

Parental Knowledge and Youth Risky Behavior: A Person Oriented Approach

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Abstract Most studies isolate the effects of one knowledge-related behavior on youth outcomes. This study explores the relationship between subgroups of mother–youth dyads that use specific *combinations* of parental knowledge-related behaviors and youth risky behavior. Using a sample of 796 rural 6th graders (53 % female), we assessed mother and youth reports of maternal knowledge, active parent monitoring efforts, youth disclosure, parental supervision, and the amount of parent–youth communication to identify five knowledge latent classes: High-Monitors, Maternal Over-Estimators, Low-Monitors, Communication-Focused, and Supervision-Focused. Delinquency, antisocial peers, and substance use were associated with increased odds of membership in the Supervision-Focused class, relative to the High Monitors. Membership in the Low Monitors and Maternal Over-Estimators classes was associated with unhealthy attitudes towards substances and for Low Monitors, substance use. The discussion focuses on the value of using a person-oriented approach to understand parental

knowledge and risky behavior during early adolescence and intervention implications.

Keywords Parenting · Parental knowledge · Problem behavior · Substance use · Delinquency

Introduction

Low levels of parental knowledge about youth activities have been associated with high levels of adolescent problem behaviors, such as delinquency and substance use (Crouter and Head 2002). Parent, youth, and joint parent–youth behaviors all may lead to parental knowledge. Parents may seek information by soliciting information from youth or by directly supervising and observing youth activities (Dishion and McMahon 1998; Crouter and Head 2002). Youth may manage the information they share with their parents, and may choose to disclose some information, while hiding other information (Kerr et al. 2010). The combination of both parent actions (Fletcher et al. 2004) and youth actions (Stattin and Kerr 2000) may be associated with parental knowledge of youth activities.

To date, most studies on parental knowledge attempt to parse out the effects of one specific knowledge-related behavior on youth outcomes. Yet, knowledge-related behaviors do not occur in isolation; parents and youth are likely engaging in multiple knowledge-related behaviors simultaneously. Further, parents and youth are likely to have different perceptions of knowledge-related activities and some studies have found different results depending on if the behavior is reported by parents or youth (Stattin and Kerr 2000; Smetana et al. 2006). This study takes an integrative approach to studying parental knowledge by identifying patterns of knowledge-related behaviors used in

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families and integrating the reports of parents and youth. Thus, this article extends prior studies by exploring how risky behavior is related to combinations of knowledge-related behaviors from multiple perspectives.

Defining Knowledge-Related Behaviors

Measurement issues have obscured our understanding regarding which specific knowledge-related behaviors may be protective. As Crouter and Head (2002) review, many studies have combined items that measure parental knowledge, with measures of parental efforts to solicit information or provide supervision. Combining measures may mask underlying processes, making it difficult to disentangle which knowledge-related behaviors may be associated with problem behavior. For example, early studies concluded that parents who made efforts to monitor youth, solicit them for information, and track their activities had youth who were less likely to engage in delinquency and other problem behaviors (for a review see Crouter and Head 2002; Dishion and McMahon 1998). Stattin and Kerr (2000) argued that many of these studies on monitoring actually measured parental knowledge, the information parents had about youth activities, without specifying how parents obtained this information. Stattin and Kerr (2000) found that child disclosure, the information that youth share with their parents, was a stronger predictor of problem behavior than was parent attempts to solicit youth for information or exert behavioral control. The lack of clear and consistent definitions and measures of knowledge-related behaviors in the literature has made it difficult to understand which specific behaviors, and which combinations of behaviors, may be related to problem behavior.

In this study, parental knowledge is defined as the extent to which mothers are aware of the location and activities of youth, for example, whether a mother knows what her child is doing after school. Parent active efforts to monitor youth are defined as parents' attempts to solicit youth for information about their activities and to set monitoring-related rules about their behavior, for example, whether a parent asked their child what they are doing today, and/or required the child to call and ask for permission before engaging in an activity. We define parental supervision as whether or not a parent or another adult is present to observe youth activities. The amount of communication between mothers and youth is defined as the frequency in which mothers and youth report discussing daily activities. We define youth disclosure as youth decisions to share their thoughts and feelings with their mother. It should be noted that our measure of youth disclosure does not specifically measure disclosure of activities, commonly used in the literature. However, analysis in a frequently cited dataset (Stattin and

Kerr 2000) suggests that youth disclosure of thoughts and feelings is highly correlated with youth disclosure of information ($r = .70$), suggesting it may be an effective proxy. By clearly defining each knowledge-related behavior and separating them into distinct constructs, we aim to identify the specific combinations of these behaviors that are protective against risky behavior.

Knowledge-Related Behaviors and Youth Risky Behavior

Recent variable-oriented studies have aimed to differentiate the effects of disclosure, solicitation, and supervision on problem behavior. These studies suggest that high levels of youth disclosure and parent–child communication are linked to lower levels of problem behavior, on average. However, findings are less clear on the role of parental solicitation, control, and supervision on youth behavior. Stattin and Kerr (2000) found that youth's decisions on which information to share with their parents was a stronger predictor of parental knowledge, youth norm-breaking, and police contact than either parental control or solicitation (Stattin and Kerr 2000). Recent longitudinal studies have replicated Stattin and Kerr's findings, suggesting that disclosure may be a stronger predictor of delinquency than other knowledge-related behaviors, but these findings have not yet been replicated for youth substance use (Keijsers et al. 2010; Stattin et al. 2010; Willoughby and Hamza 2010). Some cross-sectional studies have found that parents' efforts to monitor youth through behavioral control or solicitation also may be important in preventing youth delinquency and substance use (e.g., Fletcher et al. 2004; Soenens et al. 2006, Vieno et al. 2009) but these findings have not been replicated in some longitudinal studies, especially when solicitation is considered concurrently with youth disclosure (e.g., Stattin et al. 2010). Other studies have found that a lack of parental supervision also can be associated with youth delinquency (Stoolmiller 1994) and that parental actions to monitor youth may have stronger effects in the absence of adult supervision (Laird et al. 2010). Variable-oriented studies have suggested that disclosure, supervision, and parents' efforts to monitor may be important in reducing risky behavior. However, even though studies have identified the role of specific aspects of the knowledge process, studies have yet to explore if families are using combinations of these behaviors and how combinations of knowledge-related behaviors are linked to problem behavior.

The Benefits of a Person-Oriented Approach

Person-oriented models may be beneficial because they allow researchers to explore the effects of the whole

process of obtaining and managing parental knowledge on youth outcomes. Instead of exploring the effects of a specific variable, averaged across the sample, person-oriented methods identify subgroups of individuals in a population that use particular combinations of behaviors and explore differences in outcomes among these subgroups. The goal in a person-oriented model is not to identify which variable is the strongest predictor of an outcome, on average. Instead, person-oriented models help researchers understand patterns of knowledge-related behaviors and how these are related to child outcomes (Bergman et al. 2000; Bergman and Trost 2006). By identifying patterns of different knowledge-related behaviors, person-oriented models may allow researchers to understand the effects of many different behaviors, rather than focusing on just one or two.

Parents and youth are likely engaging in many knowledge-related behaviors: parental solicitation, disclosure, supervision, communication. Further, these behaviors may be accompanied by different levels of actual knowledge. These behaviors are likely highly inter-related and form a system of information management and exchange. For example, within an individual family, changing one knowledge-related behavior, such as disclosure, is likely to impact other behaviors, such as solicitation (Keijsers et al. 2010). At the level of an individual family, it is likely that each knowledge behavior is not occurring in isolation. Instead, there are likely combinations of parental attempts to solicit information, parental attempts to provide supervision, youth disclosure, and actual knowledge that are associated with reduced risk of problem behavior (Bergman and Trost 2006). The effects of knowledge-related behaviors may result from the combination of behaviors used in families.

Most studies of parental knowledge have been variable-oriented, relying on multiple regression or structural equation approaches to explore how one knowledge-related behavior (e.g., disclosure) influences youth outcomes while controlling for other knowledge-related behaviors (e.g., solicitation) (Fletcher et al. 2004; Kerr et al. 2010). In variable-oriented models, the estimates reflect the effect of a particular variable on average across the sample, holding any control variables constant. Variable-oriented approaches are helpful for drawing conclusions about the average effects of an isolated variable across a study population, but they do not inform researchers about the relationship between a variable and an outcome at the individual level. Further, researchers are not able to model the effect of the entire knowledge process on youth outcomes using variable-oriented approaches. We argue that a person-oriented approach that incorporates multiple behaviors and reporters will have added value in understanding the processes of managing and obtaining parental knowledge.

Integrating Multiple Reporters

To fully capture patterns of knowledge-related behaviors, the perspectives of both parents and youth should be included. Parents and youth may have different perceptions of knowledge-related behaviors, especially when youth are not disclosing information to their parents. Studies suggest that parents may over-estimate their own knowledge and youth disclosure (Cottrell et al. 2003; Smetana et al. 2006). Such biases may influence parental decisions on the amount of structure to provide to youth to ensure healthy development. To date, most studies on knowledge use only one reporter (e.g., Barnes et al. 2006), run separate models for youth and parent reports of knowledge (e.g., Stattin and Kerr 2000), or use the average of parent and youth reports (Kiesner et al. 2010). Interestingly, research indicates differences in findings based whether or not knowledge is reported by mothers, fathers, or youth (e.g., Keijsers et al. 2009, 2010; Kerr et al. 2010). Lippold et al. (2011) found that higher mother than youth ratings of parental knowledge were associated with delinquency and less healthy attitudes towards substances and De Los Reyes et al. (2010) found that discrepancies in parent and youth perceptions of knowledge were linked to higher levels of problem behavior 2 years later. These studies suggest that maternal overestimation of knowledge-related behaviors may be a risk factor for problem behavior. Therefore, it may be useful for models to include reports of knowledge-related behaviors from both parents and youth.

This Study

Here we explore associations between patterns of knowledge-related behaviors and early adolescent substance use initiation, attitudes towards substances, delinquency, and antisocial peer associations. We identify the patterns of knowledge-related behaviors used in mother–youth dyads, allowing us to capture the influence of combinations of a broad range of knowledge-related activities. Second, we integrate both mother and youth reports of knowledge-related behaviors, allowing us to capture important differences in their perceptions. Third, we utilize a large community sample of 6th grades in rural US, a particularly understudied population with substantial rates of early substance use (Donnermeyer 1992). We focus our study on youth reports of the relationships with their mothers, as they are often the main source of parental knowledge in families (Waizenhofer et al. 2004). By using measures of many knowledge-related behaviors from both mothers and youth, we aim to capture the effects of the whole knowledge process on youth outcomes.

Our knowledge latent classes are formed using measures of active parental efforts to monitor youth, supervision, youth disclosure, maternal-youth communication, and parental knowledge. As Crouter and Head review (2002), measures of supervision, control, and knowledge are combined inconsistently in studies, and are frequently given an overall label (e.g., parental monitoring) without specifying which specific processes are occurring. We chose to include all of these constructs in our models, as they have been defined as important knowledge-related behaviors in prior studies (Crouter and Head 2002).

We focus on 6th graders because parents may change knowledge-related behaviors and because youth who engage in early problem behavior may be at particular high risk for negative outcomes. Parents may need to adapt their knowledge-related behaviors during the adolescent transition in order to balance youth control with a growing need for autonomy (Nelson et al. 2004; Steinberg 2007). Further, studying knowledge-related behaviors at the transition to adolescence provides information on early starters of problem behavior, a group that consistently has been identified as high-risk for later delinquency and substance abuse problems (DeWit et al. 2000; Grant and Dawson 1997; Patterson et al. 1989). Because of the low prevalence of substance use at this age, we also measure substance use expectancies, the attitudes youth hold about substances, which have been linked to future substance use. Youth who perceive drinking to have more social benefits and to be common among peers may be more likely to use substances later (Callas et al. 2004; Patel and Fromme 2009). By focusing on sixth graders, this study enables us to understand the effects of knowledge-related behaviors during a critical period of youth development, when parents may be changing knowledge-related behaviors and when youth are beginning to experiment with substance use and other risky behaviors.

Method

Study Design and Participants

This study uses a subset of 796 6th 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 (for more information see Spoth et al. 2004). Participants in PROSPER resided in 28 rural communities and small towns in Iowa and Pennsylvania (14 intervention communities, 14 control communities). The PROSPER project involved youth from two successive cohorts of sixth graders from the 28 project communities. Schools in

intervention communities implemented two evidence-based programs designed to reduce adolescent substance use: a school-based curriculum (delivered in the seventh grade to all students) and a family-based program (offered to all families of sixth graders). Schools selected programs from a menu of evidence-based interventions. In addition, districts were supported by community-based prevention teams. Students in each of the two PROSPER cohorts completed in-school questionnaires. 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 and recruited for participation in in-home assessments with their sixth grade youth. A total of 2267 families were recruited for in-home family assessments; of these, 979 (43 %) completed the assessments. Targeted sample sizes ranged from 30 families in the smallest community school district to 74 families in the largest district; actual sample sizes ranged from 18 to 68 families across the 28 project communities. Family recruitment included mail and telephone contacts followed by an in-person recruitment visit. The in-home assessments included a family interview, and written questionnaires completed independently by the youth, mother, and, if present, father. Family interactions were also videotaped.

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 who 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 in-school population at Wave 1 on receipt of free or reduced lunch (33.6 vs. 33.0 % respectively), living with two biological parents (59.3 vs. 62.5 %), race (88.6 White vs. 86.5 % White), gender (49.5 vs. 46.8 % male) or intervention condition (50.4 vs. 52.1 % treatment condition). In addition, no significant differences were found between groups in substance use initiation. However, youth who received in-home assessments were less likely to engage in delinquent behavior than youth in the in-school sample ($M = .58$, $SE = .06$ vs. $M = .82$, $SE = .04$): $F(1, 27) = 18.32$, $p < .01$. Youth in the in-home sample also perceived fewer benefits from using substances ($M = 4.77$, $SE = .01$ vs. 4.71 , $SE = .02$): $F(1, 27) = 12.36$, $p < .01$.

The demographics of the sample are as follows. The mean age of the youth is 11.3 years ($SD = .49$) and 53 % were female. The mean age of mothers is 38.7 ($SD = 6.05$) and of fathers is 41.2 ($SD = 7.14$). Sixty-one percent of youth resided in Iowa and 39 % lived in Pennsylvania. The average household income was \$51,000 (in 2003) and 62 % of parents had some post-secondary education. The average number of youth per home was three ($SD = 1.56$).

Most youth were living in two-parent homes; 80 % were living with married parents and 54 % were living with both biological parents. Most youth were Caucasian (84 %); 6 % were Hispanic, 3 % African American, 2 % were Native American/American Indian, 1 % Asian and 4 % identified as Other.

A FIML missing data procedure is available for LCA, however, it does not extend to models with covariates. Thus, it was necessary to delete all cases with missing data on covariates from our analysis (Collins and Lanza 2010). Therefore, the current study includes data from 796 youth and their mothers who had complete data on the covariates at Wave 1, in the Fall of Grade 6, before the intervention was delivered. Because deleting cases with missing data could potentially influence our findings, a series of *t* tests or Chi square difference tests were run to compare differences in our outcome and control variables between cases that did or did not have missing data on any covariate. These tests suggested that there were no significant differences in any of our measures of risky behavior (delinquency, substance use initiation, antisocial peers, and substance use expectancies) or gender between cases with and without missing data. However, youth with complete data were more likely to have parents with more than a high school education those with missing data (64.3 vs. 52.4 %: $\chi^2(1) = 8.17$, $p < .01$) and were more likely to be living with married biological parents (55.9 % vs. 41.8 %: $\chi^2(1) = 10.14$, $p < .01$).

Measures

Knowledge-related measures were gathered from in-home data collection and were coded so that higher scores indicate higher levels of each construct. Because research suggests that youth are more likely to report problem behavior if asked in school, rather than home settings, we use PROSPER in-school data for the measures of youth substance use initiation and delinquency (Redmond et al. 2007); these measures were gathered within months of the home visit.

Knowledge-Related Activities

All items were adapted from the Iowa Youth and Families Project (Conger 1989; McMahon and Metzler 1998; Spoth et al. 1998).

Maternal knowledge of youth activity Mother and youth perceptions of maternal knowledge were measured using five items on a Likert-type scale (1 = always to 5 = never). Mothers and youth were asked to rate how often they know where their youth is and who their youth is

with when he or she is away from home ($\alpha = .67$ mother, $.69$ youth).

Parental active efforts to monitor Mother and youth perceptions of maternal efforts to solicit information from youth and set monitoring related rules about behavior are measured using five comparable Likert-type items (1 = almost always true to 5 = almost always false). Examples of items include ‘Most afternoons or evenings I ask my youth if she/he has homework to do for the next day’, ‘I expect my youth to let me know in advance who will be driving for my youth and his/her friends when they go out’ ($\alpha = .66$ mother, $.69$ youth).

Parental supervision Mothers and youth were asked to rate how often (1) Is an adult home when your youth gets home from school and (2) Does your youth get home from school before either you or your partner are home. (1 = always to 5 = never) ($\alpha = .81$ mother, $.83$ youth).

Youth 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). Our measure of youth disclosure does not specifically measure disclosure of activities, commonly used in the literature. However, analysis in a frequently cited dataset (Stattin and Kerr 2000) suggests that youth disclosure of thoughts and feelings is highly correlated with youth disclosure of information ($r = .70$), suggesting it may be an effective proxy.

Amount of communication This scale captures the amount of communication between parents and youth without specifying the initiator of such conversation. The mother scale has 8 items and the youth scale has 4 items. Examples of items include how often mothers and youth talk about plans for the day, his or her school work, what’s going on in his or her life. All items are on 1–4 Likert-type scales where a low score indicates infrequent communication (e.g., ‘never’) ($\alpha = .74$ mother, $.71$ youth).

Youth Risky Behavior

Items are adapted from the National Youth Survey (Elliott et al. 1978) and from the Iowa Youth and Families Project (Conger 1989; McMahon and Metzler 1998; Spoth et al. 1998).

Substance use initiation A four item index was used that summed dichotomous items that 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. Twenty-eight percent of respondents indicated that they had ever used at least one substance. The mean of the scale was $.36$ ($SD = .67$).

Substance use expectancies Substance use expectancies were measured using an eleven item scale about how youth perceive that substance use affects their reputation with peers. Examples of the Likert scale items (1 = strongly agree to 5 = strongly disagree) include: “Kids who smoke have more friends” and “Drinking alcohol lets you have more fun”. Items were coded with higher scores indicating greater perceived benefits from substance use ($\alpha = .92$).

Delinquency Delinquency was measured with a twelve-item scale that asked youth how often they had engaged in a delinquent act in the past 12 months (1 = Never to 5 = Five or more times). Each item was dichotomized to indicate if youth had engaged in each behavior (0 = no, 1 = yes) and then summed. An example item is “In the past 12 months, how often have you taken something worth <\$25 that didn’t belong to you”, or “carried a hidden weapon”. Twenty-eight percent of participants reported committing at least one delinquent act. The mean was .57 (SD = 1.20).

Antisocial peer associations Three items measured whether participants’ closest friends engaged in antisocial behavior. An example includes: “These friends sometimes get into trouble with the police.” Responses were scored on a Likert scale ranging from “Strongly Disagree” (1) to “Strongly Agree” (5) ($\alpha = .79$).

Control variables All models also included four control variables that have been associated with our outcome variables (Hawkins et al. 1992): gender (0 = female; 1 = male), dual biological parent status (0 = not living with biological parents; 1 = living with both biological parents), parent education (0 = high school education or less; 1 = some college) and intervention condition (0 = control condition; 1 = intervention condition).

Plan of Analysis

Latent Class Analysis (LCA) identifies patterns of knowledge-related behaviors used in mother–youth dyads. LCA is a measurement model that accounts for measurement error and identifies latent subgroups of individuals in a population based on responses to a set of observed categorical items (Collins and Lanza 2010). Mother and youth reports of knowledge-related behaviors were used to identify the latent classes and were dichotomized to indicate high or low levels of behaviors based on a median split. We chose a median split because it is important to consider levels of knowledge *relative* to other mothers or youth and because the field has yet to identify the level of knowledge behaviors that are protective. We chose LCA over latent profile analysis because many of our knowledge-related measures had strong ceiling effects that could

not be corrected by statistical transformation (See Table 1). Therefore, categorical analysis may be more appropriate than latent profile models which assume normality (Collins and Lanza 2010; Feldman et al. 2009; Steinley and Brusco 2011). However, it should be noted that we have analyzed these data using both latent class and latent profile models and both analyses resulted in the same best fitting model.

Once we identified the latent classes, we explored the construct validity of our identified latent classes by exploring whether they are predictive of youth behavior. If the latent classes predict youth behavior, it increases our confidence that the model is valid (Collins and Lanza 2010). We investigated the relationship between these latent classes and a series of problem behavior covariates using multinomial logistic regression (Collins and Lanza 2010). Because LCA is primarily an exploratory technique, researchers typically do not generate a priori hypotheses about the latent class solution. Although based on prior literature, we expect that classes with high levels of all behaviors, low levels of all behaviors, and discrepant patterns will emerge; we do not generate specific hypotheses about the latent class structure. After the latent class solution is identified, we test specific hypotheses about their relationship to risky behavior.

Results

Model Identification

Using MPLUS (Muthén and Muthén 2012), a series of models with one to seven latent classes were examined to identify the best fitting latent class model (See Table 2). The final model was chosen based on conceptual clarity and fit statistics, including the AIC (Akaike Information Criterion; Akaike 1987), the BIC (Bayesian Information Criterion; Schwarz 1978), the LMRT (Lo Mendel Rubin Test; Lo et al. 2001) and the BLRT (Bootstrap Likelihood Ratio Test; McLachlan and Peel 2000). Because recent research suggests that the BLRT may be a better indicator of model fit than the LMRT (Nylund et al. 2007), we used the BLRT to determine if adding additional latent classes provided a significant improvement in model fit. The 5 class model had the lowest AIC but the 4 class model had the lowest BIC. We chose the five class model as our best fitting model because the BLRT suggested that it was a significantly better fitting model than the 4-class solution. We also selected the five class solution as the final model because it had stronger conceptual clarity and more distinct latent classes than the four class solution (Collins and Lanza 2010).

LCA estimates two types of model parameters that range from 0 to 1 (Table 3). Membership probabilities indicate

Table 1 Descriptive statistics of knowledge-related activities

	Means (SD)		Skewness		Kurtosis	
	Mother	Youth	Mother	Youth	Mother	Youth
Parental knowledge	4.35 (.42)	4.61 (.50)	−0.53	−1.85	0.61	4.22
Parent efforts to monitor	4.83 (.35)	4.58 (.58)	−3.62	−1.86	24.23	4.12
Parental supervision	3.89 (1.12)	3.72 (1.19)	−0.87	−0.63	−1.70	−0.72
Child disclosure	–	4.20 (.95)	–	−1.02	–	0.39
Amount of communication	3.48 (.32)	3.17 (.65)	−0.95	−0.74	1.57	0.21

Table 2 Model selection MPLUS

Number of classes	BLRT	LMRT	AIC	BIC
2	444.25***	437.69**	9166.17	9255.08
3	180.32***	177.66	9005.84	9141.55
4	77.09***	75.95*	8948.76	9131.26
5	58.64***	57.78*	8901.18	9139.42
6	Unidentified			
7	Unidentified			

* $p < .05$; ** $p < .01$; *** $p < .001$. Fit statistics for the selected model (5 class) are in bold

the proportion of the sample estimated to be in each knowledge latent class. Item response probabilities indicate that the probability that a mother-youth dyad will use a high level of each knowledge-related behavior given membership in a knowledge latent class. For example, an item response probability of .5 would indicate a 50 % chance that dyad in a particular latent class have high levels of a particular knowledge-related behavior.

The final model contains five knowledge latent classes termed: High Monitors (26 %), Communication-Focused (18 %), Supervision-Focused (30 %), Maternal Over-Estimators (10 %), and Low Monitors (17 %). *High Monitors* (26 %) are mother–youth dyads characterized as having a

high probability (>.70) of being above the median on all knowledge-related behaviors according to both mothers and youth. Mothers and youth in the *Communication-Focused* (18 %) class report a high probability of being above the median in youth disclosure, solicitation, and communication (above .60 for these knowledge behaviors), but they both report a low probability of being above the median for supervision (only .19 based on youth report and .13 based on mother report). This pattern of item response probabilities suggests that Communication-Focused dyads monitor primarily through communication that includes parent monitoring efforts, youth sharing of information, and high levels of parental knowledge. In contrast, youth and mothers in the *Supervision-Focused* class (30 %) report a very high probability of being above the median on supervision, but they report average or low probabilities of being above the median for all other knowledge strategies. Dyads in the *Maternal Over-Estimators* (10 %) class differ by reporter and are characterized by a high probability of being above the median in knowledge-related behaviors based on mother reports but a low probability of these same behaviors based on youth reports (for example, .98 for mother report of knowledge versus .28 for youth report). *Low Monitors* (17 %) report a low probability of being above the median on all knowledge-related behaviors regardless of reporter.

Table 3 A latent class model for parental knowledge-related behaviors

	High monitors 0.26	Communication-focused 0.18	Supervision-focused 0.30	Maternal over-estimators 0.10	Low monitors 0.17
Parent active efforts-youth	0.83 (0.04)	0.78 (0.05)	0.45 (0.05)	0.59 (0.09)	0.29 (0.06)
Parent active efforts-mother	0.79 (0.04)	0.71 (0.05)	0.51 (0.04)	0.91 (0.08)	0.42 (0.06)
Knowledge-youth	0.84 (0.04)	0.87 (0.05)	0.45 (0.04)	0.28 (0.08)	0.30 (0.06)
Knowledge-mother	0.80 (0.04)	0.62 (0.06)	0.36 (0.06)	0.98 (0.07)	0.28 (0.05)
Youth disclosure-youth	0.85 (0.05)	0.80 (0.06)	0.31 (0.04)	0.13 (0.07)	0.17 (0.05)
Supervision-youth	0.87 (0.05)	0.19 (0.10)	0.83 (0.07)	0.50 (0.10)	0.08 (0.03)
Supervision-mother	0.94 (0.07)	0.13 (0.11)	1.00 (0.01)	0.79 (0.08)	0.14 (0.11)
Amt communication-youth	0.92 (0.04)	0.76 (0.06)	0.38 (0.05)	0.13 (0.09)	0.22 (0.06)
Amt communication-mother	0.78 (0.04)	0.64 (0.06)	0.29 (0.05)	0.75 (0.09)	0.28 (0.05)

Item response probabilities indicate the probability of being above the median in a particular knowledge-related behavior. Model estimates above .5 are in bold. Standard Errors are in parenthesis

Latent Class Analysis with Covariates

We used multinomial logistic regression to test the relationship of covariates to the latent classes, and to determine if the latent class solution was valid using PROC LCA in SAS (Collins and Lanza 2010; Lanza et al. 2007). The odds ratio indicates the change in odds of membership in a particular class (relative to a reference class), given a one standard deviation increase in the covariate (Collins and Lanza 2010). Because prior studies suggest high levels of parent and youth knowledge-related behaviors are protective against problem behavior (Crouter and Head 2002), we chose the High Monitor class as the reference class for all analysis. Odds ratios >1.0 indicate an increased odds of membership in a latent class relative to the reference class, while those <1 indicate decreased odds. A separate model was run for each risky behavior, all continuous variables were standardized, and both the odds and inverse-odds ratios are included (Collins and Lanza 2010).

We hypothesized that early risky behavior will be associated with an increased likelihood that a mother-youth dyad is a member of the Low Monitors and Communication-Focused class (as these classes have low levels of supervision) relative to the High Monitors class. We also expected risky behavior to be associated with increased odds of membership in the Maternal Over-Estimators class, as prior studies have found maternal overestimation of knowledge to be a risk factor for problem behavior (De Los Reyes et al. 2010; Lippold et al. 2011).

Control Variables

First, we assessed if four control variables were significant covariates; gender, dual biological parent status, parent education, and intervention status. Two control variables were significant: gender ($G_{diff}^2(4) = 13.47, p < .01$) and dual biological parent status ($G_{diff}^2(4) = 15.37, p < .01$). The odds of being in the Low Monitors and Supervision-Focused classes relative to the High Monitors class were significantly higher for boys than girls (see Table 4). Youth in homes with both biological parents were less likely to be in the Low Monitors class.

Risky Behavior

Next, we tested the association between youth risky behavior and latent class membership, including dual biological parent status and gender as control variables. All risky behavior variables were significant predictors of latent class membership (See Table 4) and were coded so higher scores indicate more problem behavior. Significant odds ratios (where a 1 was not in the estimate confidence interval) are indicated with an asterisk.

Increases in risky behavior were associated with increased odds that a dyad was in the Supervision-Focused, Maternal Over-Estimators and Low Monitors class relative to the High Monitors class, however the associations varied by the specific behavior. For example, all of our risky behavior variables were associated with increased odds of membership in the Supervisor-Focused class. A one standard deviation increase in delinquency was associated with a 39 % increase in the odds of being in the Supervision-Focused class, relative to the High Monitors. Increases in substance use initiation, antisocial peer relationships, and youth perceptions of the social benefits of substance use were also linked to membership in the Supervision-Focused class, relative to High Monitors (OR = 1.47, 1.53, 1.46). Membership in the Low Monitors class was also associated with substance use initiation and substance use expectancies but not antisocial peer relationships or delinquency. For example, a one standard deviation increase in substance use initiation was associated with a 39 % increase in the odds of membership in the Low Monitors class relative to the High Monitors class. It should be noted that the odds ratios for the Maternal Over-Estimators only reached statistical significance for substance use expectancies and not other risky behaviors. A one standard deviation increase in perceiving benefits from substance use (substance use expectancies) was associated with a 83 % increase in the odds of belonging to the Maternal Over-Estimators class, relative to the High Monitors.

Discussion

Parental knowledge of youth activities has been identified as one of the strongest family-based predictors of adolescent substance use, delinquency and other problem behaviors (Crouter and Head 2002). Parents and youth may engage in many behaviors to manage or seek knowledge, such as parental supervision, parental solicitation of information, and youth disclosure of information. Here, by taking a person-oriented perspective, we sought to identify specific combinations of parent and youth knowledge-related behaviors that are protective against youth problem behaviors and to integrate the perspective of mothers and youth into the same model. This is in contrast to most studies that have isolated the effects of one particular knowledge-related variable from one family member's perspective on youth outcomes.

Our analysis identified five latent classes of knowledge-related behaviors used in families: High Monitors, Communication-Focused, Supervision-Focused, Maternal Over-Estimators, Low Monitors. Although some dyads showed all high or low rates of multiple knowledge-related behaviors (Low Monitors and High

Table 4 Odds ratios and inverse odds ratios

	High monitors	Communication-focused	Supervision-focused	Maternal over-estimators	Low monitors	<i>p</i> value
Covariates	Reference					
Gender		1.35 (0.74)	1.66 (.60)*	0.58 (1.73)	2.32 (0.43)*	0.01
Dual biological parents		0.87 (1.14)	0.62 (1.61)	0.74 (1.35)	0.36 (2.76)*	0.004
Parent education		1.34 (0.75)	0.66 (1.52)	0.68 (1.46)	1.12 (0.90)	.06 ns
Condition		1.45 (0.69)	1.02 (.98)	0.88 (1.14)	0.81 (1.24)	.46 ns
Grade 6 risky behavior						
Delinquency		0.82 (1.23)	1.39 (0.72)*	1.08 (0.93)	1.19 (0.84)	0.006
Substance use initiation		0.89 (1.12)	1.47 (0.68)*	1.41 (0.71)	1.39 (0.72)*	0.004
Antisocial peer associations		0.63 (1.58)	1.53 (0.65)*	1.54 (0.65)	1.44 (0.69)	<.0001
Substance use expectancies		0.86 (1.16)	1.46 (0.69)*	1.83 (0.55)*	1.61(0.62)*	<.0001

All models control for dual biological marital status and gender. Inverse odds ratios are in parenthesis. The reference class is the High Monitors. An asterisks indicates a significant odds ratio: $p < .05$

Monitors), other dyads engaged in only some knowledge-related behaviors and not others. For example, Supervision-Focused dyads used high rates only of supervision strategies. One pattern emerged in which youth and mothers had discrepant perceptions: Maternal Over-Estimators (where mothers perceived higher levels of knowledge related behaviors than youth). These patterns of behavior have not been identified in prior variable-oriented studies. Our findings suggest that, in natural family settings, dyads are engaging in distinct combinations of knowledge-related behaviors and that specific behaviors often do not occur in isolation. These findings suggest that person-oriented models that integrate multiple reporters and multiple behaviors provide unique and novel information on the knowledge process and its relationship to risky behavior (Bergman et al. 2000).

These patterns of knowledge have clear associations with risky behavior confirming the validity of the latent class solution. Risky behavior was associated with an increased likelihood of membership in the Low Monitors, Supervision-Focused, and Maternal Over-Estimators classes; however, the specific behaviors associated with latent class membership varied. For example, membership in the Supervision-Focused class was associated with all of the problem behaviors we tested, including delinquency, antisocial peer behaviors, substance use, and substance use expectancies. However, membership in the Low Monitors class only was associated with substance use and substance use expectancies (youth perceptions of the social benefits to substance use) and membership in the Maternal Over-Estimators class only was associated with substance use expectancies. The Supervision-Focused class had the strongest pattern of associations with risky behavior, yet the Low Monitors and Maternal Over-Estimators classes also demonstrated increased risk of some indicators related to substance use.

Because this study is cross-sectional, we cannot determine the direction of effects in our models. In other words, the patterns of knowledge-related behaviors in the Low Monitors, Supervision-Focused, and Maternal-Over-Estimators classes may lead to risky behavior (a parent-driven model) or risky behavior may lead to these patterns of knowledge-related behaviors (a child-driven model). Because the direction of effects is unknown in this study, we discuss both possibilities when interpreting our findings.

Integrating youth and mother reports into our person-oriented models enabled us to identify one at-risk class, the Maternal Over-Estimators, which was characterized by higher perceptions of knowledge-related behaviors by mothers than youth. Mothers and youth in the Maternal Over-Estimators class both report an above average probability of active parental efforts to monitor. Yet, these mothers may be over-estimating the extent to which solicitation is leading to actual information on youth activities, as seen by discrepancies in mother and youth perceptions of parental knowledge and the low probability of youth disclosure. This finding partially supports prior studies that found that maternal overestimation of parental knowledge to be associated with early adolescent problem behavior (De Los Reyes et al. 2010; Lippold et al. 2011). Important differences in parent and youth perspectives may have been masked in earlier studies that ran separate variable-oriented models for parents and youth. By integrating different perceptions into our models, we were able to identify the Maternal Over-Estimators class that was at increased risk of unhealthy attitudes towards substances.

The risk associated with the Maternal Over-Estimators class may reflect a child or parent driven process. One interpretation is that maternal overestimation of knowledge may lead to inaccurate decisions about a child's need for

structure and guidance. For example, mothers in this class may feel that it is unnecessary to discuss youth perceptions of and attitudes towards adolescent substance use. However, without clear parental communication around these issues, youth may seek information about substance use from their peers and may overestimate the extent to which substance use may have social benefits. Alternately, from a child-effects perspective, youth who feel that there are social benefits to using substances may be hesitant to discuss this issue with their parents, or may withhold information regarding their attitudes and intentions to use substance from their parents, leading to discordant perceptions. The negative outcome associated with the Maternal Over-Estimators group may suggest that improving maternal perceptions of disclosure and communication, and helping mothers accurately gauge the level of information youth are sharing may be a salient prevention strategy.

Interestingly, our findings suggest that the group most associated with youth problem behavior is the Supervision-Focused class. This suggests that supervision may be ineffective at preventing problem behaviors when it occurs in the absence of other strategies. Perhaps in the absence of other knowledge-related behaviors, adult supervision is viewed negatively by adolescents, as a source of over-control or privacy invasion (Hawk et al. 2008). Alternately, it is possible that increases in supervision may emerge in reaction to youth risky behavior yet without increases in other knowledge-related behaviors may be less likely to reduce risk (Kerr and Stattin 2003). These findings suggest that patterns that rely solely on supervision are associated with increased risk, but our study cannot determine the direction of effects.

Membership in the Low Monitors class was associated with substance use but not delinquency or antisocial peer associations. This finding contradicts other studies that have found low levels of youth disclosure and parent efforts to monitor to be linked to increased risk of delinquency and negative peer associations (Crouter and Head 2002). It may be that youth most at-risk of delinquent behavior and antisocial peer associations are those who have parents present to provide supervision yet are still lacking in other knowledge-related behaviors, as seen in the Supervision-Focused class. In a traditional variable oriented approach, the distinction between these two classes may be masked, as the influence of one particular behavior (e.g., supervision) would have been averaged across the sample, holding other behaviors constant. However, it is important to note that there are many differences between our sample and some of these other studies, many of which have not focused on rural youth living in the US. The lack of findings for the Low Monitors regarding delinquency and antisocial peer associations may

reflect important differences between the Low Monitors and Supervision-Focused classes and/or differences between our sample versus those used in prior research.

Risky behavior did not significantly change the odds of membership in the Communication-Focused class, relative to the High Monitors, suggesting that the constellation of strategies in the Communication-Focused class may be equivalent to the High Monitors regarding risk for problem behavior. This may suggest that supervision may be more effective when it occurs in combination with other knowledge behaviors, as seen in the Communication-Focused Class, but less effective at preventing problem behaviors when it occurs in the absence of other strategies, as seen in the Supervision-Focused Class. Therefore, having an adult present to observe activities may have different effects on youth problem behavior depending on the broader parenting context and other behaviors that co-occur. This finding may indicate that high levels of other knowledge-related behaviors (as reported by mothers and youth) may be sufficient to prevent problem behavior in the absence of supervision. The low risk associated with the Communication-Focused class may suggest that the effects of supervision vary by context and that supervision may not be necessary to afford protection against problem behavior if other knowledge-related behaviors are co-occurring.

Interestingly, our findings suggest that youth disclosure often co-occurs with other knowledge-related behaviors and that it may be the joint effects of disclosure with other knowledge-related behaviors that reduce the risk of problem behavior. Several variable oriented approaches suggest that youth disclosure is the strongest predictor of youth problem behavior, on average when holding other variables, such as solicitation, constant (Crouter and Head 2002). However, our analyses revealed that, in dyads where mothers and youth had similar perceptions of knowledge-related behaviors, disclosure often co-occurred with a mutual communication process that included parental attempts to solicit information, youth sharing of information, and high levels of knowledge. Youth disclosure was part of a combination of behaviors and does not occur in isolation, or in contrast to other activities. In fact, our analysis suggests that it may be the joint effect of parent efforts, disclosure, and knowledge that are associated with problem behavior, highlighting the importance of a person-oriented approach to understanding risk.

Strengths and Limitations

The latent class approach used here has limitations and strengths. Although a FIML missing data procedure is available for LCA, it does not extend to models with covariates. Thus, as recommended by Collins and Lanza (2010),

all cases with missing covariates were deleted from our analysis, reducing the sample size and potentially influencing the findings. LCA also required the use of categorical variables; therefore, how the variables were dichotomized may have influenced these findings. However, despite these methodological limitations, LCA allowed us to bring a unique perspective to studying parental knowledge. Rather than focusing on a specific variable, LCA permitted us to explore differences in the patterning of knowledge behaviors between subgroups of families as well as to include the perspectives of mothers and youth (Crouter et al. 2005). It should be noted that, although this article use a person-oriented technique, it still explores differences in outcomes between subgroups of individuals characterized by different patterns of behavior. Thus, our approach models intra-group change over time rather than intra-individual change across time. Models that use intensive time-series methods or the p-technique may present additional information on intra-individual variability and change (Molenaar et al. 2009).

Further, it is possible that adding fathers would enhance future work. Although mothers are often the main source of knowledge (Waizenhofer et al. 2004), it is possible that differences in patterns of father knowledge would also have implications for youths' behavior. There is some evidence that fathers' reports of specific knowledge-related behaviors may differ from mothers' (Keijsers et al. 2009) and that differences in fathers' strategies to obtain knowledge may be linked to risky behavior (Crouter et al. 2005). Adding fathers to our models would allow us to differentiate families in which parents are similar and/or differ in their knowledge-related behaviors (e.g., one parent engages in different knowledge-related behaviors than other members) and to explore how paternal perceptions of knowledge-related behaviors may map onto mother and youth perceptions. Adding fathers may allow us to more fully model the family ecology.

The present sample used is limited to youth in small towns and rural communities in two states and most are Caucasian; findings may not be generalizable to urban youth or youth in other cultural groups. The in-home sample was somewhat lower in risk than the entire community population and it is possible that high risk youth were somewhat under-represented which may have masked additional effects on problem behavior. However, rural youth are understudied, yet may be at elevated risk for problem behaviors, especially early substance use (Donnermeyer 1992) and more studies on this population are needed. Most studies on parental knowledge have been conducted on US youth living in urban or suburban areas (e.g., Barnes et al. 2006) or youth in non-US settings (Kerr et al. 2010).

Our measures of knowledge-related behaviors, while extensive, also have limitations. Our measure of youth

disclosure focuses on youth sharing their thoughts and feelings with their parents. Although this aspect of disclosure is commonly included as part of disclosure measures, this item does not specifically ask if youth are sharing information on their activities with parents without parents asking them. Thus, although our measure is highly correlated with disclosure of information, our measures may not map specifically on other knowledge work (Stattin and Kerr 2000). Our measures of supervision assess the extent to which an adult is present; they do not measure actual engagement between parents and youth. It is possible that parents in the Supervision-Focused class may be physically present but disengaged (Patterson et al. 1989). Our measures of parental supervision and parents' active efforts to monitor youth reflect youth perceptions of both parents. These behaviors are likely to occur jointly between parents but specific questions on mothers may have provided different information. Finally, some measures had moderate reliability, which may have attenuated our findings, making it more difficult to detect effects. More precise measures may have strengthened our results. Despite these limitations, our measures were comprehensive, allowing us to distinguish among the major knowledge-related behaviors identified in prior literature (Crouter and Head 2002).

Conclusions and Implications

This study takes an integrative approach to knowledge, investigating combinations of knowledge-related behaviors used in mother–youth dyads and their relationship to early adolescent problem behavior. Our findings suggest that the effects of supervision may vary depending on the broader constellation of strategies. Patterns that rely solely on supervision may be linked to delinquency, antisocial peer associations, substance use, and unhealthy attitudes towards substance (substance use expectancies). Yet, patterns that include supervision along with a mutual communication process and high levels of knowledge were not associated with increased risk. Membership in the Low Monitors classes was associated with substance use. Dyads in which mothers perceive higher levels of knowledge-related behaviors than youth also may be at risk for unhealthy attitudes towards substances. Longitudinal work is necessary to understand causal processes underlying these findings.

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Author Contributions M.L. conceived of the study, analyzed the data, and drafted the manuscript. M.G. participated in the design and conceptualization of the study, facilitated access to the data, and provided feedback on all drafts. L.C. participated in the design and conceptualization of the study, provided methodological guidance, and provided feedback on all drafts. All authors have read and approved the final draft of this manuscript.

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