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Youths' Substance Use and Changes in Parental Knowledge-Related Behaviors During Middle School: A Person-Oriented Approach

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Abstract

Parental knowledge is a key protective factor for youths' risky behavior. Little is known about how longitudinal *combinations* of knowledge-related behaviors are associated with youths' substance use. This longitudinal study uses Latent Transition Analysis to identify latent patterns of parental knowledge-related behaviors occurring in mother-youth dyads during middle school and to investigate how changes in knowledge-related patterns are associated with youths' substance use in Grade 6 and the initiation of substance use from Grade 6 to 8. Using a sample of 536 rural dyads (53% female, 84% White), we assessed mother and youths' reports of parental knowledge, active parental monitoring efforts, youth disclosure, and parent-youth communication to identify six latent patterns of knowledge-related behaviors: High Monitors, Low Monitors, Communication-Focused, Supervision-Focused, Maternal Over-Estimators, and Youth Over-Estimators. Fifty percent or more of dyads in the High Monitors, Communication-Focused and Youth Over-Estimators were in the same status in both 6th and 8th grade: 98% of Low Monitors in Grade 6 were also in this status in Grade 8. The initiation of alcohol, smoking, and marijuana was associated significantly with transitions between patterns of knowledge-related behaviors. The initiation of alcohol and smoking were associated with increased odds of transitions into the Low Monitors from the Communication-Focused, Supervision-Focused, and Maternal Over-Estimators. However, the initiation of substance use was associated with decreased odds of transitions from the High Monitors to the Low Monitors and with increased odds of transitions from High Monitors to Supervision-Focused. The discussion focuses on the value of using a person-oriented dyadic approach with multiple reporters to study changes in knowledge-related behaviors over the middle school period.

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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.

Introduction

Low levels of parental knowledge about youths' activities and whereabouts have been associated with high levels of a host of adolescent problem behaviors including delinquency, substance use, and risky sexual behavior (for a review, see Crouter & Head, 2002). Parental knowledge may emerge from several different processes, as parents and youth may both attempt to gain and manage information. Parents may seek knowledge about youths' activities by soliciting them for information or setting rules about behavior such as requiring them to check in and/or report on their activities. Alternately, parents may ensure that an adult is present to supervise youths' activities, thereby gaining knowledge through direct adult observation. Yet, parents may not always gain information from their efforts. Youth manage the information that their parents receive and choose whether or not to disclose information to their parents (Kerr, Stattin, & Burk, 2010; Soenens, Vansteenkiste, Luyckx, & Goossens, 2006). The combination of these parent and youth behaviors may lead to variability in actual parental knowledge of youths' activities and whereabouts (Fletcher, Steinberg, & Williams-Weaver, 2004; Stattin & Kerr, 2000).

This article uses a longitudinal, person-oriented approach to explore how combinations or patterns of these knowledge-related behaviors relate to substance use during the middle school period. Parents and youth are likely engaging in combinations of behaviors simultaneously. Further, parents and youth are likely to have different perceptions of knowledge-related behaviors (Lippold, Greenberg, & Feinberg, 2011). It is difficult using traditional variable-oriented methods to model patterns of knowledge-related behaviors and to integrate differences in parent and youth perspectives into the same model. Parents and youth are likely using combinations of knowledge-related behaviors and have different perspectives but these patterns may not be captured in variable-oriented models.

In this article, we take a person-oriented, dyadic approach to parental knowledge, using latent transition analysis (LTA) to model longitudinal patterns of knowledge-related behaviors used in mother-youth dyads during middle school. Our analysis integrates mother and youth reports of many knowledge-related behaviors into the same model. We also investigate the relationship between these patterns of knowledge-related behaviors and youths' substance use over the middle school period. This study builds on prior cross-sectional work that explored how patterns of knowledge-related behaviors were associated with risky behavior at the entrance to middle school (Lippold, Greenberg, & Collins, in press). This article is organized into two sub-studies. In the first study, we fit a latent transition model (i.e., patterns of knowledge-related behaviors) using reports of knowledge-related behaviors from mothers and youth when youth were in Grade 6 and 8. We also explore developmental changes in patterns of knowledge-related behaviors from Grade 6 to 8. In the second study, we confirm the construct validity of our latent status solution, exploring how youths' substance use relates to changes in patterns of knowledge-related behaviors over the middle school period.

The Need for a Person-Oriented, Dyadic Approach

Person-oriented and variable-oriented approaches have different objectives. Person-oriented approaches enable researchers to explore the effects of the whole process of obtaining parental knowledge on youth outcomes. Person-oriented methods identify subgroups of individuals in a population that use particular combinations of behaviors. Variable oriented approaches, in contrast, explore the effects of a specific variable, averaged across the sample. The goal in a person-oriented approach is not to identify which variable is the strongest predictor of an outcome, on average. Instead, the goal is to understand the patterns of knowledge-related behaviors that are related to child outcomes (Bergman, Cairns, Nilsson, & Nystedt, 2000; Bergman & Trost, 2006).

Using a person-oriented, dyadic approach may be particularly helpful when studying the behaviors in which youth and parents engage to manage information and parental knowledge about youths' activities (Lippold, Greenberg, & Collins, in press). Parents and youth are likely engaging in many knowledge-related behaviors such as parental solicitation, disclosure, supervision, and communication. It is likely that these processes are inter-related and form a system. In other words, changes in youth disclosure may lead to changes in parental attempts to solicit information and provide supervision, as well as changes in parental perceptions of the amount of knowledge that they have. Each knowledge behavior is likely not occurring in isolation in families. At the level of an individual family, there may be 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 & Trost, 2006; Lippold, Greenberg, & Collins, in press). A person-oriented, dyadic approach enables researchers to explore the effects of combinations of knowledge-related behaviors on youth outcomes.

As parents and youth may have different perceptions of knowledge-related behaviors, especially when youth are not disclosing information to their parents, it is important to capture both perspectives when modeling these patterns of knowledge processes. Some longitudinal research has reported different findings depending on the reporter (e.g., Keijsers et al, 2009; Kerr, Stattin, & Burke, 2010). For example, parents may over-estimate their knowledge and youth disclosure (Cottrell et al., 2003; Smetana et al., 2006) and such a pattern of discrepancy may be associated with high levels of problem behavior (Lippold, Greenberg, & Feinberg, 2011; De Los Reyes et al., 2010). Using a person-oriented, dyadic approach that integrates the perspectives of mothers and youth enables the identification of patterns that reflect where parents and youth agree or differ in their perceptions of some knowledge-related behaviors. This, in turn, enables exploration of how these patterns of agreement relate to risky behavior.

Many studies of parental knowledge have been variable-oriented. For example, they have explored how one knowledge-related behavior (e.g., disclosure) influences youth outcomes while controlling for other knowledge-related behaviors (e.g., solicitation) using multiple regression or structural equation approaches (e.g., Fletcher et al., 2004; Kerr, Stattin, & Burk, 2010). Variable-oriented studies have identified which knowledge-related behaviors may be the strongest predictors of risky youth behavior, and which variables predict the greatest amount of variance in outcomes. For example, findings have suggested that youth disclosure is a stronger predictor of youth outcomes than parental solicitation, spurring a new line of research centered on youth disclosure (Stattin & Kerr 2003). Variable-oriented approaches are helpful for drawing conclusions about the average effects of an isolated variable across a study population, but they do not enable researchers to model the effect of the entire knowledge process on youth outcomes. Further, variable-oriented approaches do not inform researchers about the relationships between a variable and an outcome at the individual level or, in the present study, the level of the dyad. Building on prior work and using a person-oriented, dyadic approach that integrates multiple behaviors and reporters may shed new light on knowledge-related behaviors and their longitudinal relationships to substance use over the middle school period.

Developmental Changes in Knowledge

Knowledge-related behaviors may change over the middle school period, as youth become more autonomous and independent. Parents and youth spend less time together during adolescence, making it more difficult for parents to track and supervise youths' activities directly (Larson et al., 1996). High levels of parental control may be viewed as a threat to an adolescents' growing sense of autonomy (Marshall & Chassin, 2000). Only a few studies have explored how knowledge-related behaviors change over time. These studies suggest

that parental control, youth disclosure, and parental knowledge may decline during the adolescent period (Keijsers et al., 2009; Kerr, Stattin, & Burke, 2010). The patterns of change in specific knowledge-related behaviors may vary depending on who is reporting the behavior. Keijsers et al. (2009) found that adolescents reported a steady decrease in disclosure from age 13–16. However, fathers report a L-shaped pattern of sudden decline in disclosure whereas mothers report a more V-shaped pattern in which decreases in disclosure were followed by increases. Similarly, Keijsers et al. (2009) found significant changes in parental solicitation across adolescence based on mothers' reports but not based on adolescents' and fathers' reports. These findings suggest that different family members may have distinct perspectives on how a specific knowledge-related behavior may change over time.

Knowledge-Related Behaviors and Risky Behavior

Longitudinal studies have begun to identify the effects of specific knowledge-related behaviors on youths' substance use and other problem behaviors over time. These studies suggest that parent, youth, and joint knowledge-related behaviors all may be protective against substance use (Barnes et al., 2006; Fletcher et al., 2004). Most of these studies explore how parental knowledge at one time predicts subsequent changes in substance use. For example, Barnes et al., (2006) found that parent knowledge of youths' activities predicted both the initial level and increases in substance use over time. It should be noted that, although recent longitudinal studies have found strong evidence that youth disclosure may be a stronger predictor of youth delinquency than parental solicitation (Kerr, Stattin, & Burk, 2010; Keijsers et al., 2009, 2010), this relationship has yet to be tested adequately for youths' substance use.

Fully understanding the relationship between risky behavior and knowledge-related behaviors requires models that analyze repeated data on parents and youth over time. Yet, most longitudinal studies explore how knowledge-related behaviors predict changes in problem behavior or how problem behavior predicts changes in knowledge-related behaviors (e.g., Kerr and Stattin, 2003; Fletcher et al., 2004). In fact, only one study, to our knowledge, has explored how changes in knowledge-related behaviors relate to substance use over time. Tobler & Komro (2010) identified 4 knowledge trajectories: high, medium, decreasing, inconsistent. Youth in the decreasing knowledge trajectory were more likely to report substance use in Grade 8 than those in the High Trajectory (grade 6–8).

Early Adolescence

Early adolescence is an important time to study parental knowledge for two reasons. First, early onset of substance use has been linked to cumulative, long term consequences such as adult alcohol disorders and more severe drug use (DeWit et al., 2000; Grant & Dawson, 1997). Youth at the greatest risk for developing lifetime alcohol disorders are those who begin using substances between the ages of 11 and 14 (Dewit et al., 2000). Thus, understanding the relationship between knowledge-related behaviors and substance use during early adolescence has important implications for prevention efforts. Second, studying knowledge-related behaviors during early adolescence allows us to understand changes in knowledge during the emergence of substance use. Parents and youth may decrease knowledge-related behaviors during early adolescence for positive or negative reasons. For example, Coercion theory (Patterson et al., 1989) posits that parents may reduce supervision or solicitation of information in the presence of problem behavior, as they may perceive their efforts to be ineffective (Bandura, 2001) or to avoid confrontation with youth (Granick & Patterson, 2006). In contrast, some reductions in knowledge-related behaviors may occur in response to positive youth behavior. Parents of youth who are not engaging in problem behavior may reduce supervision and solicitation because they perceive their youth to be

trustworthy and responsible. In this context, reductions in specific knowledge-related behaviors may be a parent's attempt to allow youth more autonomy. Thus, early adolescence is an important time to study the knowledge process, as it allows us to investigate how initial changes in youth behavior may be linked to changes in knowledge-related behaviors over time (Pettit & Laird, 2002).

This Study

This article explores the relationship between combinations of knowledge-related behaviors and early adolescent substance use over the middle school period. In the first study, we use Latent Transition Analysis (LTA) to identify *combinations* of knowledge-related behaviors used in mother-youth dyads when youth are in the sixth and eighth grade. Both mothers' and youths' reports of knowledge-related behaviors are integrated into our models, allowing us to capture important differences in their perceptions. Then, we explore how combinations of knowledge-related behaviors (statuses) change over the middle school period. In the second study, we investigate how youths' substance use is associated with changes in these knowledge statuses over time. Because we begin our analysis in 6th grade, before most youth begin engaging in substance use, our analysis allows us to explore the specific role of the initiation of substance use during the middle school period.

Our knowledge latent statuses are formed using measures of active parental efforts to monitor youth, supervision, maternal knowledge, youth disclosure, and maternal-youth communication. We use youths' and mothers' reports of the following knowledge-related behaviors in our models: parent active efforts to monitor youth (where parents ask youth for information), supervision (where parents or another adult are present to observe youth behaviors), parental knowledge (what parents know about youths' activities), youth disclosure (the information youth share with their parents), and the amount of communication occurring between parents and youth. 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 & Head, 2002).

Study 1: Modeling Knowledge Latent Statuses

Method

Plan of Analysis—We use Latent Transition Analysis (LTA) to identify patterns of knowledge-related behaviors during early adolescence. Latent Transition Analysis identifies latent subgroups (i.e., latent statuses) in a population based on responses to a set of observed categorical items. Similar to factor analysis, LTA accounts for measurement error (for full descriptions of LTA see Collins & Lanza, 2010). LTA also estimates patterns of change in these latent statuses over time, by estimating the proportion of dyads that move between latent statuses over time. Mothers' and youths' reports of our knowledge constructs in 6th and 8th grade were used to identify our latent statuses and were dichotomized to indicate high or low levels of behaviors based on a median split at 6th grade. We chose to dichotomize our measures because many of our knowledge measures were skewed, with pronounced ceiling or floor effects that could not be corrected by statistical transformations. Therefore, categorical analysis may be more appropriate than latent profile analysis, which uses continuous variables, but assumes normality (Collins & Lanza, 2010; Feldman, Masyn, & Conger, 2009; Steinley & Brusco, 2011). We chose to dichotomize our variables at the median in Grade 6 in order to maintain consistency in the meaning of our latent classes at both time points. Because Latent Transition Analysis is primarily an exploratory technique,

researchers typically do not generate a priori hypotheses about the specific latent status solution.

Study Design and Participants—This study includes 536 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 the initiation of substance use among rural adolescents (see Spoth, Greenberg, Bierman, & Redmond, 2004). Participants in PROSPER resided in 28 rural communities and small towns in Iowa and Pennsylvania . The PROSPER project involved youth from two successive cohorts of sixth graders who 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 selected and recruited randomly 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. 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. As recommended by Collins & Lanza (2010), all cases with missing data on covariates were deleted for this analysis because although a FIML missing data procedure is available for LTA, it does not extend to models with covariates. Therefore, the current study includes data from 536 youth and their mothers who had complete data on the covariates at in the Fall of Grade 6 (Mean age = 11.9, SD = .47) and in the Spring of Grade 8 (Mean age = 13.9, SD = .50).

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, or gender. In addition, no significant differences were found between groups in the initiation of substance use. 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): $F(1, 27) = 12.36$, $p < .01$).

Maternal knowledge and parenting measures were gathered from in-home data collection. Because previous research suggests that youth are more likely to report the initiation of substance use initiation and delinquency if asked in school, rather than home settings, we use PROSPER in-school data for our measures of youth initiation of substance use and delinquency (Redmond, Schainker, Shin, & Spoth, 2007); these measures were gathered within months of the home visit. At Wave 1, the mean age of the youth is 11.3 years (SD=.49); the mean age of their mothers is 38.7 (SD=6.05). 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. Most youth 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. Forty-seven percent of the youth in our sample were male and 53% were female. There were no significant differences between the in-home sample and the in-school sample on any of these demographic variables.

Our study uses a sample of early adolescents residing in rural communities and small towns, an at-risk but understudied population (Donnermeyer, 1992; Johnston et al. 2005). We focus our study on youths' reports of their relationships with their mothers, as mothers are often the main source of parental knowledge in families (Waizenhofer, Buchanan, & Jackson-Newsom, 2004). Thus, our models include youths' and mothers' reports of maternal knowledge, youth disclosure to mothers, and communication between youth and their mothers. Our measures of parental supervision and parent active efforts to monitor youth reflect youths' perceptions of both parents, because these behaviors are likely to occur jointly between parents.

Measures—All items were adapted from the Iowa Youth and Families Project (Conger, 1989; McMahon & Metzler, 1998; Spoth, Redmond, & Shin, 1998). All items in parental knowledge scales were recoded so that higher scores indicate higher levels of each construct. Alphas are reported when youth were in Grade 6 (G6) and Grade 8 (G8).

Maternal knowledge of youth activity: Maternal knowledge is defined as the extent to which mothers are aware of the location and activities of youth. Mothers' and youths' perceptions of maternal knowledge were measured using comparable five-item Likert-type items [1=always to 5=never]. For example, mothers 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. Youth were asked about their mothers' knowledge using the same items written from the youth perspective (e.g., "In the course of a day, how often does your mom know where you are?"). The Cronbach alpha for the scale (G6/G8) was .67/.71 for mothers' reports and .69/.86 for youths' reports.

Parental active efforts to monitor: We define active efforts as mother-driven attempts to solicit information from youth or track youths' activities. Mothers' and youths' perceptions of parental efforts 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 (to parties, movies, etc.)". Youth were asked the same questions about their parents. The Cronbach alpha for the scale (G6/G8) was .66/.66 for mothers' reports and .69/.79 for youths' reports.

Parental supervision: We define parental supervision as whether or not a parent or another adult is present to observe youths' activities. Mothers were asked to rate how often (1) Is an adult home when our youth gets home from school and (2) Does your youth get home from school before either you or your partner are home. Youth were asked the same questions about their parents [1= always to 5 = never]. The Cronbach alpha for the scale (G6/G8) was .81/.84 for mothers' reports and .73/.78 for youths' reports.

Youth disclosure: We define youth disclosure as youth decisions to share their thoughts and feelings with their mother. Youth disclosure is measured with one item. 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 & 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: The amount of communication between mothers and youth is defined as the frequency with which mother and youth report discussing daily activities without specifying the initiator of such conversation. The mother scale has 8 items and the youth scale has 4 items. Items assess how often mothers and youth talk about what is going on in their life, plans for the day, and the youths' school work. For example, mothers were asked "How often do you talk to this child about what is going on in his/her life?". Youth were asked similar questions (e.g., "How often does your mother talk to you about what is going on in your life?"). All items are on 1–4 Likert-type scales where a low score indicates infrequent communication (e.g., "never). The Cronbach alpha for the scale (G6/G8) was . 74/.78 for mothers' reports and .71/.76 for youths' reports.

Results

Model Identification—A six status solution was chosen as the best fitting model. Using SAS Proc LTA (Collins & Lanza, 2010), we tested a series of models with one to seven latent statuses 100 randomly selected starting values (See Table 1). The final model was chosen based on fit statistics and conceptual clarity. We used the AIC (Akaike Information Criterion; Akaike, 1987) and the BIC (Bayesian Information Criterion; Schwarz, 1978) to assess model fit (Coffman et al., 2007). The five status model had the lowest BIC but the six status model had the lowest AIC (See Table 1). We chose the six status model because it had a clearer conceptual meaning and more distinct latent statuses than the five status model. Item response probabilities that are very high or low are most useful for determining differences between latent statuses (Collins & Lanza, 2010). The six status model also contained all statuses that were identified when conducting latent class analysis on Grade 6 and 8 data separately (analysis not shown). As recommended by Collins & Lanza (2010), we imposed measurement invariance in our models across time to aid in interpretation of our results.

Final LTA Model—Our final LTA model contains six knowledge latent statuses termed: High Monitors, Communication-Focused, Supervision-Focused, Maternal Over-Estimators, Youth Over-Estimators, and Low Monitors (See Table 2). Table 2 identifies two types of model parameters; the probability of membership in each knowledge latent status and item response probabilities. Membership probabilities indicate the proportion of the sample estimated to be in each knowledge latent status at both time points and range from 0 to 1. For example a membership probability of .6 would indicate that 60% of dyads are estimated to belong to that particular latent status. Item response probabilities indicate the probability that a mother-youth dyad will be above the median in a knowledge-related behavior given membership in a specific knowledge latent status. Item response probabilities also range from 0 to 1. For example, an item response probability of .75 would indicate a 75% chance that mother-youth dyads in a particular latent status are above the median in a particular behavior (e.g., supervision).

High Monitors (24% at Time 1 and 18% at Time 2): Mothers and youth report a high probability (.70 or greater) of being above the median on all knowledge-related behaviors.

Communication-Focused (19% at Time 1 and 12% at Time 2): Dyads in this status report a high probability of being above the median in youth disclosure, solicitation, and communication (above .72 for these knowledge behaviors). However, mothers and youth are both likely to report low levels for supervision (only .18 based on youths' report and .23 based on mothers' report). This pattern of item response probabilities suggests that Communication-Focused dyads have high amounts of knowledge and active communication that includes both parental efforts to gain information and youth sharing of information.

Supervision-Focused (31% at Time 1, 20% at Time 2): Supervision-Focused dyads report a high probability of being above the median on supervision (.89 for youths' report and .98 for mothers' report). However, these dyads are likely to report low levels of all other knowledge-related behaviors. For example, the probability that youth in this status are above the median in disclosure is only .23.

Maternal Over-Estimators (16% at Time 1, 10% at Time 2): In these dyads, mothers report a higher probability of being above the median than youth for all knowledge-related behaviors. For example, the probability of being above the median in active parental efforts is .80 based on mothers' reports but only .39 based on youths' reports. We label them Maternal Over-Estimators as mother's perceptions of knowledge-related behaviors are higher than youths' perceptions.

Youth Over-Estimators (5% at Time 1, and 18% at Time 2): are dyads in which youth report a higher probability of high knowledge-related behaviors than do their mothers. For example, the probability that youth will report mothers are above the median in knowledge is .89 whereas for mothers it is only .36. We label them as Youth Over-Estimators as mothers have perceptions of lower knowledge-related behaviors than youth.

Low Monitors (7% at Time 1 and 21% at Time 2): report a low probability of being above the median on all knowledge-related behaviors regardless of reporter. These dyads are characterized by a low probability of having high levels of all knowledge-related behaviors, with most item-response probabilities below .25. The probability that mothers and youth will report high levels of active parental efforts and disclosure are close to zero.

Transitions Between Latent Statuses—Transition probabilities represent the probability that an individual in a latent status at Time 1 will be in particular latent status at Time 2 (See Table 3). Transition probabilities located along the diagonal of the transition matrix indicate the proportion of individuals in a latent status at both 6^{th} and 8^{th} grade. For example a diagonal probability of .50 would indicate that half of the dyads in this status at Time 1 were also in this status at Time 2. Transition probabilities off the diagonal indicate dyads that change to a new latent status between Grade 6 and 8.

Dyads in three latent statuses are likely to be in the same status in 6^{th} and 8^{th} grade (See Table 3). Ninety-eight percent of dyads in the Low Monitors Status in 6^{th} grade are in the same status in 8^{th} grade. Sixty-eight percent of Youth Over-Estimators are also in the same status at both time points (26% percent transition to Low Monitors). The majority of High Monitors in Grade 6 (57%) are in the same status at Grade 8 (19% transition to Supervision-Focused, 11% to Low Monitors and 10% to Communication-Focused).

However, more than half of dyads in three other statuses transition to a new status between Grade 6 and 8. Only half of the dyads in the Communication-Focused status in Grade 6 are also in this status at Grade 8 (31% transition to Youth Over-Estimators and 14% transition to the Low Monitors). Forty-six percent of dyads in the Supervision-Focused status are in the same status at both time points (22% transition to Low Monitors, 13% to Youth Over-Estimators, and 11% to High Monitors). Only 36% of Maternal Over-Estimators in 6^{th} grade are in the same status in 8^{th} grade: 27% transition to Low Monitors, 19% to Youth Over-Estimators, and 10% to Supervision-Focused. There is a substantial increase in Low Monitors over time. Between 11 and 27 % of youth from other statuses in Grade 6 transition to Low Monitors by Grade 8.

Summary of Findings From Study 1—The latent transition model identified six latent statuses of knowledge: High Monitors, Communication-Focused, Supervision-Focused,

Maternal Over-Estimators, Youth Over-Estimators, and Low Monitors. More than half of the dyads in the Low Monitors, Youth Over-Estimators, and High Monitors in Grade 6 were in the same status in Grade 8.

Study 2: Youths' Substance Use and Latent Status Transitions

Method

Plan of analysis—In Study 1, we identified a latent transition model for knowledge-related behaviors. Here, we explore the construct validity of our identified latent statuses by exploring whether they are predictive of youth behavior. If our latent statuses predict youth behavior, it increases our confidence that the model is valid (Collins & Lanza, 2010). We used multinomial logistic regression to explore how youths' substance use was associated with changes in patterns of knowledge over time (e.g., transitions between latent statuses). In our models, substance use was conceptualized as a predictor of change in latent statuses over time (Collins & Lanza, 2010). We use two types of predictor variables: 6^{th} grade levels of substance use and the initiation of substance use between 6^{th} and 8^{th} grade. We chose to use these two types of predictors as they addressed slightly different research questions. Using 6^{th} grade behavior as a covariate allowed us to explore if early substance use predicts changes in knowledge statuses two and a half years later. We also investigated if beginning to use substances (e.g., substance use initiation) predicted changes in knowledge statuses. From a prevention standpoint, this analysis enabled us to isolate youth who began using substances prior to 6^{th} grade from those who initiated use during middle school.

Transition Patterns—We focus our discussion on transitions experienced by at least 10 dyads. In order to estimate the approximate number of dyads making a particular transition, we multiplied the proportion of youth in a particular latent class at Time 1 by the tau matrix probability and the sample size.

Measures—All items were adapted from the Iowa Youth and Families Project (Conger, 1989; McMahon & Metzler, 1998; Spoth, Redmond, & Shin, 1998).

Substance Use Initiation: In both Grade 6 and 8, three items were used to assess if youth had ever drunk more than a few sips of alcohol, smoked a cigarette or smoked marijuana[0=no; 1=yes]. Youth were coded as initiating substances if they had not used a substance in Grade 6 but had used the substance in Grade 8. No use was the reference group for this analysis. To examine the initiation of substance use, two dummy coded variables were created: one to indicate beginning to use substances between sixth and eighth grade and a second to indicate use at both time points (with no use as the reference group). Twenty-six percent of the sample initiated alcohol use between Grade 6 and 8, 13% initiated smoking, and 7% initiated marijuana. It should be noted that we focus our results and discussion sections on the effects of the initiation of substance use on knowledge transitions. We included a variable to capture use at both time points in order to isolate the specific effects of the initiation of substance use and to compare initiators with those who do not use substances during this time period. However because 5% or less of the sample used marijuana and cigarettes at both time points, they are not the foci of this article, and the results for use at both time points are not shown.

Results

We compared two nested models to test the significance of our predictor variables. First, we ran a model where 6^{th} grade substance use and control variables were entered as predictors of the initial knowledge status (e.g., which status the dyad belonged to in the 6^{th} grade). Next, we added one of our predictor variables to model the transition between latent statuses

(e.g., 6th grade level of substance use or substance use initiation variable). We then tested the difference between these two models. A variable was a significant predictor of latent status transitions if the difference in the fit of the models (2* log likelihood) was significant based on the chi-square distribution (Collins & Lanza, 2010). The difference in model fit was significant for one control variable: dual biological marital status (chi square difference =38.64, df=20, $p < .001$) but not for parent education or condition. The difference in model fit was also significant for our three indices of the initiation of substance use between Grade 6 and 8 (for the initiation of drinking chi-square difference=146.16, df=37, for smoking cigarettes chi-square difference = 142.6, df=37, $p < .001$, and for smoking marijuana chi-square difference = 79.60, df=37, $p < .001$). No significant differences were found for sixth grade indicators of substance use. Because our data was from an intervention study, we also included condition as a control variable in all of our models, even though it was not a significant predictor of transitions.

Each multinomial model estimates an odds ratio, which indicates the change in the likelihood of transitioning to a new latent status (relative to a reference status), given an increase in the covariate (See Table 3). For all analysis, the reference status is dyads that are in the same latent status at both time points (e.g., High Monitor in Grade 6 and 8). Odds ratios greater than 1.0 indicate an increased odds of transitioning into new a latent status relative to being in the same status in Grade 6 and 8, while odds ratios less than one indicate decreased odds of transitioning to a new status. A separate model was run for each predictor variable. In addition, ten of our model parameters could not be estimated by multinomial logistic regression because the transition probabilities were estimated to be zero. As recommended by Collins and Lanza (2010), we fixed these model parameters to zero (and odds ratios to 1.00) in all of our multinomial models.

Odds Ratios for Substance Use Initiation—All indicators of the initiation of substance between Grade 6 and 8 were related significantly to transitions between knowledge latent statuses from Grade 6 to 8, after controlling for sixth grade substance use. Table 4 presents the odds ratios for latent status transitions relative to the reference group (i.e., membership in the same latent status at both time points) for transitions experienced by more than ten dyads. For example, the odds of transitioning from the High Monitors to Communication-Focused (relative to membership in the same status at both time points) is .67 for the initiation of alcohol use and .36 for smoking (See Table 4). Proc LTA has the capacity to test the significance of overall covariates, however not the significance of each individual odds ratio. Therefore, instead of testing specific hypothesis about transitions, we discuss overall patterns observed in the data.

Patterns of Transitions

High Monitors to Communication-Focused: The initiation of alcohol use, smoking and marijuana were associated with decreased odds of transitions from the High Monitors status to Communication-Focused relative to membership in the same status (OR = .67, .36, .10 respectively).

High Monitors to Supervision-Focused: The initiation of alcohol and smoking was associated with increased odds of transitions from High Monitors to Supervision-Focused (OR = 3.54, 29.32), but the initiation of marijuana demonstrated the opposite pattern (OR = .46).

High Monitors to Low Monitors: The initiation of substance use was associated with decreased odds of transitions from High Monitors to Low Monitors (OR = .32 for alcohol, .26 for smoking, .15 for marijuana).

Communication-Focused to Youth Over-Estimators: The initiation of alcohol and marijuana was associated with increased odds of transitions from Communication-Focused to Youth Over-Estimators, relative to remaining in the same status (OR = 2.09, 1.11). However the initiation of smoking was associated with decreased odds of this transition (OR= .69).

Communication-Focused to Low Monitors: All odds ratios were greater than one. For example, youth who initiated smoking between Grades 6 and 8 were 3.73 times more likely to transition from the Communication-Focused to Low Monitors than those who did not initiate smoking during this time period, relative to membership in the same status (OR = 32.47 for alcohol, 3.73 for smoking, and 26.02 for marijuana).

Supervision-Focused to High Monitors: The initiation of alcohol, smoking, and marijuana use were all associated with lower odds of transitioning from Supervision-Focused to High Monitors, relative to membership in the same status (OR = .73, .60, .04, respectively).

Supervision-Focused to Youth Over-Estimators: The initiation of alcohol, smoking, and marijuana were associated with decreased odds of this transition (OR = .60, .08, .27 respectively).

Supervision-Focused to Low Monitors: The initiation of alcohol and smoking were associated with increased odds that a dyad would transition from the Supervision-Focused status to Low Monitors, relative to membership in the same status (for alcohol OR = 4.13 and for smoking OR = 1.81). However, the initiation of marijuana was associated with lower odds of transitions into the Low Monitors from Supervision-Focused (OR = .82).

Maternal Over-Estimators to Supervision-Focused: The initiation of marijuana was associated with odds ratios greater than one (OR = 3.40). However, the initiation of smoking and drinking had the opposite pattern, with increases in smoking and drinking associated with lower odds of transitions from Maternal Over-Estimators to Supervision-Focused (for alcohol OR = .11, for smoking OR = .90)

Maternal Over-Estimators to Youth Over-Estimators: Initiation of alcohol, smoking and marijuana was associated with lower odds of transitions from Maternal Over-Estimators to Youth Over-Estimators, relative to remaining in the same status (OR = .31, .09, .29 respectively)

Maternal Over-Estimators to Low Monitors: Relative to membership in the same status, the initiation of substance use was associated with increased odds of transitioning to Low Monitors (for alcohol OR = 1.67, for smoking OR = 1.12, for marijuana, OR =2.66). In fact, youth who initiated alcohol were 1.67 times more likely to make this transition than youth who did not initiate alcohol, relative to membership in the same status.

Summary of Study 2—The initiation of substances was a significant predictor of latent status transitions, increasing confidence in the construct validity of the latent status model. The initiation of alcohol and smoking was associated with increased odds of transitions into Low Monitors from Communication-Focused, Supervision-Focused and Maternal Over-Estimators. Transitions from High Monitors to Low Monitors demonstrated the opposite pattern (OR < 1). Sixth grade levels of substance use were not a significant predictor of latent status transitions.

Discussion

Low levels of parental knowledge have been identified as an important risk factor in the prevention of early adolescent problem behaviors, such as substance use and delinquency (Crouter & Head, 2002). The goal of this longitudinal study was three fold. First, we identified patterns of parental and youth knowledge-related behaviors used in middle school integrating the perspectives of mothers and youth. Second, we explored explore developmental changes in these patterns of knowledge-related behaviors over the middle school period. Lastly, we investigated how substance use relates to changes in these patterns of knowledge behaviors. By integrating multiple behaviors from multiple perspectives into the same model, this study aimed to model the effects of the whole knowledge process on youth outcomes.

The Contribution of a Person-Oriented Dyadic Approach

Using a person-oriented, dyadic approach with both mothers' and youths' reports provided new insights into patterns of knowledge-related behaviors used in dyads. Our analysis revealed six distinct patterns: High Monitors, Communication-Focused, Supervision-Focused, Maternal Over-Estimators, Youth Over-Estimators, and Low Monitors. Although some dyads showed all high or low rates of multiple knowledge-related behaviors, other dyads engaged in only some knowledge-related behaviors and not others. For example, Communication-Focused dyads engaged in all behaviors except supervision, while Supervision-Focused dyads used high rates only of supervision strategies. Two patterns emerged in which youth and mothers had quite different perceptions: Maternal Over-Estimators (where mothers perceived higher levels of knowledge related behaviors than youth) and Youth Over-Estimators (where youth perceived higher levels of knowledge than mothers).

The approaches, which are reported here complements findings from variable oriented approaches which suggest that youth disclosure is the strongest predictor of youth problem behavior, on average when holding other variables, such as solicitation, constant (Crouter & Head, 2002). In dyads where mothers and youth had concordant perceptions of many knowledge-related behaviors, disclosure often co-occurred with high levels of knowledge and with behaviors such as parental attempts to solicit information. In this way, youth disclosure was part of a larger patterning of behaviors and may reflect a mutual communication pattern that includes a wide array of behaviors. Our analysis suggests that it may be the entire system of knowledge-related behaviors that may afford risk or protection against problem behavior.

Developmental Changes in Patterns of Knowledge-Related Behaviors

This study also revealed new information on changes in patterns of knowledge related behaviors over time. Many dyads remained in the same latent status both in Grade 6 and 8. Fifty percent or more of dyads in the High Monitors, Communication-Focused and Youth Over-Estimators were in the same status in both 6^{th} and 8^{th} grade. The Low Monitors were incredibly stable, with 98% of dyads in this status in Grade 6 and Grade 8. Thus, even though adolescents may face significant developmental changes over middle school (Steinberg, 2001), many dyads may not change their patterns of behaviors to adapt to these differences. Yet, membership in the same latent status at both time points may not always be positive. The high percentage of dyads in the Low Monitors at Grade 6 that are also Low Monitors in Grade 8 suggests that once dyads disengage from all knowledge-related behaviors, they are not likely to increase behaviors later.

The patterns of change confirmed some findings from variable-oriented studies. All of the statuses where either youth or mothers report high levels of parent active efforts to monitor decrease in prevalence (High Monitors, Communication-Focused, Maternal Over-Estimators), as did the statuses with high levels of Supervision (Supervision-Focused, High Monitors, Maternal Over-Estimators). These findings suggest that parental efforts to actively monitor youth may decline, on average, over the middle school transition. These reductions may reflect normative attempts to grant youth more autonomy during this developmental period and reductions in the time parents and youth spend together (Collins & Laursen, 2006; Larson et al., 1996).

However, using the LTA approach revealed that not all dyads report such declines. For example, one transition reflected increases in both youths' and mothers' reports of many knowledge-related behaviors, including communication, knowledge, and youth disclosure: 11% of dyads in the Supervision-Focused status became High Monitors. Other dyads showed decreases only in some knowledge-related behaviors but not others. For example, 10% of High Monitors transitioned to Communication-Reliant, decreasing only supervision. Thus, whether or not knowledge behaviors increase during middle school may be related to the specific combinations of other knowledge-related behaviors that co-occur, highlighting the unique contribution a person-oriented, dyadic approach.

Latent Statuses and Substance Use

The latent status model had clear associations with the initiation of substance use. Yet, the temporal ordering of our variables is unknown. It is possible that initiating substances causes changes in patterns of knowledge, a child-effects model. Alternatively, it is possible that changes in patterns of knowledge-related behaviors influence whether youth begin using substances, a parent-effects model. It is likely that these findings represent a reciprocal process where parents and youth are influencing one another over time. We will discuss all of these possible interpretations.

The initiation of substance use was associated with increased odds of transitions into the Low Monitors from three other statuses (Communication-Focused, Supervision-Focused, and the Maternal Over-Estimators). This finding may suggest that reducing all knowledge-related behaviors may place youth at risk for initiating substance use. It is possible that reducing one knowledge behavior may be related to reductions in others. For example reductions in parent-child communication may lead parents to solicit information less often and for both parents and youth to feel parents have little knowledge of youths' activities. The combination of these changes may reduce youths' access to their parents for advice or support about decisions regarding risky behaviors, and increase risk of using substances. However, from a child-effects perspective, these changes may emerge in response to youths' risky behavior (Patterson et al., 1989); that is, youth who engage in substance use may begin to withhold information from their parents, which may lead parents to reduce efforts to monitor, and result in lower knowledge.

Yet, not all transitions into the Low Monitors status were associated with increased risk of initiating substance use. The initiation of substance was associated with decreased odds of transitions from High Monitors to Low Monitors, relative to membership in the same status, suggesting that High Monitors were more likely to continue to use the same strategy after youth initiate substances than to change to Low Monitors. These findings may contradict some prior research, which suggests low levels of disclosure may be associated with increased risky behavior (Stattin & Kerr, 2000). Our findings suggest that declines in youth disclosure and communication may not be negative if youth experienced high levels of all other knowledge-related behaviors two years earlier. There are several possible explanations for this finding. From a child-effects perspective, parents may be granting youth more

autonomy and reducing all monitoring behaviors because they believe their youth are not going to use substances and that youth are capable of increased independence. From a parent-effects perspective, youth in the High Monitors status in Grade 6 may have already internalized positive norms and values from their parents (Catalano & Hawkins, 1996) and this may have led to the selection of prosocial peers earlier in middle school, both of which may protect youth from risky behavior two years later, even if knowledge-related behaviors are reduced. It should be noted that the initiation of substance use reduced the odds of transitions only from High Monitors to Low Monitors, not from other statuses. Therefore whether or not reductions in all knowledge-related behaviors are positive may depend on the particular constellation of knowledge behaviors used at both time points, again highlighting the importance of understanding the overall pattern of knowledge-related behaviors rather than focusing on a single variable.

The analysis also shed new light on the effects of supervision, as the association between supervision and substance use varied based on the constellation of other knowledge-related behaviors used in dyads. The initiation of drinking and smoking were linked to a greater likelihood of transitions from the High Monitors to Supervision-Focused, which implies lower levels of communication, solicitation, and disclosure while still maintaining high amounts of supervised time. This may suggest that supervision may be most effective when it co-occurs with other knowledge-related behaviors and that supervision, in the absence of other strategies, may not be as effective at preventing youth from engaging in substances. Or, from a child-effects perspective, it may suggest that parents may disengage from communication in response to youths' risky behavior but are not likely to reduce their efforts at supervision. Yet, supervision, as measured here, may not be necessary to ensure healthy development. The initiation of substance use was associated with decreased odds of transitions from High Monitors to Communication-Focused, a transition that reflects reductions in supervision but maintaining high levels of all other behaviors. Positive youth behavior may lead parents to have a higher level of trust in youth, and a belief that youth who are not likely to be engaging in substances do not need to be closely supervised (Kerr, Stattin, & Trost, 1999). This finding suggests that the effects of supervision may vary depending on the characteristics of the overall pattern of parent and child behaviors.

The Importance of Including Multiple Perspectives

By integrating the perceptions of mothers and youth into the same model, two patterns were identified where youth and mothers had different perceptions of knowledge-related behaviors: Maternal Over-Estimators and Youth Over-Estimators. The Maternal Over-Estimators, in which mothers reported higher levels of all knowledge-related behaviors than youth, decreased in prevalence from Grade 6 to 8, suggesting that maternal overestimation of knowledge-related behaviors may become less common as youth age. This is important, as maternal overestimation of knowledge has been identified as a risk factor for early problem behavior (De Los Reyes et al., 2010; Lippold, Greenberg, & Feinberg, 2011). Twenty-five percent of dyads in the Maternal Over-Estimators status transition to Low Monitors, becoming concordant in their low perceptions of knowledge over time: this transition was associated with increased risk of substance use.

In contrast, mothers in the Youth Over-Estimators status reported lower levels of many knowledge-related behaviors than did their youth. Mothers in the Youth-Over Estimators status may feel ineffective at obtaining knowledge or they may be likely to trust information when communication is youth-, rather than parent-, initiated. Whether or not transitions into the Youth Over-Estimators status were protective depended on the membership status in sixth grade. For example, substance use initiation was associated with decreased odds of transitions from the Maternal Over-Estimators and Supervision Focused statuses to the Youth Over-Estimators status. This finding may suggest that increases in youths'

perceptions of knowledge-related behaviors may be protective against substance use, even if mothers do not have similar high perceptions. However, initiating alcohol and marijuana was associated with increased odds of transitions from the Communication-Focused status to the Youth Over-Estimators. Therefore, concordant views of high communication, knowledge, and monitoring may be more protective against substance initiation than discordant views, even when youth perceive high levels of many knowledge-related behaviors. Using a person-oriented, dyadic approach allowed us to capture important differences in perspectives of youth and mother and to integrate both of them into the same model.

Differences in Findings by Substance and Timing

There were some inconsistent findings in which, the initiation of some substances exhibited different relationships to latent status transitions than did others. Differences in our findings may reflect differences in risk processes between drinking, smoking, and marijuana. Drinking becomes more normative over this period and may be indicative of a lower level of risk than other substances. Also, it is possible that smoking either cigarettes or marijuana is more noticeable to parents, especially if they are physically present to smell it.

The lack of significant findings for sixth grade levels of substance use warrants further discussion. Sixth grade levels of alcohol, smoking, and marijuana did not predict changes in knowledge over the middle school period. It is possible that more closely spaced measures of our variables would have resulted in different or stronger associations (Collins, 2006). However, the strong associations with our initiation variables suggest that it is not original levels of substance use, but increases in behavior that may be linked to changes in knowledge-related behaviors. Simultaneous change models, such as Associative Latent Transition Analysis, may be also helpful for exploring these processes more distinctly (Bray, Lanza, & Collins, 2010). Longer studies would be needed to explore these questions more thoroughly.

Limitations, Strengths, and Future Directions

The latent transition approach used here has limitations and strengths. As recommended by Collins & Lanza (2010), all cases with missing covariates were deleted from our analysis, reducing the sample size and potentially influencing the findings. LTA also required the use of categorical variables; therefore how the variables were dichotomized may have influenced these findings. Currently available software has the capacity to test the significance of overall covariates, however not the significance of each individual odds ratios, limiting our ability to calculate effect sizes for a particular transition. Further, the odds ratios for three of our transitions were quite large. Because these odds ratios were based on a small number of individuals, the large estimates may reflect large standard errors. Our findings should be considered in light of these limitations. However, LTA permitted us to take a unique approach to understanding parental knowledge by exploring differences in subgroups of dyads using combinations of knowledge-related behaviors. Rather than focusing on a specific variable, LTA enabled us to include several knowledge-related behaviors into our models, as well as the perspectives of mothers and youth. Thus, LTA allowed us to take a more integrated approach to understanding parental knowledge.

Latent transition analysis creates statuses specific to our sample. Study participants are from 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. This 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. It is also possible that the intervention affected family processes in ways

that were not captured in these analyses, even when controlling for intervention condition. Even though statistical tests revealed there were no associations between condition and latent status transitions, fitting these models on a sample that did not receive an intervention may improve the generalizability of our findings. Viewed from a different perspective, the rural nature of the sample is a notable strength. This study sheds light on the patterns of knowledge used in rural families, a population that may be at elevated risk for early substance use but that is relatively understudied (Donnermeyer, 1992; McIntosh et al., 1979). Most studies on parental knowledge have been conducted on American youth living in urban areas (e.g., Laird et al., 2010), mid-size towns or suburbs (e.g., Barnes et al., 2006) or youth in non-U.S. settings (Kerr, Stattin, & Burk, 2010). Replicating this analysis on different youth populations will determine whether these latent statuses are generalizable to other study populations.

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 without parents asking them. Thus, although our measure is highly correlated with disclosure of information, our measures may not map specifically on to other knowledge work (Stattin and Kerr, 2000). Our measures of supervision focus on whether or not an adult is present at home; they do not specifically capture whether youth are being supervised while the adult is present. Even though similar items have been used as part of prior supervision measures (Laird et al., 2010; Pettit et al., 1999), it is possible that some adults that are home will not notice what activities youth are engaging in. Some of our measures have a small number of items (e.g., disclosure and supervision) and some measures have only moderate reliability, especially in sixth grade, which may have attenuated some of our findings. Some of our measures ask youth about both parents; it is possible that different results would be found had all of the questions focused on relationships between youth and mothers specifically. Future work should be expanded to include the perspective of fathers, which would provide a more comprehensive model of the family ecology (Crouter, Bumpus, Davis, & McHale, 2005). 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 identify families in which mothers and fathers are similar and/or differ in their knowledge-related behaviors (e.g., one parent engages in different knowledge-related behaviors than other members) and families where fathers differ in their perspectives from their children. Despite these limitations, our measures were comprehensive, and allowed us to identify and distinguish among the major knowledge-related behaviors identified in prior literature (Crouter & Head, 2002).

Our measures also have several strengths. The measures used here contain repeated data across the middle school period from both mother and youth perspectives. This is important, as despite the complexity of our theoretical models of parenting, very few longitudinal studies are able to model changes in parent and youth behaviors over time (Keijsers et al., 2009). Prior studies have used either static measures of knowledge to model changes in youth behavior (e.g., Kerr, Stattin, & Burke, 2010) or static measures of youth behavior to model changes in knowledge over time (e.g., Kerr & Stattin, 2003).

Lastly, future work is needed that develops theories related to how parental knowledge-related behaviors may influence youths' substance use and other risky behaviors. The field has made substantial progress in identifying which various behaviors related to parental knowledge may relate to youth risk. Yet, little work has been done that explores how knowledge-related behaviors may influence risk, and the mechanisms underlying these associations (Stattin, Kerr, & Tilton Weaver, 2010). Future work on theory development

would enhance the field of parental knowledge and would enable researchers to place their work in a meaningful theoretical context.

Conclusions

By taking a person-oriented, dyadic approach and integrating multiple knowledge related behaviors from the perspectives of mothers and youth, we identified six unique patterns of knowledge behaviors used in dyads (latent statuses): High Monitors, Communication-Focused, Supervision-Focused, Youth Over-Estimators, Maternal Over-Estimators and Low Monitors. These latent statuses had distinct patterns of change over middle school period, with 98% of Low Monitors membership in the same status at both time points. Changes between latent statuses were related significantly to the initiation of substances from Grade 6–8. Taking a person-oriented, dyadic approach allowed us to identify and explore how combinations of monitoring-related behaviors relate to substance use, providing new insights on this important protective factor.

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Table 1

Model Selection

Number of Classes	Log-likelihood	*G-squared*	*df*	AIC	BIC
2	−6124.94	5591.98	262122	5633.98	5723.94
3	−5966.81	5275.73	262108	5345.73	5495.67
4	−5838.07	5018,24	262092	5120.24	5338.73
5	−577.757	4897.25	262074	5030.11	5326.42
***6**	**−7223.62**	**4789.35**	**262054**	**4967.35**	**5348.64**
7	Unidentified				

* selected model

Table 2

A Six-Class Latent Status Model For Parental Knowledge

	High Monitors	Communication-Focused	Supervision-Focused	Maternal Over-Estimators	Youth Over-Estimators	Low Monitors
Prevalence (Grade 6/8)	**(.24/.18)**	**(.19/.12)**	**(.31/.20)**	**(.16/.10)**	**(.05/.18)**	**(.07/.21)**
Parental Efforts-Youth	**0.77**	**0.76**	0.41	0.39	0.38	0.03
Parental Efforts-Mother	**0.70**	**0.85**	0.48	**0.80**	0.00	0.00
Knowledge-Youth	**0.89**	**0.86**	0.39	0.38	**0.89**	0.23
Knowledge-Mother	**0.81**	**0.76**	0.42	**0.51**	0.36	0.23
Youth Disclosure-Youth	**0.84**	**0.82**	0.23	0.17	**0.71**	0.03
Supervision-Youth	**0.94**	0.18	**0.89**	0.03	0.18	0.18
Supervision-Mother	**0.96**	0.23	**0.98**	0.29	0.23	0.38
Amt Communication-Youth	**0.92**	**0.85**	0.36	0.18	**0.77**	0.16
Amt Communication-Mother	**0.77**	**0.72**	0.36	0.47	0.35	0.11

Note: Prevalence estimates are in parenthesis. Item response probabilities indicate the probability that a particular indicator will be above the median, given membership in a particular latent status. Item response probabilities above .5 are in bold.

Table 3

Transitions Between Knowledge Latent Statuses from 6th to 8th Grade

		High Monitors	Communication-Focused	Supervision-Focused	Maternal Over-Estimators	Youth Over-Estimators	Low Monitors
Latent Status in 6th Grade	**High Monitors**	**0.57**	0.10	0.19	0.05	0.07	0.11
	Communication-Focused	0.05	**0.50**	0.00	0.00	0.31	0.14
	Supervision-Focused	0.11	0.00	**0.46**	0.09	0.13	0.22
	Maternal Over-Estimators	0.04	0.05	0.10	**0.36**	0.19	0.27
	Youth Over-Estimators	0.00	0.00	0.06	0.00	**0.68**	0.26
	Low Monitors	0.00	0.00	0.00	0.00	0.02	**0.98**

Note: Rows may not sum to 1 due to rounding. Estimates reflect the probability of membership in a particular latent status at Time 2 given latent status membership at Time 1. Estimates along the diagonal in bold indicate the probability of membership in the same status at both time points.

Table 4

Odds ratios for Latent Status Transitions between Grade 6 and 8 Relative to Remaining in the Same Status

Latent Transition			Alcohol	Smoking	Marijuana
High Monitors	to	Communication-Focused	0.67	0.36	0.10
High Monitors	to	Supervision-Focused	3.54	29.32	0.46
High Monitors	to	Low Monitors	0.32	0.26	0.15
Communication-Focused	to	Youth Over-Estimators	2.09	0.69	1.11
Communication-Focused	to	Low Monitors	32.47	3.73	26.02
Supervision-Focused	to	High Monitors	0.73	0.60	0.04
Supervision-Focused	to	Youth Over-Estimators	0.60	0.08	0.27
Supervision-Focused	to	Low Monitors	4.13	1.81	0.82
Maternal Over-Estimators	to	Supervision-Focused	0.11	0.90	3.40
Maternal Over-Estimators	to	Youth Over-Estimators	0.31	0.09	0.29
Maternal Over-Estimators	to	Low Monitors	1.67	1.12	2.66

The reference group for all transitions is remaining in the same status at both time points. All models control for dual biological marital status, condition, and Time 1 levels of behavior. Substance use initiation is dummy coded, with the reference group of no use at both Time 1 and Time 2. An additional dummy variable was included to indicate substance use at both time points (not shown). High Monitors: both mothers and youth report high behaviors; Communication Focused: high in all behaviors except supervision; Supervision-Focused: high in supervision only; Maternal Over-Estimators: mothers higher than youth; Youth Over-Estimators: youth higher than mothers; Low Monitors: low in all behaviors according to mothers and youth.