

**TRAJECTORIES OF PARENTAL MONITORING KNOWLEDGE
AND THEIR ASSOCIATIONS WITH ADOLESCENTS' SUBSTANCE USE,
POOR ACADEMIC OUTCOMES, AND BEHAVIOUR PROBLEMS**

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Abstract: Lower levels of perceived parental monitoring knowledge have been associated with various risk behaviours among children and youth. Data from the Canadian National Longitudinal Survey of Children and Youth were used to: 1) identify longitudinal patterns of parental monitoring knowledge through early adolescence; 2) explore associations between these patterns and socio-demographic factors; and 3) examine the association between patterns of parental monitoring knowledge and behavioural and academic outcomes. Results revealed that a 3-group model best represented patterns of parental monitoring knowledge. Socio-demographic factors were found to differentiate membership in these patterns. Findings also suggested that lower levels of perceived parental monitoring knowledge were associated with higher levels of behaviour problems, poorer academic outcomes, and a greater likelihood of substance use.

Keywords: Parental monitoring knowledge, adolescence, behaviour, academic outcomes, trajectories

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Parents' supervisory behaviours have a strong impact on their children's development, including various risk behaviours among children and youth. While researchers have explored the relationship between parental monitoring behaviour and child or youth outcomes, few have examined the dynamic and heterogeneous nature of parental monitoring over time (i.e., from childhood into adolescence), in particular different patterns of monitoring. It is possible, for example, that a trajectory of continuous high monitoring is differentially associated with outcomes than a pattern of high monitoring in childhood which tapers off as the child moves into adolescence, a period which is typically associated with increased autonomy (Larson & Richards, 1991). The purpose of the current study is to examine patterns of perceived parental monitoring knowledge (PPMK) over time for a population-based sample of youth, while considering socio-demographic characteristics of the child and family to examine relationships between these patterns of PPMK and youth outcomes.

Definition and measurement of parental monitoring

The foundation of research on parental monitoring is often traced back to the work of Patterson and others in the Oregon Youth Study (OYS). Patterson and colleagues developed a latent construct of parental monitoring that consisted of two elements: (a) rules and expectations regarding the kind of information that parents require of their children and youth, and (b) how much time parents spend with their child (Capaldi & Patterson, 1989). Since this seminal work, however, there has been a great deal of debate in the literature regarding the definition and measurement of parental monitoring. It has been argued that "monitoring" is not the same as supervision or surveillance, as direct observation of a child or youth's behaviour is often not truly feasible or practical (Hayes, Hudson, & Matthews, 2003). Rather, the definitions and measures used in research often focus on what parents know regarding their child's whereabouts and the activities in which they are engaging, which originates from the child's willingness to disclose rather than actual parental efforts at monitoring (Stattin & Kerr, 2000).

Patterns and correlates of parental monitoring knowledge

It is well established in the literature that levels of parental monitoring tend to decrease as the child ages (Barnes, Reifman, Farrell, & Dintcheff, 2000), although this decline may be quite modest (Pettit, Keiley, Laird, Bates, & Dodge, 2007). As children gain more autonomy and interest in spending time with peers in adolescence (Larson & Richards, 1991), their parents reportedly monitor activities outside the home to a lesser degree. However, less attention has been granted to examining whether different patterns of PPMK exist for subgroups of children and youth. For instance, it is possible that some parents continue to monitor their children at high levels throughout adolescence, whereas other parents change patterns, monitoring their children less over this time as they approach adulthood. Cross-sectional and longitudinal research which has relied on examining changes in mean scores (over time) may overlook nuances in individual differences in dynamic, or changing, patterns of monitoring (Laird, Criss, Pettit, Bates, & Dodge, 2009), in particular given that individual variability in parental monitoring behaviour is high (Laird, Pettit, Bates, & Dodge, 2003; Pettit et al., 2007). For instance, Laird et al. (2003) and Laird, Marrero, and Sentse (2010) have not found a sample-wide increase or decrease in parental monitoring knowledge over time. Rather, decreases in parental rules were a more common trajectory than decreasing monitoring knowledge in adolescence (Laird et al., 2009), reaffirming

that patterns of parental behaviour may differ based on the specific definition of the monitoring behaviour of interest.

Utilizing a semi-parametric analytic approach, previous research has generally identified three trajectories of parental monitoring, indicating heterogeneity of monitoring behaviours or subgroups of monitoring patterns among youth. For example, Laird and colleagues (2009) described three patterns of monitoring knowledge among youth aged 12 to 16: low-decreasing (16% of youth), moderate-stable (60%), and high-stable (23%). Other work by Spano and colleagues (Spano, Rivera, & Bolland, 2011; Spano, Rivera, Vazsonyi, & Bolland, 2012) found that just under half (48%) of their sample of 11 to 17 year-old at-risk African-American youth demonstrated a declining trajectory of parental monitoring.

Both cross-sectional and longitudinal studies have also shown that socio-demographic characteristics may be associated with parental monitoring practices. There is consistent evidence that girls are more highly monitored than boys (Barnes et al., 2000; Rai et al., 2003), with boys experiencing greater decreases in parental monitoring into adolescence than do girls (Laird et al., 2010). On average, children from socio-economically disadvantaged families tend to be less highly monitored (Crouter, Helms-Erikson, Updegraff, & McHale, 1999) as are children from single-parent or step-parent families and children with less educated mothers (Chilcoat & Anthony, 1996). There is also evidence that first-born children may be less highly monitored than higher birth order children (Crouter et al., 1999). Finally, maternal age, in particular teen motherhood, tends to be associated with parenting behaviours as well as adolescent outcomes (Dahinten, Shapka, & Willms, 2007) although less is known about the impact of teen motherhood on parental monitoring knowledge.

However, the aforementioned studies have generally examined associations between possible antecedents (generally socio-demographic characteristics) with mean levels of monitoring at one point in time, rather than with distinct patterns or trajectories over time. This information might identify why some youth experience certain patterns of monitoring instead of others. Of particular relevance to this study, Laird and colleagues (2008, 2009) suggested that socio-economic and child and youth behavioural characteristics may be associated with patterns of parental monitoring knowledge. Youth characteristics related to group membership included gender, living in a safe neighbourhood, and peer anti-sociality, with being female, and those with more externalizing problems showing an association with increased probability of high-stable monitoring knowledge versus low-decreasing monitoring knowledge. In contrast, Tobler and Komro (2010) did not find gender or the number of parents in the home to be associated with trajectory group membership.

Perceived parental monitoring knowledge and youth outcomes

The link between perceived parental monitoring knowledge and risk behaviours as well as social and academic outcomes is well established. For example, low levels of parental monitoring are associated with increased levels of smoking, alcohol, and drug use (Barnes et al., 2000; Tobler & Komro, 2010; Webb, Bray, Getz, & Adams, 2002), greater signs of conduct problems, aggression, and antisocial or delinquent behaviour (Crouter, Bumpus, Davis, & McHale, 2005; DiClemente et al., 2001; Laird et al., 2010), and more risky sexual practices and

earlier initiation of sexual behaviour (Baptiste, Tolou-Shams, Miller, McBride, & Paikoff, 2007; Crosby, DiClemente, Wingood, Lang, & Harrington, 2003). In contrast, greater parental monitoring has been associated with higher levels of self-esteem among youth (Dekovic & Meeus, 1997; Parker & Benson, 2004) and with academic success and school-related behaviours (Annunziata, Hogue, Faw, & Liddle, 2006; Li, Fang, Stanton, Su, & Wu, 2003).

While monitoring behaviour itself may be influenced by youth's socio-demographic characteristics, associations between parental monitoring and child outcomes may also be influenced by characteristics specific to youth, such as the number of parents in the home (Coley & Hoffman, 1996), or child/youth gender (Borawski, Levers-Landis, Lovegreen, & Trapl, 2003; Lenciauskiene & Zaborskis, 2008) or age (Chilcoat & Anthony, 1996). Moreover, examining heterogeneous patterns may also allow the examination of reciprocal relations between patterns in monitoring and child outcomes (Laird et al., 2010; Spano et al., 2011). For example, adolescent substance use has been differentially associated with parental monitoring, with those who experienced decreasing monitoring from age 12 to 14 being more likely to use alcohol or marijuana than were youth who were consistently highly monitored (Tobler & Komro, 2010). Moreover, the relationship between friends' anti-sociality and delinquent behaviour is stronger among youth with moderate-declining parental monitoring knowledge. Youth who perceived that their parents were less knowledgeable were more likely to engage in delinquent behaviour and report anti-social friends, and more likely to report rapid increases in such behaviour over time than were youth with higher levels of parental monitoring knowledge (Laird et al., 2008). Thus, differences in behavioural (or other) outcomes based on heterogeneous patterns in monitoring over time as well as characteristics of the individual should be considered in any examination of PPMK.

The Present Study

Given the variety of definitions, terms, and measures used in the literature, it is important that studies of parental monitoring clearly define the behaviours represented by the particular tool or measure employed. The measure of parental monitoring included in the present study can be likened to the concept of "parental monitoring knowledge" employed by Laird and colleagues, which emphasizes the distinction between disclosure of information (i.e., by the child/youth) versus knowledge and or solicitation of information by the parent (e.g., Laird et al., 2010; 2011). Furthermore, after examining the factor structure and conceptual strength of the measure of monitoring used in the present study, Arim, Shapka, Dahinten, and Olson, (2011) suggest that "parental knowledge" is a suitable descriptor of the scale measure used in this study. To further clarify that it is the child/youth who is reporting on their parents' monitoring knowledge, and not the parent themselves, we are utilizing the term "perceived parental monitoring knowledge" (PPMK) in the present study.

The goals of the current study were threefold. The first was to extend previous research by examining the presence of multiple patterns of PPMK among a national sample of Canadian children from late childhood through early adolescence (ages 10 to 15 years). This study is unique in that little research has been conducted on monitoring behaviours for a national sample of Canadian children/youth, and few dynamic approaches to parental monitoring have been pursued except within specific populations (e.g., at-risk or African-American/Hispanic samples,

see Spano et al., 2011) or relatively small samples with limited ability to detect effects across multiple groups (e.g., Laird et al., 2008). Second, the associations between different patterns of PPMK and several family-level socio-demographic factors were explored. Third, the association between specific patterns of PPMK and other behavioural and academic outcomes as well as substance use for youth ages 14 to 15 were examined.

Based on the reviewed literature, the present study hypothesized the following. First, it was expected that more than one trajectory of PPMK would be identified, and that at least one trajectory would show a decline in the level of PPMK as the child ages. Second, girls were hypothesized to report experiencing higher levels of PPMK than boys, whereas those from more socio-economically disadvantaged families, with single parents, with less educated parents, and first-born children were expected to report lower levels of PPMK. Finally, lower levels of PPMK were expected to be associated with increases in adolescents' substance use and problem behaviour, poorer academic performance, and lower self-esteem at ages 14 or 15.

Methods

Data Source

The National Longitudinal Survey of Children and Youth (NLSCY), conducted jointly by Statistics Canada and Human Resources and Skills Development Canada, gathered information on the development and well-being of Canadian children. First conducted in 1994, the NLSCY was conducted every two years for 8 cycles (to 2009/10). The target population of the NLSCY comprised the non-institutionalized civilian population (aged 0 to 11 at the time of their selection) in Canada's 10 provinces. The survey excluded children living on Indian reserves or Crown lands, residents of institutions, full-time members of the Canadian Armed Forces, and residents of some remote regions. Most questionnaires were administered by an interviewer using computer-assisted telephone interviewing (CATI) or computer-assisted personal interviewing (CAPI). In total, 13,439 households were interviewed in Cycle 1, with a total of 22,831 children participating in the survey (Statistics Canada, 2005). All individuals in the study sample were part of this longitudinal cohort first interviewed in 1994.

Due to changes in the measurement of PPMK across cycles, and in order to maximize the outcome variables included in the study, three cohorts were selected for the current analysis: children who were aged 12 to 13 in cycle 3 (cohort 1, $n = 2,246$), children who were aged 10 to 11 in cycle 3 (cohort 2, $n = 2,169$), and children who were aged 10 to 11 in cycle 4 (cohort 3, $n = 2,101$).¹

¹ An attrition analysis within the present study found that youth from economically disadvantaged situations were less likely to be included in the analysis than more economically advantaged youth due to missing data. Therefore, the reader should use caution when generalizing the present findings to the general population of Canadian children and youth. However, the present sample does include children from a variety of family and economic backgrounds. Replication of the present study with a different data source would be useful for determining the generalizability of the current findings.

Measures

Socio-demographic characteristics. Socio-demographic information was provided by the person most knowledgeable of the child, most frequently the child's biological mother, and was drawn from the cycle in which the child was aged 10 or 11. The person most knowledgeable will hereafter be referred to as the "parent", although a small proportion may be non-parents. Characteristics of interest were the child's gender and birth order (only child, first-born, higher birth order), the number of parents in the home (single- versus dual-parent families), household income, and parental age and highest level of educational attainment. Parent's highest educational attainment was categorized as less than a high school diploma, being a high school graduate, or having at least some post-secondary education. Household income was rescaled (divided by \$10,000) to allow for a more meaningful interpretation of the beta coefficient in the results. Therefore, the value in the model refers to a unit change of \$10,000 in household income. Although some of these characteristics could change over time, their values were fixed at the time that the child was aged 10 or 11.

Perceived parental monitoring knowledge. Parenting behaviour questions used in the NLSCY were drawn from scales developed by Lempers, Clark-Lempers, and Simons (1989). Included were measures of parental nurturance, rejection, and monitoring. As recommended by Arim and colleagues (2011), the Parental Monitoring scale in this study was reduced from five to four items in order to improve the scale's factor structure and associated fit to the data. The four items were: my parents (1) "want to know exactly where I am and what I am doing"; (2) "tell me what time to be home when I go out"; (3) "find out about my misbehaviour"; and (4) "take an interest in where I am going and who I am with". Using a 5-point Likert scale (never, rarely, often, sometimes, and always), children and youth were asked to indicate the frequency with which their parent(s) exhibited each of four monitoring behaviours. Responses to all four items were summed to create a PPMK score that ranged from 0 to 16, with higher scores indicating greater PPMK. Cronbach's alpha for the monitoring scale improved with the age of the child: $\alpha = .58$ at ages 10 and 11; $\alpha = .65$ at ages 12 and 13; and $\alpha = .67$ at ages 14 and 15. Similar internal consistency values have been found by others (Laird et al., 2008; Spano et al., 2011, 2012).

School-related outcomes. Four measures were used to describe youth's academic performance and school-related behaviour at ages 14 to 15. First, youth's math skills were measured using a shortened version of the Mathematics Computation Test of the standardized Canadian Achievement Tests (CAT/2). This objective test reflects the student's skills in addition, subtraction, multiplication, division, and problem solving. The short version of the CAT/2 used in the NLSCY consisted of 20 questions at each grade level and standardized scores were derived from norms established by the Canadian Test Centre in 1992 (Statistics Canada, 2005).

Three other measures of academic and school behaviour were based on youth self-report. Using a 4-point Likert scale (never, once or twice, 3 or 4 times, or 5 times or more), youth were asked how often they had skipped a day of school without permission or had been suspended from school since the beginning of the school year (at least once in the past year versus not). Youth also reported how often they completed their homework (all of the time or most of the time, versus some of the time, rarely, and never).

Behaviour-related outcomes. In terms of children’s social and behavioural functioning, self-reported information was collected from youth at ages 14 or 15. Six behavioural scales were used: *direct aggression* (6 items, e.g., “get into fights and threaten people”); *hyperactivity and inattention* (7 items, e.g., “impulsive, act without thinking”); *indirect aggression* (5 items, e.g., “try to get others to dislike someone”); *emotional disorder and anxiety* (7 items, e.g., “unhappy or sad”); *pro-social behaviour* (10 items, e.g., “try to help someone who is hurt”); and *property offences* (6 items, e.g., “destroy my own things”). Items for these scales were derived from the Child Behaviour Checklist (Achenbach & Edelbrock, 1981) and modified for a Canadian sample (Boyle et al., 1987; Tremblay, Vitaro, & Nagin, 2003). Cronbach’s alpha was found to be adequate across subscales ($\alpha = .70 - .87$).

Self-esteem. Questions regarding youth’s overall self-esteem were taken from the General Self Scale of Marsh’s Self Description Questionnaire (Marsh & Shavelson, 1985; Marsh, 1992). Four items were included on the NLSCY: (1) “In general I like the way I am”; (2) “Overall I have a lot to be proud of”; (3) “A lot of things about me are good”; and (4) “When I do something, I do it well”. Using a 4-point Likert scale (false, mostly false, sometimes false/sometimes true, mostly true), youth indicated the degree to which they felt that certain statements about themselves were true². For youth’s reports at ages 14 and 15, the scale had a Cronbach’s alpha of .83.

Substance use behaviours. Three measures of substance use were included in the current study. Youth reported their current and past experience with smoking, drinking, and marijuana use. Response scales were dichotomized to indicate the presence (or absence) of a risk behaviour (daily smoker, ever been drunk, weekly marijuana user). Youth who reported smoking 6 or 7 days a week were classified as *daily smokers*. Youth who had ever consumed alcohol (more than just a sip) were asked if they had ever been *drunk*. Youth were also asked if they currently used marijuana and, if so, how often. Youth who reported using marijuana at least once a week were classified as *weekly marijuana users*.

Data Analysis

Trajectory model estimation. A semi-parametric group-based approach was used to identify distinct patterns of PPMK from ages 10 through 15 (Jones, Nagin, & Roeder, 2001; Jones & Nagin, 2007; Nagin, 2005). This approach allows for qualitatively different trajectories to be identified and examined, creating sub-populations of PPMK. It should be noted that such trajectories are latent groups and that no child actually belongs to a particular group. Rather, his or her pattern of PPMK is best described by a particular pattern or trajectory, which is reflected by the posterior probability of group membership (Nagin, 2005). To be included in the trajectory analysis, youth had to provide at least two waves of information on PPMK.

²Youth who failed to provide a response to one or more of the scale items did not receive a score for the measure. For all behaviour and self-esteem scales, upwards of 89% of youth provided responses to all scale-specific items. Those with missing behaviour and self-esteem measures had similar average PME scores and socio-demographic characteristics as those with complete information, with the exception that first-born children with siblings were less likely to be missing these measures than were other children. Based on these findings, it was felt that excluding those with missing values on these scales (i.e., not imputing scores) would not significantly bias the findings.

The number and shape of trajectory groups were varied in sequential models to determine the most parsimonious number of groups in the model and the significance of the shape of the trajectories (flat, linear, or quadratic). The final model was chosen based on two factors: (a) the model which yielded the largest (i.e., least negative) Bayesian Information Criterion (BIC); and (b) a model in which all slope parameters were statistically significant (Nagin, 2005). In model fitting, each individual is assigned a posterior probability of being classified in each trajectory group; the posterior probabilities total to 1.0 across all trajectory groups for each individual.

Next, covariates were added to the model to estimate their effect on membership in a particular trajectory group. The effect of covariates on trajectory group membership was assessed using multinomial logistic analysis. Coefficients are interpreted as the increased probability (odds) that an individual will follow a particular trajectory relative to a referent trajectory group.

Regression model estimation. After identifying longitudinal patterns of PPMK, the association between the trajectories of PPMK and youth's behaviours and school-related outcomes was examined using regression models. These models controlled for a series of socio-demographic characteristics, including child gender, birth order, family structure (i.e., whether the child lived with one or two parents), parental education, parent age, and household income. The effect of PPMK trajectories was examined by including the posterior probabilities of belonging to a certain trajectory group in the regression analysis. Odds ratios (and betas) refer to a change of 10% in the posterior probability. Two dichotomous cohort identifiers (cohort 2 as the reference) were included in regression models to adjust for inter-cohort differences.

Among the continuous scale measures examined at ages 14 to 15, only mathematics and pro-social behaviour scales conformed to the normality assumption in linear regression models. Models for these behaviours were conducted using multivariate linear regression models. Appropriate transformations could not be found for the remaining scales. In these cases, scales were dichotomized using the 90th percentile as a cut-point indicating high levels of behaviour problems. The exception was self-esteem, for which a cut-point identifying low self-esteem was set at the 10th percentile. This approach has been taken by other researchers examining behaviour problem scales (Lipman, Offord, & Dooley, 1996; Lumeng, Gannon, Cabral, Frank, & Zuckerman, 2003). Due to the ordinal nature of the scales, the 90th (or 10th) percentiles did not always include exactly 10% of the sample. All dichotomous outcomes were examined using logistic modelling. Sampling weights were applied to all analyses. Bootstrap techniques were used to adjust the standard error estimates in the descriptive and logistic regression analyses for the complex design of the survey (Rust & Rao, 1996). However, due to software limitations, trajectory models and the resultant posterior probabilities were not bootstrapped. Statistical significance was set at the $p < .05$ level.

Results

Descriptive Statistics

Approximately half of the youth were male, 12% were only children, while a further 33% were first-born children. The majority of children (92%) were Caucasian, and only 3% of children were immigrants. Nearly 15% of children lived in single-parent homes. The children's parents were 39 years of age on average, most likely to be female (92%), and 10% had less than a high school level of education. The mean household income was approximately \$68,493 and approximately 14% of children's families were considered low-income for their family size and place of residence.

Trajectory Analyses

In the trajectory model-building phase of analysis, models with an increasingly higher number of trajectory groups provided the best fit to the data, but additional trajectory groups were interpretively similar or represented very small proportions of the sample. The model with the greatest number of trajectory groups that still maintained enough sample (i.e., more than 2%) in each trajectory was a three-group model (Figure 1). For ease of interpretation, these groups were labelled: *high*, *moderate* and *decreasing* PPMK. It was estimated that approximately 53% of children were best represented by the high PPMK group, 41% by the moderate PPMK trajectory, and the remaining 6% by the decreasing trajectory of PPMK. The average score in the high PPMK group was slightly lower at age 15 than at age 10. Within the moderate trajectory, although PPMK at age 15 was lower than at age 10, there was actually a slight rise in the level of PPMK, with peak levels reported at age 12. In the decreasing trajectory, levels of PPMK dropped precipitously to age 13, but then started to increase slightly up to age 15. The intercepts were similar between the moderate and decreasing trajectories (Wald chi-square = 3.35, $p = .07$), meaning that levels of PPMK were similar at age 10 for members of these two groups. Intercepts were statistically different between the high and moderate trajectories (Wald chi-square = 44.78, $p < .0001$) as well as between the high and decreasing groups (Wald chi-square = 4.27, $p = .04$), meaning that levels of PPMK were higher at age 10 for members of the high group compared to those in the moderate or decreasing trajectory groups.

Analyses were performed to identify characteristics at age 10 or 11 that were associated with membership in the trajectory groups (Table 1). Results revealed that members of the moderate PPMK trajectory were distinguished from members of the high PPMK trajectory on the basis of household income: As household income increased, the likelihood of being in the moderate PPMK trajectory decreased (OR = 0.90). Comparing members of the decreasing and high PPMK trajectory groups, girls were significantly less likely than boys to be in the decreasing PPMK trajectory group (OR = 0.37), whereas children with older siblings (not first-born children) were significantly more likely to be in the decreasing PPMK trajectory than were first-born children (OR = 3.10). Lastly, comparing members of the moderate and decreasing PPMK trajectories, only children were significantly less likely than first-born children to be in the moderate PPMK trajectory (OR = 0.24) than the decreasing PPMK group.

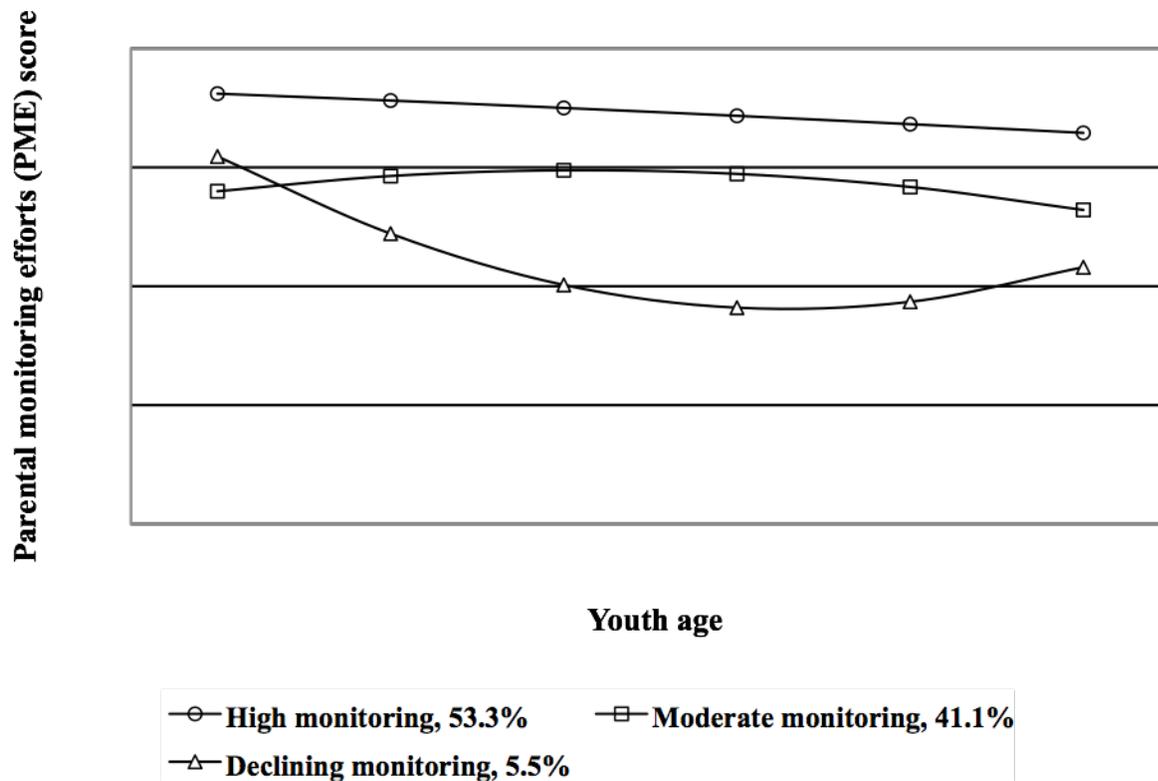


Figure 1. Trajectories of parental monitoring efforts (PME), ages 10 to 15.

Outcome Analyses

The posterior probabilities of membership in each of the three trajectory groups were used as predictors in multivariate regression models. For each participant, their probability of belonging to each of the moderate and declining trajectories were entered into the models, with the probability of belonging to the high PPMK trajectory group as the reference category. Posterior probabilities were used in lieu of assigned trajectories as the former takes into account individuals whose PPMK patterns may lie somewhere between those that are described, whereas the latter requires an individual to be assigned to a specific trajectory, even if their pattern of PPMK is not well described by that trajectory.

Behavioural outcomes. The following proportions of children were categorized as having high levels of behaviour problems: 7% for direct aggression, 9% for emotional disorder, 6% for hyperactivity, 6% for indirect aggression, and 7% for property offences. Furthermore, 8% of 14- to 15-year-olds had low levels of self-esteem. Girls were less likely than boys to report high levels of direct aggression (OR = 0.44) or property offences (OR = 0.53), scored higher in

pro-social behaviours ($B = 2.99$), but were more likely to exhibit high levels of emotional disorder ($OR = 2.52$) and low self-esteem ($OR = 2.05$). Higher birth order children were more likely to have low self-esteem than first-born children ($OR = 1.75$). Youth whose parent had some post-secondary education ($B = 0.51$) and those from higher income households ($B = 0.06$) tended to have higher pro-social behaviour scores.

Table 1. Baseline factors associated with likelihood of trajectory group membership ($n = 4035$), odds ratios (95% confidence intervals)

Baseline (age 10 or 11) risk factors	Perceived Parental Monitoring Knowledge Trajectories		
	Moderate vs. High	Decreasing vs. High	Moderate vs. Decreasing
Female child	0.82 (0.56, 1.19)	0.37 (0.14, 0.95)	2.22 (0.76, 6.47)
Single parent	0.94 (0.54, 1.63)	0.53 (0.18, 1.59)	1.76 (0.51, 6.11)
Parental educational attainment			
Less than high school	0.87 (0.45, 1.67)	3.12 (0.88, 11.00)	0.28 (0.07, 1.19)
High school graduate (ref.)	1.00	1.00	1.00
At least some post-secondary	1.15 (0.75, 1.74)	1.49 (0.60, 3.70)	0.77 (0.26, 2.23)
Birth order			
Only child	0.79 (0.42, 1.49)	3.33 (0.97, 11.46)	0.24 (0.06, 0.99)
Firstborn with siblings (ref.)	1.00	1.00	1.00
Not firstborn with siblings	1.44 (0.93, 2.23)	3.10 (1.06, 9.04)	0.47 (0.13, 1.60)
Parental age			
Age 38 or under	0.88 (0.62, 1.26)	0.92 (0.43, 1.99)	0.96 (0.40, 2.32)
Age 39 or older (ref.)	1.00	1.00	1.00
Household income (per \$10,000 unit)	0.90 (0.85, 0.96)	0.92 (0.83, 1.02)	0.98 (0.85, 1.12)

Estimates in **bold** are statistically significant at $p < .05$.

PPMK trajectories were significantly associated with four of the seven behavioural outcomes (Table 2). As the probability of belonging to the moderate PPMK trajectory increased (compared to high PPMK), the odds of reporting higher levels of direct aggression ($OR = 1.10$) and property offences ($OR = 1.15$) increased, while pro-social behaviour scores decreased ($B = -0.19$). Furthermore, as the probability of belonging to the decreasing PPMK trajectory increased, the odds of reporting higher levels of direct aggression ($OR = 1.16$), indirect

aggression (OR = 1.16), and property offences (OR = 1.12) increased, while pro-social scores decreased (B = -0.27).

Table 2. Association of perceived parental monitoring knowledge trajectory membership and socio-demographic factors with adolescents’ behaviors and self-esteem at age 14 and 15

	Above the 90 th percentile on...				Property offenses (n = 3583)	Low self-esteem, below 10 th percentile (n = 3425)	Pro-social behavior (n = 3581) Beta (SE)
	Direct aggression (n = 3586)	Emotional disorder (n = 3575)	Hyper-activity (n = 3364)				
	Odds ratio (95% confidence intervals)						
Probability of trajectory membership							
High PPMK (ref.)	...	...	...	...	...	...
Moderate PPMK (per 10% increase in probability)	1.10 (1.04, 1.17)	1.00 (0.94, 1.05)	1.03 (0.96, 1.10)	1.02 (0.93, 1.11)	1.15 (1.08, 1.22)	1.05 (0.99, 1.12)	-0.19 (0.03)
Decreasing PPMK (per 10% increase in probability)	1.16 (1.04, 1.10)	1.05 (0.96, 1.15)	1.05 (0.90, 1.22)	1.16 (1.03, 1.31)	1.12 (1.01, 1.24)	1.07 (0.98, 1.16)	-0.27 (0.09)
Female child (ref. male child)	0.44 (0.28, 0.70)	2.52 (1.68, 3.78)	0.71 (0.46, 1.09)	0.82 (0.49, 1.37)	0.53 (0.33, 0.85)	2.05 (1.41, 2.97)	2.99 (0.18)
Single-parent family (ref. dual-parent family)	1.01 (0.53, 1.91)	1.25 (0.75, 2.08)	0.93 (0.50, 1.73)	1.24 (0.53, 2.94)	1.00 (0.61, 1.63)	0.99 (0.59, 1.68)	0.18 (0.30)
Parental educational attainment							
Less than high school	0.88 (0.41, 1.88)	1.01 (0.43, 2.36)	1.09 (0.42, 2.83)	0.88 (0.38, 2.01)	0.84 (0.36, 1.94)	0.99 (0.52, 1.89)	0.75 (0.51)
High school graduated (ref.)	...	...	...	...	...	...	...
Some post-secondary	1.05 (0.61, 1.81)	1.22 (0.74, 2.03)	1.26 (0.74, 2.15)	1.79 (0.96, 3.34)	1.05 (0.63, 1.74)	0.91 (0.57, 1.47)	0.51 (0.25)
Birth order							
Only child	1.09 (0.56, 2.12)	1.62 (0.87, 3.03)	1.32 (0.57, 3.03)	0.36 (0.12, 1.08)	0.92 (0.45, 1.89)	1.09 (0.58, 2.07)	0.18 (0.36)
Firstborn with siblings (ref.)	...	...	...	...	...	...	...
Not firstborn with siblings	1.10 (0.71, 1.72)	1.27 (0.86, 1.88)	1.00 (0.62, 1.63)	1.08 (0.61, 1.90)	0.81 (0.49, 1.34)	1.75 (1.14, 2.69)	0.02 (0.21)
Parent aged 38 and under (ref. Parent aged 39 and older)	1.05 (0.69, 1.60)	0.92 (0.63, 1.33)	1.28 (0.82, 1.99)	1.25 (0.79, 2.00)	1.06 (0.67, 1.69)	1.41 (0.94, 2.12)	-0.15 (0.23)
Household income (per \$10,000 change)	0.96 (0.91, 1.01)	0.97 (0.93, 1.02)	0.99 (0.94, 1.04)	1.00 (0.91, 1.11)	0.98 (0.93, 1.03)	0.92 (0.84, 1.00)	0.06 (0.02)

Estimates in **bold** are statistically significant at p < .05; Estimates also adjusted for the child’s cohort (betas and odds ratios not presented)

Academic and school-related outcomes. Overall, 76% of 14- to 15-year-olds reported that they completed their homework at least most of the time, 27% reported skipping school without permission at least once since the beginning of the school year, and 7% reported being suspended from school at least once since the beginning of the school year. On average, girls had lower math scores than boys (B = -9.06), were more likely to complete their homework (OR = 1.61), and were less likely to be suspended from school (OR = 0.42). Youth in single-parent families were more likely to skip a day of school than youth in dual-parent families (OR = 1.39), although other academic outcomes did not show differences by the number of parents in the home. Having a parent with some post-secondary education was positively associated with higher math scores (B = 17.91). Youth’s math scores also differed significantly with the age of their parents; youth whose parent was younger than average (i.e., age 38 or under) generally had lower math scores than youth with older parents (B = -19.25). Household income was positively

related with mathematics scores ($B = 2.29$) and inversely related with the likelihood of skipping school ($OR = 0.97$) or being suspended from school ($OR = 0.87$).

Table 3. Association of perceived parental monitoring knowledge trajectory membership and socio-demographic factors with school outcomes at ages 14-15

	Math ($n = 3254$)	Homework completion ($n = 3543$)	Skip a day of school ($n = 3608$)	Suspended from school ($n = 3600$)
	Beta (SE)	Odds ratios (95% confidence intervals)		
Probability of trajectory membership				
High PPMK (ref.)	...	...	...	...
Moderate PPMK (per 10% increase in probability)	-2.03 (0.82)	0.96 (0.91, 1.00)	1.03 (0.99, 1.07)	1.07 (1.00, 1.14)
Decreasing PPMK (per 10% increase in probability)	0.94 (2.03)	0.90 (0.83, 0.98)	1.13 (1.05, 1.22)	1.02 (0.92, 1.13)
Female child (ref. male child)	-9.06 (4.88)	1.61 (1.21, 2.14)	0.83 (0.64, 1.07)	0.42 (0.28, 0.63)
Single-parent family (ref. dual-parent family)	-4.66 (8.81)	0.80 (0.55, 1.15)	1.39 (1.02, 1.89)	1.20 (0.74, 1.95)
Parental educational attainment				
Less than high school	-15.68 (9.16)	0.96 (0.60, 1.54)	0.98 (0.62, 1.54)	1.35 (0.68, 2.69)
High school graduated (ref.)	...	...	...	...
Some post-secondary	17.91 (5.87)	0.87 (0.63, 1.20)	0.80 (0.60, 1.06)	0.96 (0.59, 1.55)
Birth order				
Only child	-1.29 (7.78)	1.17 (0.75, 1.84)	0.83 (0.56, 1.22)	0.76 (0.43, 1.36)
Firstborn with siblings (ref.)	...	...	...	...
Not firstborn with siblings	-5.02 (5.58)	0.91 (0.66, 1.25)	1.13 (0.86, 1.49)	0.95 (0.61, 1.48)
Parent aged 38 and under (ref. Parent aged 39 and older)	-19.25 (5.32)	0.81 (0.62, 1.07)	1.16 (0.90, 1.49)	1.07 (0.69, 1.66)
Household income (per \$10,000 change)	2.29 (0.69)	1.02 (0.99, 1.05)	0.97 (0.94, 1.00)	0.87 (0.81, 0.93)

Estimates in **bold** are statistically significant at $p < .05$. Estimates also adjusted for the child's cohort (betas and odds ratios not presented).

Turning to the associations between academic and school-related outcomes with PPMK, as the probability of belonging to the moderate PPMK group increased, math scores tended to decrease ($B = -2.03$) while the likelihood of being suspended from school increased ($OR = 1.07$; Table 3). Furthermore, as the probability of belonging to the decreasing PPMK trajectory increased, the likelihood of completing homework at least most of the time decreased ($OR = 0.90$), while the likelihood of skipping a day of school increased ($OR = 1.13$).

Substance use outcomes. Overall, 7% of youth reported being current daily smokers at the age of 14 or 15, 35% reported ever being drunk, and 8% reported using marijuana on a weekly basis. Few of the baseline socio-demographic characteristics were significantly

associated with substance using behaviours. Girls were significantly more likely to be daily smokers (OR = 1.97), and significantly less likely to report using marijuana on a weekly basis (OR = 0.65), than boys. Youth from single-parent families were significantly more likely to be daily smokers (OR = 1.76), while youth from higher income households were less likely to be daily smokers (OR = 0.90).

PPMK trajectory membership was found to be significantly associated with the likelihood of ever being drunk (OR = 1.06), whereas the odds of reporting ever being drunk increased as the probability of belonging to the moderate PPMK trajectory increased (Table 4). There was also a tendency (OR = 1.09, $p = .08$) for the odds of being a daily smoker to increase with an increase in the probability of belonging to the decreasing PPMK trajectory.

Table 4. Association of perceived parental monitoring knowledge trajectory membership and socio-demographic factors with substance use behaviors at ages 14-15

	Daily smoker (<i>n</i> =3613)	Ever been drunk (<i>n</i> = 3608)	Weekly marijuana use (<i>n</i> = 3629)
	OR (95% CI)		
Probability of trajectory membership			
High PPMK (ref.)	...	...	...
Moderate PPMK (per 10% increase in probability)	0.98 (0.92, 1.04)	1.06 (1.01, 1.10)	1.00 (0.91, 1.09)
Decreasing PPMK (per 10% increase in probability)	1.09 (0.99, 1.19)	1.04 (0.97, 1.12)	1.03 (0.92, 1.15)
Female child (ref. male child)	1.97 (1.31, 2.96)	1.15 (0.92, 1.44)	0.65 (0.45, 0.94)
Single-parent family (ref. dual-parent family)	1.76 (1.08, 2.88)	1.26 (0.93, 1.71)	1.46 (0.90, 2.38)
Parental educational attainment			
Less than high school	0.88 (0.44, 1.66)	0.85 (0.53, 1.37)	0.74 (0.34, 1.63)
High school graduated (ref.)	...	...	...
Some post-secondary	0.80 (0.52, 1.23)	0.82 (0.61, 1.10)	1.19 (0.76, 1.89)
Birth order			
Only child	0.74 (0.39, 1.40)	1.09 (0.76, 1.56)	1.01 (0.58, 1.79)
Firstborn with siblings (ref.)	...	...	...
Not firstborn with siblings	0.66 (0.41, 1.04)	1.18 (0.91, 1.52)	1.09 (0.63, 1.89)
Parent aged 38 and under (ref. Parent aged 39 and older)	1.03 (0.68, 1.55)	1.20 (0.95, 1.53)	1.05 (0.70, 1.59)
Household income (per \$10,000 change)	0.90 (0.84, 0.98)	1.01 (0.98, 1.04)	1.01 (0.97, 1.05)

Estimates in **bold** are statistically significant at $p < .05$. Estimates also adjusted for the child's cohort (odds ratios not presented).

Discussion

This study examined youth's reports of parental monitoring knowledge over time using population-based longitudinal survey data. Similar to previous work investigating trajectories of monitoring with an at-risk sample (Spano et al., 2011, 2012), and in keeping with the hypothesized findings, results showed three distinct patterns of PPMK from ages 10 through 15. All trajectories showed declining levels of PPMK into mid-adolescence, reaffirming previous research showing that youth perceive their parents to monitor their behaviours less frequently as they age (Barnes et al., 2000). In the present study, one trajectory depicted relatively high levels of PPMK over time (53% of youth), a second trajectory depicted moderate levels of monitoring (41%), and a third depicted a trajectory of PPMK that began relatively high in late childhood but declined precipitously to relatively low levels in mid-adolescence (6%). The high and moderate PPMK trajectories are similar patterns to those identified by Laird et al. (2008) in a sample of American youth. Although the trajectory of declining PPMK is the smallest in number, it represents a group of youth with experienced PPMK patterns that differ significantly from those of their peers, and can have an impact on youth outcomes.

In the present study, youth from lower income families were more likely to be members in the moderate PPMK trajectory than they were to be in the high PPMK group. The association between lower household income and decreasing (versus high) PPMK was in the same direction but was not significant, perhaps as a result of the smaller sample size of the decreasing PPMK group. While these findings are similar to other studies that have shown PPMK to be associated with socio-economic status (Pettit, Bates, Dodge, & Meece, 1999; Pettit, Laird, Dodge, Bates, & Criss, 2001), the present study did not find an association between trajectory membership and parents' educational attainment. The latter may be due to the fact that children with less educated parents were more likely to be lost to follow-up in the survey and not contribute to the present analysis. However, the mean level of parental education in the NLSCY is higher than other studies, particularly in comparison with samples from the United States (Kohen, Brooks-Gunn, Leventhal, & Hertzman, 2002).

The present study also found that higher birth order youth were more likely to be characterized by the decreasing PPMK trajectory than they were by the high trajectory, and only children were significantly more likely to be in the decreasing PPMK trajectory than they were to be in the moderate PPMK trajectory. This is in contrast to other studies that have found that higher birth order children tend to be more highly monitored. However, the work by Crouter and colleagues (1999) did not distinguish age effects from the effect of birth order, where second-born children were necessarily younger than first-born children within a family, and therefore more likely to be more highly monitored. Further examination of the impact of birth order on levels of PPMK could be explored in future research.

Although there were some significant differences, not many of the baseline socio-demographic characteristics distinguished between the PPMK trajectories. It is possible, however, that other factors or events that occurred post-baseline could have distinguished these two trajectories. Although this was beyond the scope of the present study, future research may seek to determine which factors differentiate youth who perceived significant declines in their parents' PPMK relative from those who maintained a relatively high level of PPMK.

Turning to the relations between PPMK and outcomes at ages 14 to 15, several significant associations were seen. PPMK trajectory membership was associated with 9 of 14 outcomes examined. As a youth's probability of belonging to the moderate PPMK trajectory increased compared to high PPMK, they were significantly more likely to report higher levels of direct aggression and property offences, lower levels of pro-social behaviour, scored lower in math skills, and were more likely to have been suspended from school and to report ever being drunk. As a youth's probability of belonging to the decreasing (versus high) PPMK trajectory increased, they were significantly more likely to report higher levels of direct and indirect aggression, to report more property offences and less pro-social behaviour, were less likely to complete their homework, and were more likely to report skipping school. These findings support previous research suggesting that lower levels of PPMK are associated with higher levels of behaviour problems and substance use behaviours (Barnes et al., 2000; Tobler & Komro, 2010; Crouter et al., 2005).

Although this study found significant associations between PPMK trajectory membership and outcomes in adolescence, no clear pattern of association emerged. Some of the behaviours for which significant associations were found are externalizing in nature, meaning that the behaviours are prominent and observable, such as direct aggression and property offences. These types of behaviours may be more easily monitored, as opposed to other outcomes that may be more internal, such as self-esteem, which seem to be less associated with parents' monitoring knowledge. Future examinations may wish to investigate whether other parental behaviours, such as nurturance, are more strongly associated with such internalized feelings and behaviours than with parental monitoring.

This study makes a significant contribution to the literature on the effects of PPMK on academic and school-related behaviours, outcomes which have received less attention in the monitoring literature. The findings show that moderate or decreasing levels of monitoring were more likely to be associated with lower youth academic outcomes. Significant associations were found between the probability of membership in the moderate PPMK trajectory group (on math scores and being suspended from school), as well as the probability of belonging to the decreasing PPMK trajectory (homework, skipping school).

Limitations and Conclusions

The current study is unique in that it examined multiple patterns of PPMK with a population-based, longitudinal sample of Canadian children and youth aged 10 to 15. Although other work has been conducted with longitudinal samples (e.g., Spano et al., 2011; Laird et al., 2008), the present study utilized a far greater sample than previous work, drawing conclusions based on a sample of several thousand children, as opposed to samples of several hundred children. This affords greater statistical power to this study's analyses, and perhaps strengthens the findings across studies. Other studies also focused on specific sub-populations (e.g., youth at risk), whereas the present study examines a more heterogeneous, general population sample. In addition, a wide range of socio-economic predictors and youth outcomes were examined for associations with PPMK. Multiple outcome measures were available, including behavioural, academic, and substance use outcomes, as well as an objective, standardized measure of math.

However, because the majority of outcomes were reported by youth, as was the measure of PPMK, we cannot discount the issue of shared method variance. Although parent-reported outcomes are available in the NLSCY, they are not available for youth in this age range.

Although the present study took a longitudinal approach, the findings cannot be interpreted as causal. That is, although the behavioural outcomes examined in the study occurred at the end of the study period (ages 14 to 15), this study does not conclude that parental monitoring practices cause certain adolescent behaviours. In fact, many of the adolescent outcomes examined follow, themselves, longitudinal patterns, such as stable or changing levels of behaviours. Laird and colleagues (2003) found that there was a reciprocal relationship between adolescents' delinquent behaviour and parents' monitoring-relevant knowledge. Future research may wish to extend such findings by examining reciprocal associations between longitudinal patterns of PPMK and patterns of behavioural and academic outcomes. It might also be of interest to examine these relations for specific sub-populations of youth (e.g., first-born children, those at risk, see Spano et al., 2012). Furthermore, heterogeneous trajectories of PPMK could be considered as a moderator variable in future research examining associations between family-level variables and youth outcomes (e.g., Kiesner, Poulin, & Dishion, 2010).

The measure of PPMK used in this study also has certain limitations. As a youth-reported measure, the items only capture youth's perceptions of their parents' monitoring behaviours. Several studies have demonstrated that parental reports may overestimate parental knowledge of their child's whereabouts and activities and significantly underestimate their child's engagement in high-risk behaviours (Cottrel et al., 2003; Stanton et al., 2000). Conversely, adolescent reports of parental monitoring behaviours are generally thought to be more accurate than parental reports as they have been found to be significantly associated with adolescent risk behaviours (Cottrel et al., 2003). However, adolescents can only provide reports of their *perceptions* of parental monitoring rather than actual parent behaviours (Hayes et al., 2003). A different or more objective measure of parental monitoring may have yielded different findings. Furthermore, the measure of monitoring was limited by survey items, which may not fit with theoretical concepts of monitoring (e.g., Stattin & Kerr, 2000) and may be more reflective of the construct of parental knowledge. Thus, some caution is warranted in interpreting the findings.

The results of this study point to the heterogeneity in parental monitoring practices as well as the association between levels of PPMK and adolescent behaviours, school outcomes, and substance use. Overall, this study underscores the important role played by PPMK in youth development, even as the child enters adolescence and exerts greater independence, in particular in terms of behavioural, academic, and substance-use outcomes. Future research may wish to examine predictors of monitoring behaviours, different measures of monitoring behaviours or practices that have the greater impact on children's development, and the period during which their importance is most salient.

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