type items (1=always to 5=never). Items ask youth how often their mother knows where they are and who they are with, when they do something really well at school or someplace else away from home, and how often their mother knows when they do not do things they have asked him/ her to do. Similar items were also asked to mothers about their perceptions of their knowledge of youth activities ( $\alpha=.83$  Youth,  $\alpha=.70$  Mother). Mother and youth reports were averaged to create a composite score for our analysis.

### Outcome variables

**Delinquency**—Twelve items assessed participants' involvement in four deviant behaviors in the past 12 months ( $\alpha = .88$ ), including: (a) taking something worth less than \$25, (b) beating up someone or physically fighting with someone out of anger, (c) purposely damaging or destroying someone else's property, (d) throwing objects such as rocks or bottles at people to hurt or scare them. Responses were coded: *Never* (0) or *Once or more* (1) and summed. At Wave 3, 29.83% of youth had engaged in at least one delinquent act.

**Antisocial peers**—Three items measured whether participants' closest friends engaged in antisocial behaviors ( $\alpha=.81$ ). One item, for example, read: "These friends sometimes get into trouble with the police." Responses were scored on a 5-point Likert scale ranging from *Strongly Disagree* (1) to *Strongly Agree* (5).

**Substance use initiation**—A four item index was used to measure substance use initiation. The items asked youth if they have ever had a drink of alcohol, ever drunk more than a few sips of alcohol, ever smoked a cigarette, or ever smoked marijuana or hashish (0=no; 1=yes). At Wave 3, 49.87% had initiated at least one substance.

**Polysubstance initiation**—Initiation of alcohol, tobacco, and drug use was assessed by asking participants to indicate whether they had ever used seven different substances (e.g., cigarettes, ecstasy, glue, Vicodin). Responses were coded *No* (0) or *Yes* (1) with the index ranging from 0 to 7 with higher scores indicating greater amounts of polysubstance use ( $\alpha=.66$ ). At Wave 3, 33.35% had engaged in polysubstance use.

**Cigarette use**—This scale summed two dichotomous items that asked youth if they have ever smoked cigarettes and if they have smoked cigarettes in the past month *No* (0) or *Yes* (1) ( $\alpha=.70$ ). At Wave 3, 14.02% had used cigarettes.

**Alcohol use**—A cumulative index of participants' alcohol use was created using 6 items about various forms of beer, wine, and liquor consumption (e.g., more than just a few sips, ever had a drink, drunkenness). Items were coded to create an index ranging from 0 to 6 with higher scores indicating greater amounts of alcohol use ( $\alpha=.78$ ). At Wave 3, 49.18% had used some form of alcohol.

**Positive substance use expectancies**—Beliefs about the use of alcohol, cigarettes, and marijuana were assessed using 11 items ( $\alpha=.95$ ). Example items include: “Smoking cigarettes makes you look cool” and “Kids who use marijuana (pot) have more friends.” Agreement was recorded on a 5-point Likert scale: *Strongly Disagree* (1) to *Strongly Agree* (5), coded such that higher scores indicate youth perceive fewer social benefits from substance use.

**Attitudes towards substances**—Youth views on whether or not it is wrong to use substances was measured with three items ( $\alpha=.83$ ). An example item is “How wrong do you think it is for someone your age to smoke cigarettes?” Each item was coded on a 4-point scale: *Not at all wrong* (1) to *Very Wrong* (4).

**Substance use norms**—Youth were asked three items to assess their perceptions of peer substance use ( $\alpha=.85$ ). Youth were asked how many people their age smoke cigarettes, use alcohol, and smoke marijuana. Each item was coded on a 5-point scale: *None or almost none* (1) to *All or Almost All* (5).

### Confounder Variables

The propensity models included 33 confounder variables: youth and mother reports of other monitoring-related behaviors, other aspects of parenting and the parent-child relationship, and demographic variables. We also included Time 1 measures of our predictor variable (parental knowledge as reported by mothers and youth) and youth outcome variables. A summary of confounder variables can be found in Table 1.

## Results

Analysis progressed through a series of four steps. First, we imputed missing data using Proc MI in SAS (Schafer, 1997; Schafer & Graham, 2002). This allowed us to retain all cases with missing data on the confounders in our analysis.<sup>1</sup> Second, we estimated a propensity score for each case and computed the weights. Applying weights to the observed sample allowed us to mimic a randomized sample by evenly distributing confounders across levels of knowledge. Third, we checked the balance of our sample to ensure that the confounding had been properly accounted for. Lastly, we calculated the Average Causal Effect (ACE) of parental knowledge on each youth outcome using our weighted sample.

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<sup>1</sup>Model results presented are from one imputed dataset. Models were run on five different imputed datasets and the same general pattern was found across datasets. Model estimates were not averaged across imputed datasets because studies suggest that Rubin's rules do not apply to propensity score models (Qu & Lipkovich, 2009).



## Estimating Propensity Scores and Applying Weights

Conceptually IPW is similar to using survey weights in an analysis. In IPW, individuals with a low probability of having their reported level of knowledge given their levels of confounders are up-weighted, and those with a high probability of having their reported level of knowledge given their levels of confounders are down-weighted. Thus, assuming no unmeasured confounders, the weighted sample mimics a randomized sample where individuals are randomly assigned to levels of parental knowledge and confounders are evenly distributed between families with different levels of knowledge.

Each individual case was assigned a propensity score. Estimating propensity scores and creating weights for continuous variables, such as parental knowledge, is only slightly more difficult than it is for a binary variable (for an example of estimating propensity weights for continuous variables, see Coffman, Caldwell, & Smith, 2012). The propensity score may be obtained from the distribution of the standardized residuals from a linear regression of parental knowledge on the measured confounders (Imai & Van Dyk, 2004; Robins, Hernan, & Brumback, 2000).<sup>2</sup> Standardized residuals are calculated by subtracting each individual's fitted value of parental knowledge from their observed value and dividing by the square root of the estimated error variance. Given the assumptions of the linear regression model, these residuals should be normally distributed with a mean of 0 and a standard deviation of 1.0. Propensity scores are then estimated as the probability of an individual's standardized residual under this standard normal probability distribution function. Each case is assigned a weight of mean parental knowledge/pro propensity score, also called the Inverse Propensity Weight. Because large weights can lead to estimation problems, stabilized weights were computed by dividing the sample mean of parental knowledge by an individual's propensity score. In addition, 13 cases had extreme weights that were greater than 10 or smaller than .10. To minimize estimation problems, weights over 10 were set to 10 and those less than .10 were set to .10. Thus, after IPW, individuals with a high propensity for their level of knowledge are given smaller weights than those with a low propensity for their level of knowledge.

## Checking Balance

After weights are applied, the balance is checked. Weighting the sample based on IPWs should reduce the relationship between the confounder variables and parental knowledge. Therefore, correlations between study confounders and parental knowledge are expected to be smaller in the weighted sample than the unweighted sample. As seen in Table 2, all of the correlations between our confounders and knowledge decreased after sample weights were applied. All of the correlations in the weighted sample had an absolute value of .12 or less, which meets Cohen's definition of a small effect (Cohen, 1988, 1992). This indicates that our confounders were effectively balanced across levels of knowledge in our weighted sample.

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<sup>2</sup>Results of the regression analysis used to obtain propensity scores are available from the first author upon request. The squared multiple correlation for the regression model is .37.

## Calculating the ACE

Once the sample was balanced, weighted regression was used to estimate the effect of parental knowledge on youth outcomes. The Beta coefficient from this regression can be interpreted as the effect of a one unit increase in knowledge on youth outcomes. Table 3 displays the beta weights and significance for each outcome. The effect of parental knowledge was significant for substance and polysubstance use initiation ( $p < .05$ ), cigarette use ( $p < .05$ ), alcohol use ( $p < .05$ ), attitudes towards substances ( $p < .001$ ), and delinquency ( $p < .05$ ). The effect of parental knowledge did not reach statistical significance for substance use norms, substance use expectancies, or antisocial peer relationships.

## Discussion

Our results suggest that parental knowledge may be causally related to substance use during middle school, as the relationship between knowledge and youth outcomes remained after controlling for 33 different confounding variables. Obtaining high levels of knowledge about youth activities may lead youth to engage in less alcohol, cigarettes, and other drugs. This work supports some prior correlational analysis that found that parental knowledge was related to youth substance use (Barnes et al., 2006). This study extends this work by suggesting that when accounting for a broad array of possible confounding variables, parental knowledge remains an important protective factor for youth development.

Parental knowledge was also related to individual attitudes towards whether or not it is wrong to use substances. However, parental knowledge was not associated with youth perceptions of substance use norms among peers or youth expectancies (perceptions of the potential social benefits of substance use). All three of these mechanisms have been identified as important intermediary steps in youth decisions to use alcohol and other substances (Patel & Fromme, 2009). These findings suggest that parents may use knowledge to influence their child's individual perceptions of whether or not it is wrong to use substances. For example, parents who are aware of upcoming youth activities may be more likely to discuss the possibility of alcohol being present at an event and their views on whether or not youth substance use is a morally acceptable behavior for their child. However, parents may be less likely to use knowledge to discuss or correct perceptions of peer attitudes that may influence use, such as youth perceptions of the overall prevalence of substance use among peers or how substance use may influence a child's social status. Or alternately, it may be that it is effective for parents to use knowledge to change youth individual perceptions of whether or not it is wrong for them to use substances, but that parent attempts to use knowledge to alter youth perceptions of peer norms and potential peer related social benefits may be less effective as these factors may be more affected by other peer group and community-level factors.

Parental knowledge was also related to delinquency but not antisocial peer associations. This finding partially supports prior studies that have found that youth who have parents with high levels of knowledge are less likely to engage in delinquency (Laird et al., 2008; Veronneau & Dishion, 2010). However, our findings differ from others that have found knowledge to be related to the selection and influence of antisocial peers (Laird et al., 2008; Veronneau & Dishion, 2010), which is one of the main mechanisms by which parental

knowledge is theorized to exert its influence on delinquency. Therefore although our findings suggests that knowledge may be an important causal mechanism for preventing delinquency; it does not suggest that knowledge allows parents to more closely monitor or intervene in deviant peer relationships.

There are several possible explanations for this finding. Perhaps parents who know about youth activities are more likely to discuss their own child's behaviors and less likely to discuss the behavior of their peers. Alternately, parents with knowledge may be more likely to discuss peer pressure with their children, thus equipping youth with the skills needed to resist engaging in deviant behavior even in the presence of deviant peers. It is also possible that parents with knowledge may attempt to intervene in antisocial peer friendships or provide guidance on the types of friends to choose, but these attempts may be unsuccessful. In fact, a recent study suggests that parent attempts to prohibit friendships with deviant peers may increase the likelihood that youth have deviant peer friendships (Keijsers et al., 2012), raising questions as to whether or not parent attempts to intervene in deviant peer relationships have unintended consequences. More specific measures of parent behavior related to their children's peers are needed to further our understanding of these processes.

This work has potential intervention implications. Early use of substances can have longterm negative consequences including a higher risk of adult alcohol disorders (Grant & Dawson, 1997; Dewit et al., 2000). The present findings suggest that targeting parental knowledge in family-based interventions is likely to reduce the risk of substance use during the middle school years, a critical time for prevention efforts. It also suggests that increasing knowledge is likely to be linked to reductions in risky behavior regardless of other characteristics of the parent-child relationship. Knowledge may be a salient intervention target.

More work is needed to understand how knowledge is gained in families and the specific mechanisms that link knowledge to youth substance use. Our work suggests that parental knowledge may lead to parent efforts to influence youth attitudes towards substances. This is important as youth who perceive drinking to be acceptable may be more likely to use substances (Callas, Flynn & Worden, 2004; Patel & Fromme, 2009). More work is needed to understand other possible mechanisms that link knowledge to substance use and delinquency. For example, theory suggests that parents use knowledge to provide structure, supervision, and discipline but these mediational links have not been adequately tested (Stattin, Kerr, & Tilton-Weaver, 2010). Propensity score techniques that investigate causal mediation processes may help fill this gap. Lastly, additional research is needed that explores the causal relationship between other monitoring related behaviors and parental knowledge. Several studies have explored the roles of disclosure and parental monitoring in predicting parental knowledge but these studies have controlled for a very limited number of potential confounders. Propensity score techniques would allow researchers to draw stronger causal inferences about potential predictors of knowledge, which would have important intervention implications.

There are several limitations to this study. First, propensity score methods assume that all of the confounders are included in our models. It is possible that there are unmeasured confounders that could influence both knowledge and youth outcomes that are not included

in our model. Note, however, that traditional regression methods also rely on this assumption and that propensity score methods have an advantage over traditional regression in that they reduce a large number of confounders into a single-number summary. Second, parenting behaviors occur in patterns. Isolating the specific effects of knowledge removes it from the broader context of the parent-child relationship. This strategy is helpful, as it addresses if knowledge affects youth outcomes regardless of how parents obtain information. Yet, this study does not reflect how knowledge occurs in conjunction with other parenting behaviors. Third, our measures of some of the confounders are limited. Specifically our measure of youth disclosure taps into youth disclosure of thoughts and feelings not youth disclosure of information. Although analysis in a highly cited dataset (Stattin & Kerr, 2000) suggests these two constructs are highly related ( $r=.67$ ), limitations of this and other measures could have influenced our propensity score estimates. Lastly, this study was conducted on a sample of early adolescents residing in rural communities and small towns. These study findings may not be generalizable to other study populations, such as youth in urban settings, and may not apply to older or younger youth.

Despite these limitations, this study takes a unique approach to understanding the role that parental knowledge plays in the development of problem behavior in early adolescence. By accounting for 33 different confounder variables, this study suggests that parental knowledge may be causally related to youth decisions to use substances and may be an important element to target in our preventive interventions.

## Acknowledgments

Work on this paper was supported by research grants P50 DA10075-16, R01 DA013709, and F31-DA028047 from the National Institute on Drug Abuse. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute on Drug Abuse or the National Institutes of Health. The authors would like to thank the anonymous reviewers for their helpful feedback on this article.

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**Table 1**

## Confounder Variables

Construct	Item Description	Alpha (Youth/Mother)
Parent Efforts to Monitor	5 items [1= almost always true to 5 = almost always false]. Example items include “Most afternoons or evenings my parents ask me if I have homework to do for the next day” and “I’m not allowed to leave home after dinner without my parent’s permission”.	0.69/0.66
Child Disclosure	Youth were asked how strongly they agree with the statement “I share my thoughts and feelings with my mother” [1=strongly agree to 5=strongly disagree]	--
Quality of Communication	6 items on a 1–5 Likert-type scale. The youth-report scale has 5 items on a 1–7 scale. Example items include how often the mother listens to the child’s point of view, criticizes the child’s ideas, and appreciates the child’s ideas.	0.84/0.74
Amount of Communication	6 item scale. Items include how often parents and child talk about plans for the day, his or her school work, and what’s going on in her life [1=every day to 6=never]	0.71/0.65
Affective Quality	3 items. During the past month how often did your mother act loving and affectionate towards you	0.75/0.82
Consistent Discipline	3 item scale [1= always, 5=never]. Examples of items include “Once a discipline has been decided, how often can he or she get out of it?”	0.56/0.83
Supervision	Youth were asked to rate how often (1) Is an adult home when you come home from school; (2) Do you get home from school before your parents are home (1= Always and 5=Never).	0.73/0.71
Standard Setting	4 items on a 1–5 scale. When you don’t understand why your mom makes a rule for you to follow, how often does she explain the reason? [almost always to almost never]	0.70/0.70
Parent-Youth Conflict	3 items [1=always to 5= never]. During an average week, how often do you and this child have serious arguments	0.66/0.70
Parent Education	0=high school education or less; 1=some college	--
Dual Bio Parent Status	0=not living with biological parents; 1=living with both biological parents	--
Gender	0=female; 1=male	--
Condition	0=control group; 1=intervention condition	--

Confounder variables were measured at Wave 1 and include T1 levels of parental knowledge and youth outcome variables (not shown). All variables were recoded such that higher scores indicate higher levels of each construct

**Table 2**

Correlations of Confounders at Wave 1 with Parental Knowledge at Wave 2 in the Unweighted and Weighted Sample

	<b>Unweighted Correlation</b>	<b>Weighted Correlation</b>
	<b>(Youth/Mother)</b>	<b>(Youth/Mother)</b>
<b><i>Monitoring-Related Behaviors</i></b>		
Knowledge	0.37/0.39	-0.04/0.02
Parental Solicitation	0.11/0.25	0.02/-0.04
Child Disclosure	0.25/N.A.	0.02/N.A.
Quality of Communication	0.28/.032	-0.06/0.07
Amount of Communication	0.31/0.25	0.0/0.02
Supervision	0.12/0.12	0.0/-0.07
<b><i>Other Aspects of Parenting</i></b>		
Affective Quality	0.28/0.28	0.07/0.06
Consistent Discipline	0.19/0.13	0.0/0.12
Standard Setting	0.18/0.21	0.10/-0.04
Parent-Youth Conflict	0.21/0.26	0.02/0.03
<b><i>Demographics</i></b>		
Parent Education	0.09	0.02
Dual Bio Parent Status	0.1	-0.01
Gender	-0.21	-0.04
Condition	0.01	-0.01
<b><i>Problem Behavior at Wave 1</i></b>		
Delinquency	-0.22	-0.03
Substance Use Initiation	-0.11	0.01
Polysubstance Use Initiation	-0.11	0.05
Alcohol Use	-0.16	0.04
Substance Use Expectancies	0.2	0
Attitudes Towards Substances	0.11	-0.07
Substance Use Norms	-0.1	-0.02
Antisocial Peer Associations	-0.24	-0.06
Cigarette Use	-0.03	-0.06

Youth Report/Mother Report: All Confounders were measured when youth were in the Fall of Grade 6. Child disclosure and youth outcomes were only available as reported by youth.



**Table 3**

Average Causal Effect (ACE) of Parental Knowledge on Youth Risky Behavior

	<b>B</b>	<b>SE</b>	<b>t</b>	<b>P value</b>
Delinquency	-0.81	0.37	-2.18	<.05
Substance Use Initiation	-0.51	0.22	-2.36	<.05
Polysubstance Use Initiation	-0.4	0.17	-2.37	<.05
Alcohol Use	-0.69	0.31	-2.23	<.05
Substance Use Expectancies	0.09	0.1	1.36	0.17ns
Attitudes Towards Substances	0.31	0.11	2.78	<.001
Substance Use Norms	-0.16	0.13	-1.19	0.23ns
Antisocial Peer Associations	-0.15	0.17	-0.93	0.35ns
Cigarette Use	-0.25	0.12	-2.18	<.05