Identifying Birth Order Effects on Adolescent Risky Behaviour

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Abstract

In this paper I look at how birth order affects a Canadian adolescent's propensity to engage in risky behaviour such as, smoking, drinking, marijuana use, and drug trafficking. Using data from the National Longitudinal Survey of Children and Youth I investigate the impact of having at least one older sibling on a child's likelihood to engage in these behaviours. My results demonstrate that middle and last borns are much more likely to engage in risky behaviour than firstborns. This suggests that birth order is an important determinant of risky adolescent activity.

Introduction

Illicit drug use is a serious concern costing the Canadian society upwards of an estimated $8 billion dollars a year (Canadian Centre on Substance Abuse, 2007). Due to the fact that sixty percent of drug users in Canada are between the ages of 15 and 24, drug prevention policies are often focused on the youth (Canadian Centre on Substance Abuse, 2007). The Canadian government devotes a lot of resources to drug prevention policies aimed at reducing levels of substance abuse among the countries youth. It is important to identify the reasons teenagers choose to engage in these risky behaviours, as well as the most at risk groups, in order to implement the most successful policies.

The importance of peer effects, and how they impact a youth's choices to engage in risky behaviour has been acknowledged in the literature (Evans et al. 1992). The effect of school-based peer influences vs. neighbourhood influences has also been well documented (Gavira and Raphael, 2001). It is often debated whether or not the social interactions a youth faces, either at school or in the neighborhood are important in shaping their decisions. However, there is another important peer group, the family.

Studies like those by Becker (1981), Ottenger (2000), Iacovou (2001), and Argys el. al (2006) suggest that birth order can impact a child's important life decisions. There are a number of studies that attempt to link the effect of birth order on wages, education, and test scores (Olneck and Bills, 1979; Kessler 1991; and Hanushek, 1992). Recently studies like, Ouyang (2004), Argys et al (2006), and Altonji et al. (2010), have used teen risky behaviour as an avenue for studying birth order or sibling effects.

Using National Longitudinal Survey of Children and Youth (NLSCY), I attempt to identify the influence of birth order effects on Canadian youth. I do this by looking at

adolescents aged 12-17, to investigate how the presence of an older sibling affects a child's likelihood to engage in a number of risky and delinquent behaviour. I use a model similar to that in Argys et. al (2006) to capture how birth order affects a Canadian teen's alcohol, smoking, marijuana use, and drug trafficking.

I find evidence suggesting that birth order influences the likelihood that a teen will engage in risky behaviours. Specifically, it is later born children that are left worse off because of birth order effects, and are more likely to participate in the activities under study. However, it is difficult to pinpoint exactly how birth order affects the behaviour of teenagers. My results are consistent with the hypothesis that peers and older siblings influence later born children, and that parents have less time and energy to invest in their later offspring.

This paper focuses on outcomes of substance abuse and does not examine other delinquent activities like stealing and gang involvement. Unlike Argys et. al (2006) I find no evidence that females with older siblings are more likely to smoke marijuana. Although the results of this paper reinforce the findings of Argys et. al (2006), which is that on average adolescents with older siblings are more likely to engage in risky behaviour, the results in my paper are estimated using the limited probability model (LPM), not the univariate probit model used in Argys et. al (2006).

The findings of this study should be considered by public policy makers creating programs attempting to reduce substance abuse among Canadian teenagers. It should be taken away that focusing parental resources on firstborn children, encouraging good behaviour and positive role modeling, could have a spill over effect on later-born children.

Literature Review

Intrahousehold allocation defined as, the allocation of resources among individuals in a family, suggests that resources and time must be divided between all of the children in a family, and as families get larger there is less for each additional child. Thus, the economic theory behind birth order effects argues that parents invest their time and effort differently according to a child's birth order.[1] Specifically, birth order effects favor firstborn children because of stronger endowment effects available to them. The idea being that, parents invest less time and energy into supervising younger siblings. Furthermore, younger siblings may be influenced by their older siblings behaviour.

There is a common belief among social scientists that birth order effects are important in determining an individual's personality, intelligence, and economical and educational achievements. Zajonc (1976) theorized that a child's intellectual level could be seen as the average of the "absolute intellectual levels" of all the members of a family. When a new child is born the average intellectual level of the family falls. Thus, firstborns benefit from the undivided attention they receive from their parents before other children enter the picture. However it has proven difficult to accurately measure this effect.

Behrman and Taubman (1986) present the problem where parents maximize their utility in a one period problem defined over their own consumption and the expected earnings capacity of their children. The earning capacity of a child depends largely on the endowments available to them and human capital investments, often determined by their parents. Thus, parents face a budget constraint where their income is divided into their

[1] See Becker (1981), Behrman, et al. (1982), and Becker and Tomes (1986).

own consumption and investment in their children, which consists of things like education. It is reasonable for parents to invest more in their early born children since the financial and emotional returns would be available to them at a younger age where it benefits them the most.

Behrman and Taubman (1986), also argue that the nature of parental preferences combined with life cycle timing may help explain birth order effects. Diminishing marginal utility with parenting, the theory that parents gain less utility from each additional child, could lead to preferential treatment of firstborns. Furthermore, Diminishing marginal costs to parenting, the idea being that each additional child costs less than the first, may lead parents to have extra children where they might have otherwise refrained. Then again, later born children may benefit from being raised at a time when parents are less career motivated and focused more on the continuation of their family into future generations.

It is easy to confuse the effects of family size when attempting to measure birth order effects by studying sibling educational achievements. Haveman and Wolfe (1995) have documented that family size and educational attainment are negatively related. Olneck and Bills (1979) authored one of the first papers that attempted to control for birth order and family size effects, while looking at income and test scores. After controlling for family size they found no statistically significant evidence of birth order effects. However, due to data limitations, Olneck and Bills (1979) were not able to use single child families, and their model has been criticized by Kessler (1991) for being over restrictive.

Researchers have since realized the shortcomings of Olneck and Bills (1979). However few have produced dramatically different results. Researchers attempting to study birth order effects focusing on economic indicators like wages (Kessler, 1991), and educational attainment (Hanushek, 1992), have failed to produce convincing arguments that birth order effects exist. Steelman et al. (2002) document the difficulties in capturing birth order effects on intellectual development, and educational achievements. Despite its appeal, most findings do not support the existence of birth order effects on levels, or growth of earnings, or intellectual development, and education (Kessler, 1991 Steelman et al. 2002).

It appears that researchers have had more success identifying differences between firstborn and later-born children during their teenage years. Rodgers et al. (1992) used data from the NLSY79 cohort to identify differences in age at a sibling's first sexual encounter. Controlling for family size and they find younger siblings are more likely to have sexual intercourse at a younger age.

Another popular research focus related to birth order effects has been to examine the effects of sibling sex composition. In these studies researchers test whether siblings of the same gender influence each other differently then opposite gendered siblings. Butcher and Case (1994) found that sibling sex composition had little effect on educational achievement on men. They did however find that women with sisters gained less education than those raised only with brothers. However, when Kaestner (1997) examined theses same relationships his result were in sharp contrast with those of Butcher and Case (1994). That is to say he found very little evidence of the effects of sibling sex composition on education for both sexes.

Recent studies have examined how the behaviour and achievements of older siblings affect their younger siblings. The difficulty in studying this is the unobserved heterogeneity that exists between siblings. Ottenger (2000) demonstrates a significant positive effect of an older siblings educational achievement, while controlling for unobserved heterogeneity on high school graduation by using instrumental variables. Ottenger (2000) uses measures of family "intactness" during childhood, gender, and unemployment rates as instrumental variables to address the problem of sibling endogeneity.

Iacovou (2001) finds evidence that birth order effects change in magnitude due to sibling ship defined as, the number of siblings one has, and where the child is in the birth order. For example Iacovou (2001) finds evidence that, in general, children from large families do worse on test scores, as do children born later in the birth order. However he does find evidence to suggest that only children do worse than children from two child households. This suggests that interactions with other children may be vital to a child's development. By using twin birth as an instrument for family size, Black et al. (2005) find that birth order has a greater influence on educational achievement than family size. These papers have further highlighted the importance of controlling for family size when examining birth order effects.

Argys et al. (2006) argue that it may be more effective to study birth order effects on adolescent's risky behaviour, as opposed to earnings or educational achievements. Using data from the 1997 cohort of the National Longitudinal Survey of Youth (NLSY97), they demonstrate that adolescents with younger siblings are more likely to

have used tobacco, alcohol, and marijuana than their older siblings, as well as participate in other delinquent behaviour such as stealing and property destruction.

Argys et al. (2006) are quick to admit that theses behaviours could be due to a number of plausible explanations such as exposure from older siblings or imitation. They do not find evidence that older siblings serve as positive role models. While they do find evidence that teenagers with older siblings are more likely to engage in risky behaviour, they do not test sibling interactions directly.

A handful of studies focused on studying sibling influences directly have used adolescent risky behaviour as a measure (Ouyang, 2004; Altonji et al., 2010). Both of these studies find significant effects of older sibling behaviour impacting tobacco, alcohol, and marijuana consumption of the younger sibling. These studies are consistent with a number of hypotheses such as, the "role model hypothesis" and the "opportunity hypotheses". The "role model hypothesis" argues that older siblings influence their younger siblings' behaviour through observation and imitation, (Widmer, 1997; Rodgers and Rowe, 1988). The "opportunity hypothesis" suggests that siblings influence each other by providing similar settings and friends, which provide them opportunity for substance use and sexual exploration. These hypotheses are consistent with the basic principals behind birth order effects, which argues that diminishing returns to parenting leaves less time, energy, and resources for younger siblings. This may lead to less parental supervision and more reliance on leaving the younger siblings in the care of the older.

In summary, there is lots of appeal to studying birth order effects and, there is strong theoretical support behind it. Historically it has been difficult to document this

effect, especially when focusing on income and education. However, there is evidence that studying adolescent risky behaviour, such as drinking, smoking, and drugs is a good avenue for measuring birth order effects.

In this paper I do not focus on sibling interactions directly, rather I am focused on birth order effects in its simplest form, the presence of an older sibling. The results of this paper suggest that birth order can shape an adolescents' decision making. This paper also supports the theoretical expectations of birth order effects, which suggest that younger siblings are negatively effected due to diminishing returns to parenting and sibling influence.

Data Description

The empirical analysis is based on youth from the last three rounds of the National Longitudinal Survey of Children and Youth (NLSCY), collected in 2004, 2006, and 2008. The NLSCY is a panel study of Canadian children and youth that follows their development from birth to early adulthood. The NLSCY was launched to, "collect information about factors influencing a child's social, emotional and behavioral development and to monitor the impact of these factors on the child's development over time."[2] The NLSCY began in 1994 and data was collected jointly by Statistics Canada and Human Resources Development Canada. The NLSCY is well suited for this proposed work. Not only does the NLSCY gather important family and household information, it records data on youth's risky behaviours such as, illicit drug use, smoking, and alcohol consumption.

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[2]Statistics Canada. n.d. *Microdata User Guide, National Longitudinal Survey of Children and Youth, Cycle 7, September 2006 to July 2007.* http://www.statcan.gc.ca/imdbbmdi/document/4450_D4_T9_V7-eng.pdf (November 9, 2010).

Households asked to participate in the NLSCY were initially drawn from the Labour Force Survey's (LFS) sample of respondent households. The households surveyed for the LFS that had children between the ages of 0 and 11 were asked to participate in the NLSCY. Respondents continued to be interviewed every two years until 2008. Respondents were gathered from the 10 provinces and not from the Territories or Native Reserves.

The NLSCY is divided into several components; I utilize the *Household, Adult,* and *Self-complete* components to construct my variables. The *Household* component is the first part of the interview, and asks basic demographic information about members in the household. The *Adult* component asks questions about the Person Most Knowledgeable (PMK), most commonly the mother, of the adolescent as well as the spouse of the PMK. The PMK is responsible for answering parts of the *Youth* component where the children are too young to answer themselves. The purpose of the *Adult* component is to gather general health information about the PMK and spouse, as well as information regarding the child's social and economic environment. The *Self Complete* component is a paper questionnaire which youth's between the ages of 12 and 17 complete themselves.

The main outcome I analyze is whether or not the respondent has engaged in specific risky behaviours such as cigarette, alcohol, and marijuana consumption, and drug trafficking. With the exception of cigarette smoking, the NLSCY asks respondents their experience with these behaviours in the 12 months prior to the interview date. For cigarette smoking it is only asked whether or not the respondent has ever smoked. I construct binary variables based on these survey questions asked in the "Smoking, Drinking and Drugs," section of the *Self-complete* component. Some individuals do not

answer questions about all behaviours in every round, thus my sample size is slightly different for the different activities. For example the sample size for male smoking is 6,339 and 6,349 for male alcohol consumption.

The *Household* component of the NSLCY allows me to ascertain the presence and number of, older and younger siblings, as well as the family size of each respondent. Table 1 reports the weighted descriptive statistics for the explanatory, family size and birth order variables for males and females. In the female sample 45.8% have older siblings compared to 44% in the male sample.

Furthermore, the *Adult* components gather extensive information about a child's parents, neighbourhood, and family, social and socioeconomic factors. The average age of a respondent's mother at the time of birth is 34 for males and 33 for females. In both the male and female samples 4% of families receive social assistance. 53% of males have college-educated mothers compared to 50% of females. The sample is 99% white for both sexes.

Table 2 contains the weighted means of the dependent variables presented separately for males and females and divided into the full sample, older and younger siblings. The proportion of younger siblings who report having participated in the risky behaviour in question is higher in all cases for males. For females, the reported proportions of younger siblings are higher in smoking only, and are essentially the same for the other three behaviours.

This study uses data from respondents between the ages of 12 and 17. Since the survey is administered ever 2 years, by a respondent's fourth cycle they would be 18 and leave the analysis. Thus, I limit my study to three cycles of the NLSCY. Therefore, a

single respondent can contribute up to three observations and I observe most children more than once. When the first cycle of the NLSCY was gathered only children 2-11 were included. In order to get the proper age demographic I use the last three cycles of the survey for my analysis, cycles 6, 7, and 8. There are 7,422 males and 7,650 females in my sample.

Methodology

Baseline Model

I estimate the following baseline model, similar to that in Argys et al. (2006), to examine the effect birth order has on the risky behaviours of adolescents.

$$y_{it}^* = \beta S_{it} + \alpha F_{it} + \gamma X_{it} + \varepsilon_{it}$$

y_{it}^* is a latent variable, and is not directly observed. When $y_{it}^* > 0$, the indicator variable, y_{it}, is assumed to equal one. Thus the model takes the form,

(1) $$\text{Prob}(y_{it} = 1) = \text{Prob}(\beta + \alpha F_{it} + \gamma X_{it} + \varepsilon_{it} > 0).$$

This model focuses on the role older siblings have on y_i, a binary variable equal to one if the adolescent has engaged in a risky activity at time *t*. In my analysis y_i takes on four forms: whether or not the adolescent has been drunk, smoked marijuana, or sold drugs in the past 12 months, and whether or not the individual has ever smoked cigarettes.

Although I observe the same children more than once I do not take advantage of the longitudinal aspect of the data, as I do not have variation in older siblings. Thus I do not use fixed effects when estimating my model and instead us the limited probability model.

S_{it} is a dichotomous variable equal to 1 if the adolescent has an older sibling. F_{it} represents a vector of family size controls. As mentioned earlier, this is integral when

attempting to capture birth order effects, as they are often confused with family size effects. The vector F_{it} takes on five forms and represents whether the child is from a one-child household, two-child household, three-child household, four-child household or a household with 5 or more children. Note that families with two children or more are the largest and thus the omitted category when the regression is run.

Let X_{it} represent a vector of other important controls. The control vector X_{it} is made up of observed control variables gathered from the NLSCY. Individual characteristics consist of the child's age, language dummies distinguishing if the child speaks only French or only English, age of mother at birth, and race. I include a control for family "intactness", a dichotomous variable equal to one if the child does not live with both biological parents. Socioeconomic indicators include, if the child's person most knowledgeable (PMK) is college educated, and whether or not the family has received social insurance during the survey years. The social assistance indicator is a proxy for poor families. Finally geographical dummy variables are included for the different provinces, and to indicate if the child is from a rural or urban area.

The main variable of interest in the baseline model is S_{it}. If β_1 is estimated at a value greater than zero it indicates that the presence of an older sibling increases a middle-born or last-born child's propensity to engage in the risky behavior in question. An estimated coefficient less than zero indicates that middle-born and last-born children are less likely to engage in the risky behaviour under study than their firstborn counterparts. All the while holding constant family size, and other control variables contained in X_i. Recall that the omitted category is firstborn children, thus a value of S_i equal to one means that a child has a least one older sibling.

Extensions of the Baseline Model

In this section I make extensions to the baseline model to further investigate how birth order and family size impact an adolescent's risky behaviour. The baseline model is only able to demonstrate differences in behaviour between firstborns and younger siblings. In the first extension of the model, Model 2, I distinguish between middle-born and last-born children. This allows me to adopt a more flexible specification of birth order.

I expand the original model by replacing the dichotomous variable representing the presence of on older sibling, S_{it}, with two dichotomous variables, MB_{it} and LB_{it}, that equal one if the adolescent is middle or last-born respectively. Thus Model 2 takes on the form:

$$(2) \qquad y_{it}^* = \beta_1 MB_{it} + \beta_2 LB_{it} + \alpha F_{it} + \gamma X_{it} + \varepsilon_{it}$$

Here, the principal coefficients of interest are MB_{it} and LB_{it}. Specifically, I am looking at how behaviour of middle-born and last-born children is different from firstborns. Estimates that are greater than zero indicate that children who are middle-born and last-born are more likely to engage in risky behaviour than firstborns holding family size and factors in X_{it} constant. In Model 2 I can see if the estimated effect of being middle-born is different than the estimated effect of being last-born.

In the second extension of the baseline model, Model 3, I explore how birth order effects systematically vary according to family size. In Model 3 I adopt an even more flexible specification of birth order by replacing S_{it} by a vector of dichotomous variables, $\mathbf{O}_{it}$, which distinguish whether a child is first-, second-, third-, fourth-, or fifth-born. To determine how the effects birth order vary with family size I run separate regressions for

two-, three-, and four-child households, using the birth order measures in $\mathbf{O}_{it}$. When running the regression for two-child households I only use observations that come from two child-families. I do the same with three-child and four-child families. Thus, I do not include the vector F_{it} in Model 3.

(3) $$y_{it}^* = \beta \mathbf{O}_{it} + \gamma X_{it} + \varepsilon_{it}$$

Model 3 allows me to investigate the hypothesis that the effect of being born second is significant among two-, three-, and four-child households, and if the effect of being born third is significant among three-child and four-child households. Hence I will be able to observe if birth order and family size interact in a significant fashion.

Results

Tables 3 through 6 present the results from the baseline model using the limited probability model (LPM) approach for the four outcomes, ever smoked cigarettes, been drunk, smoked marijuana, and sold drugs.[3] The results are presented first without any control variables in column (1) for males and (4) for females. Family size controls are then introduced in column (2) for males and (5) for females, followed by the complete model with full controls in columns (3) and (6). The baseline model includes one measure of birth order, the presence of an older sibling. Presenting the results separately for males and females allows for gender differences in the relationship between birth order and risky behaviour.

An interesting note is that before introducing any controls having an older sibling negatively impacts the likelihood of an adolescent's likelihood to engage in the four risky behaviours, with the exception of drug trafficking for males. In most cases after

[3] The results are weighted, using longitudinal weights in an attempt for conclusions to be drawn on all Canadian youth, and are presented separately for males and females.

introducing family size controls the coefficients become positive. This again highlights the importance of controlling for family size when studying birth order effects.

I find that, on average, adolescents with older siblings are more likely to engage in risky activities for all four behaviours, with the exception of females selling drugs, when controlling for family size, socioeconomic status, individual characteristics, and other factors, columns (3) and (6). This is consistent with the findings of Argys et al. (2006).

In the model with full controls males with older siblings are 4.1 percentage points more likely to have smoked cigarettes, while females are 5.6 percentage points more likely, compared to firstborns. This is the largest effect we see for females across the four behaviours. Compared to the proportion of adolescents in the sample who report having ever smoked, 28.1% for males and 33.2% for females, these effects are substantial.

Similar to cigarette smoking, adolescents with older siblings are more likely to have been drunk in the previous 12 months with full controls. Males are 4.6 percentage points more likely compared to females who are 3.4 percentage points more likely. These results are considerable as the proportions of males and females reporting having been drunk are 32.5% and 34.8% respectively, the largest in the sample.

Birth order effects are the strongest for marijuana usage in males who are 6.6 percentage points more likely to consume marijuana than those without older siblings. The result is similar for females, although not as large, who are 1.9 percentage points more likely to partake in the activity, the coefficient however is significant only at the 10% level. The results with marijuana smoking are striking for males, the indicator is the

largest of the behaviours, and the marijuana proportions for males are lower compared to alcohol and cigarettes at 21.2%.

Under the presence of full controls male adolescents are 3.6 percentage points more likely to have sold drugs if they have an older sibling, while the results from the female regression are negligible. The proportions of adolescents who report having participated in risky behaviours is unsurprisingly the lowest for drug trafficking, 7.2% for males and 4.1% for females. With selling drugs we see the strongest gender difference of the four behaviours, with the effect for females actually being negative. It is also important to note that even though this is the smallest effect observed for males, it is sizeable when compared to the low proportion of males who reported engaging in the activity.

The estimate of the effect of having an older sibling on substance abuse is statistically greater than zero at the 1% level in all of the behaviours for males.[4] The estimates for females are statistically greater than zero at the 1% level for cigarette and alcohol consumption and the estimate for marijuana use is statistically greater than zero at the 5%. Thus I can persuasively conclude that having an older sibling does, on average, have a positive impact on younger siblings likelihood to engage in substance abuse.

I find race to have a negative impact on drug trafficking, cigarette, and marijuana consumption for males and alcohol consumption for both sexes. This suggests that being white is associated with a higher probability of engaging in risky behaviour. This is in line with pervious research, Ouyang (2004), Argys et al. (2006), and Altonji (2010) find evidence supporting that nonwhite teens are less likely, on average, to engage in substance abuse. In addition, I find that adolescents who do not live with both of their

[4] See appendix 3 for t statistics and calculations

biological parents are much more likely to have consumed cigarettes, alcohol, and marijuana, as well as have sold drugs. These results are statistically significant across both sexes.

There is no clear relationship that living in an urban area affects the probability of engaging in risky behaviours. For example smoking cigarettes, getting drunk, and selling drugs is no more likely for males and females who live in urban areas. Thus, on average, it is no more likely that children in urban areas will participate in risky behaviours than teens from rural areas.

In most cases, living in a household that has received social assistance is associated with an increased probability of partaking in risky behaviour, while PMK education is associated with a decreased probability. For example female adolescents who come from a family receiving social assistance are 11.9 percentage points more likely to smoke marijuana, while having a college educated mother reduces the likelihood they will smoke marijuana by 4 percentage points. These two factors suggest that, on average, socioeconomic status is inversely related to the probability of an adolescent consuming tobacco, alcohol, marijuana, and having sold drugs.

The results from the baseline model strongly suggest that adolescents with older siblings are more likely than firstborns to partake in risky behaviours. This is consistent with the argument that parents may not be able to invest as much time or resources into their later-born children. It also goes against the common misconception that experienced parents are more efficient at raising children, or that older siblings serve as positive role models to their younger brothers and sisters. These results may be a consequence of younger siblings being "prematurely" exposed to these behaviours by their older siblings.

Recall the "role model" hypothesis, which argues that teens look up to their older siblings, mimicking and imitating their behaviours, and the "opportunity" hypothesis, in which older siblings provide friends and settings that could encourage delinquent behaviour. Thus a possible explanation of birth order effects could be that younger siblings are imitating or mimicking their older siblings behaviour, or even learning how to engage in these types activities, being taught by their older siblings.

Tables 7 and 8 present the results from the first extension of the baseline model. Here, I introduce two new measures of birth order effects, where middle-born and last-born children are separated into two distinct categories. The results for males suggest that later-born children are more prone to partaking in risky behaviours. The probability of engaging in any of the four risk behaviours is higher for last-born males compared to middle borns and firstborns for all four activities, however only last-born indicators reach conventional levels. In females the results vary. On average middle-born children are no more likely to engage in risky behaviour than their first and last-born counterparts, and the estimators often do not reach conventional levels. For smoking however, where both indicators are significant at the 1% level, middle-born and last-born females are exactly as likely to have smoke cigarettes. The results for males tend to suggest that early born children benefit somehow, possibly due to marginal returns to parenting, while it is difficult to draw conclusions from the female population.

As mentioned, in the first extension of the model, being middle-born fails to reach conventional levels for males in all cases, and is significant in females for estimates of smoking and being drunk. I can gain inference by jointly testing the effect of being middle-born and last-born on risky behaviour. The F statistics from testing this

hypothesis reveal that being middle-born and last-born is jointly significant at any conventional level for smoking cigarettes, smoking marijuana and drug trafficking for males.[5] For females being middle-born and last-born is jointly significant for the estimates of alcohol and cigarette use. These tests results further support the idea that being born later in the birth order increases an adolescent's propensity to partake in risky activities and substance abuse.

The results of the second extension to the baseline model are displayed in Tables 9 and 10. In extension two I run separate regressions for each family size in order to test if the effect of birth order varies systematically according to family size. The results of this extension for males again suggest that middle-born and last-born children are more likely to engage in risky behaviours, especially in two-child and three-child households. The strongest effect is seen in three-child households where third born children are, in all cases, more likely to have engaged in all four risky activities compared to second borns and firstborns. The results for females indicate again that middle-born and last-born children are, on average, more prone to engage in risky behaviour, however we do not see an increased amount of risk for last-born females.

I do not see evidence that birth order and family size interact in a significant way. Estimates reach conventional levels for second-born children nine times across all four behaviours and both sexes. Estimates for third-born children across the different family sizes reach significance only five times for both sexes. Thus, I cannot reject the hypothesis that the effect of being born second or third is equal across family sizes. Overall, from this extension I cannot conclude that family size interacts with birth order in a significant fashion. However, it is interesting to note that as family size increases the

[5] See appendix 4 for F tests on the joint significance of being middleborn and lastborn

proportions of teenagers who report engaging in the risky behaviours decreases. For example, 32.6% of males from two-child households report being drunk in the past 12 months compared to 22.6% of males from four-child households. A similar trend is seen in all four behaviours in males and females and warrants further analysis.

Conclusion

There is a general belief that birth order can affect a child's life decisions, especially in his teenage years. This paper uses data on Canadians, aged 12-17, gathered from the NLSCY to examine how birth order effects an adolescent's likelihood to partake in risky behaviour, specifically smoking, drinking, and selling drugs.

After controlling for family size and other factors like socioeconomic status and individual characteristics, I find evidence that birth order effects leave younger siblings at a bigger risk of engaging in delinquent behaviour in their teenage years. The effect is strong for males across the four behaviours. Females with older siblings are much more likely to smoke cigarettes and get drunk, however are no more likely to have sold drugs. In extensions to the baseline model I find that last-born children are at more risk than middle-born, and that family size does not interact with birth order in a significant fashion.

There are a number of explanations for why birth order may affect an adolescents' propensity to participate in what is perceived by most people to be risky behaviour. It could be that older siblings are introducing these substances to their younger siblings earlier than they would have seen them otherwise, or that they are put in situations where risky behaviour is accessible and even encouraged. It may be that parents are not able to invest as much time or energy into disciplining or supervising their youngest children.

Whatever the reason, these results suggest that birth order can have long run consequences.

Family interactions are important in determine a child's behaviour and parents often expect their older children to serve as positive role model's for their younger brothers and sisters. This paper finds no evidence that older siblings serve as positive mentors, and that imploring older siblings to set better examples could have spillover effects.

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Table1 Weighted Means of Descriptive Statistics

	Males		Female	
Variable	Mean	Standard Deviation	Mean	Standard Deviation
Birth Order Variables				
Has Older Sibling	0.44	(0.496)	0.458	(0.5)
Last Born	0.181	(0.358)	0.19	(0.392)
Middle Born	0.145	(0.353)	0.147	(0.354)
First Born	0.56	(0.496)	0.542	(0.498)
Second Born	0.326	(0.469)	0.335	(0.472)
Third Born	0.093	(0.29)	0.092	(0.289)
Fourth Born	0.016	(0.126)	0.025	(0.156)
Born 5th or later	0.002	(0.048)	0.002	(0.05)
Family Size Variables				
Only Child	0.187	(0.39)	0.183	(0.386)
2 Child Household	0.459	(0.498)	0.451	(0.5)
3 Child Household	0.267	(0.443)	0.24	(0.427)
4 Child Household	0.065	(0.246)	0.095	(0.293)
5 or more Child Household	0.023	(0.149)	0.032	(0.175)
Control Variables				
Age	14.77	(1.623)	14.77	(1.623)
PMK is College Educated	0.533	(0.563)	0.503	(0.57)
Social Assistance	0.04	(0.195)	0.042	(0.2)
Mother's age at birth	33.8	(18.508)	33.01	(17.38)
Ontario	0.377	(0.485)	0.381	(0.486)
Newfoundland	0.016	(0.125)	0.017	(0.13)
PEI	0.005	(0.0715)	0.005	(0.07)
Nova Scotia	0.031	(0.173)	0.028	(0.164)
New Brunswick	0.024	(0.153)	0.023	(0.150)
Quebec	0.242	(0.438)	0.237	(0.425)
Manitoba	0.038	(0.192)	0.04	(0.195)
Saskatchewan	0.035	(0.184)	0.036	(0.187)
Alberta	0.114	(0.318)	0.113	(0.317)
British Columbia	0.117	(0.322)	0.121	(0.326)
Non White	0.088	(0.283)	0.099	(0.298)
Lives in Urban Area	0.845	(0.362)	0.849	(0.358)
Does not live with Biological Parents	0.342	(0.475)	0.336	(0.473)
Speaks English Only	0.592	(0.491)	0.604	(0.489)
Speaks French Only	0.254	(0.435)	0.244	(0.429)
Observations	7650		7422	

Standard Deviations in parentheses

Table 2 Weighted Means of Substance Abuse for Older and Younger Siblings

	Full Sample	Older Siblings	Younger Siblings
Males			
Smoking	28.10%	25.80%	27.10%
	(0.4494686)	(4377516)	(.4443498)
Drinking	32.50%	30.60%	30.70%
	(.4682717)	(.4608514)	(.4612942)
Marijuana	21.20%	18.60%	21.10%
	(.4087799)	(.3888075)	(.4078802)
Sold Drugs	7.20%	5.90%	7.90%
	(.2576366)	(.2361474)	(.2697097)
Females			
Smoking	33.20%	30.70%	31.40%
	(0.4708126)	(0.4614386)	(0.4642122)
Drinking	34.80%	32.00%	31.60%
	(0.4762558)	(0.4666637)	(.4651731)
Marijuana	22.10%	20.90%	20.00%
	(.4145892)	(.4069702)	(.4003025)
Sold Drugs	4.10%	3.50%	3%
	(.1977649)	(.1849428)	(.1692344)

Standard Deviations in parentheses

Table 3 Determinates of Cigarette Consumption LPM

	Male			Female		
	Ever Smoked Cigarettes			Ever Smoked Cigarettes		
	(1)	(2)	(3)	(4)	(5)	(6)
Has Older Siblings	-0.018	0.010	0.041***	-0.032***	0.019	0.056***
	(0.011)	(0.013)	(0.012)	(0.012)	(0.013)	(0.013)
Only Child		0.060***	0.012		0.105***	0.052***
		(0.017)	(0.016)		(0.017)	(0.017)
Three-child household		-0.012	-0.008		-0.051***	-0.040***
		(0.014)	(0.013)		(0.015)	(0.014)
Four-child household		-0.061**	-0.026		-0.042**	-0.031
		(0.024)	(0.023)		(0.021)	(0.020)
Five or more child household		-0.034	-0.025		-0.101***	-0.097***
		(0.039)	(0.037)		(0.035)	(0.033)
Age12			-0.256***			-0.268***
			(0.020)			(0.020)
Age13			-0.186***			-0.222***
			(0.019)			(0.020)
Age14			-0.089***			-0.129***
			(0.017)			(0.018)
Age16			0.120***			0.061***
			(0.017)			(0.018)
Age17			0.170***			0.176***
			(0.017)			(0.018)
PMK is college educated			-0.028***			-0.040***
			(0.009)			(0.010)
Lives in urban area			-0.002			-0.015
			(0.015)			(0.016)
Social Assistance			0.054*			0.119***
			(0.030)			(0.028)
Mother's age at birth			-0.001**			-0.001
			(0.000)			(0.000)
Not intact family			0.134***			0.122***
			(0.013)			(0.013)
Nonwhite			-0.167***			0.019
			(0.022)			(0.020)
Proportion who engage in behaviour	28.10%	28.10%	28.10%	33.20%	33.20%	33.20%
Observations	6339	6339	6339	6463	6463	6463
R-squared	0.00	0.00	0.15	0.00	0.01	0.16

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Controls used in the model but not presented include, survey year, provincial dummies, family income and language dummies.

A child that belongs to a not intact family means that the child does not live with both biological parents.

Social Assistance is a dichotomous variable equal to one if the child's family has received social assistance.

Table 4 Determinates of Alcohol Consumption LPM

	Male			Female		
	Been Drunk in previous 12 Months			Been Drunk in previous 12 Months		
	(1)	(2)	(3)	(4)	(5)	(6)
Has Older Siblings	-0.032***	0.004	0.046***	-0.057***	-0.003	0.034***
	(0.012)	(0.013)	(0.012)	(0.012)	(0.013)	(0.012)
Only Child		0.065***	0.027*		0.076***	0.040**
		(0.017)	(0.015)		(0.018)	(0.016)
Three-child household		-0.018	-0.022*		-0.074***	-0.071***
		(0.014)	(0.013)		(0.015)	(0.013)
Four-child household		-0.102***	-0.062***		-0.088***	-0.088***
		(0.025)	(0.022)		(0.021)	(0.019)
Five or more child household		-0.059	-0.043		-0.204***	-0.177***
		(0.041)	(0.035)		(0.035)	(0.032)
Age12			-0.333***			-0.359***
			(0.019)			(0.020)
Age13			-0.300***			-0.305***
			(0.018)			(0.019)
Age14			-0.159***			-0.160***
			(0.016)			(0.017)
Age16			0.187***			0.112***
			(0.017)			(0.017)
Age17			0.272***			0.190***
			(0.017)			(0.017)
PMK is college educated			0.016*			-0.034***
			(0.009)			(0.010)
Lives in urban area			-0.012			-0.037**
			(0.015)			(0.015)
Social Assistance			-0.039			0.048*
			(0.028)			(0.027)
Mother's age at birth			-0.001**			-0.001*
			(0.000)			(0.000)
Not intact family			0.090***			0.121***
			(0.012)			(0.013)
Nonwhite			-0.190***			-0.088***
			(0.021)			(0.020)
Proportion who engage in behaviour	32.50%	32.50%	32.50%	34.80%	34.80%	34.80%
Observations	6349	6349	6349	6459	6459	6459
R-squared	0.00	0.01	0.26	0.00	0.02	0.23

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Controls used in the model but not presented include, survey year, provincial dummies, family income and language dummies.

A child that belongs to a not intact family means that the child does not live with both biological parents.

Social Assistance is a dichotomous variable equal to one if the child's family has received social assistance.

Table 6 Determinants of Drug Trafficking LPM

	Male			Female		
	Sold Drugs in Previous Year			Sold Drugs in Previous Year		
	(1)	(2)	(3)	(4)	(5)	(6)
Has Older Siblings	0.013**	0.025***	0.036***	-0.020***	-0.008	-0.001
	(0.007)	(0.007)	(0.007)	(0.005)	(0.006)	(0.006)
Only Child		0.010	0.005		0.018**	0.006
		(0.010)	(0.010)		(0.007)	(0.007)
Three-child household		-0.014*	-0.012		-0.014**	-0.014**
		(0.008)	(0.008)		(0.006)	(0.006)
Four-child household		-0.034**	-0.022		-0.030***	-0.030***
		(0.014)	(0.014)		(0.009)	(0.009)
Five or more child household		-0.052**	-0.046**		-0.028*	-0.032**
		(0.022)	(0.022)		(0.015)	(0.015)
Age12			-0.089***			-0.042***
			(0.012)			(0.009)
Age13			-0.076***			-0.026***
			(0.011)			(0.009)
Age14			-0.042***			-0.018**
			(0.010)			(0.008)
Age16			0.034***			-0.002
			(0.010)			(0.008)
Age17			0.047***			0.040***
			(0.010)			(0.008)
PMK is college educated			-0.001			-0.011**
			(0.006)			(0.004)
Lives in urban area			0.015			-0.001
			(0.009)			(0.007)
Social Assistance			0.066***			-0.000
			(0.018)			(0.013)
Mother's age at birth			-0.001***			0.000
			(0.000)			(0.000)
Not intact family			0.043***			0.035***
			(0.008)			(0.006)
Nonwhite			-0.035***			0.012
			(0.013)			(0.009)
Proportion who engage in behaviour	7.20%	7.20%	7.20%	4.10%	4.10%	4.10%
Observations	6318	6318	6318	6441	6441	6441
R-squared	0.00	0.00	0.06	0.00	0.01	0.04

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Controls used in the model but not presented include, survey year, provincial dummies, family income and language dummies.

A child that belongs to a not intact family means that the child does not live with both biological parents.

Social Assistance is a dichotomous variable equal to one if the child's family has received social assistance.

Table 5 Determinants of Marijuana Consumption LPM

	Male			Female		
	Smoked Marijuana in previous year			Smoked Marijuana in previous year		
	(1)	(2)	(3)	(4)	(5)	(6)
Has Older Siblings	-0.002	0.034***	0.066***	-0.037***	-0.011	0.019*
	(0.010)	(0.012)	(0.011)	(0.010)	(0.012)	(0.011)
Only Child		0.048***	0.022		0.036**	-0.001
		(0.015)	(0.014)		(0.015)	(0.015)
Three-child household		-0.033***	-0.035***		-0.030**	-0.028**
		(0.013)	(0.012)		(0.013)	(0.012)
Four-child household		-0.102***	-0.065***		-0.060***	-0.055***
		(0.022)	(0.021)		(0.018)	(0.018)
Five or more child household		-0.127***	-0.107***		-0.085***	-0.074**
		(0.035)	(0.033)		(0.031)	(0.029)
Age12			-0.233***			-0.268***
			(0.018)			(0.020)
Age13			-0.198***			-0.222***
			(0.017)			(0.020)
Age14			-0.094***			-0.129***
			(0.015)			(0.018)
Age16			0.069***			0.061***
			(0.015)			(0.018)
Age17			0.188***			0.176***
			(0.016)			(0.018)
PMK is college educated			0.026***			-0.040***
			(0.009)			(0.010)
Lives in urban area			0.045***			-0.015
			(0.014)			(0.016)
Social Assistance			0.044*			0.119***
			(0.027)			(0.028)
Mother's age at birth			-0.000			-0.001
			(0.000)			(0.000)
Not intact family			0.101***			0.122***
			(0.012)			(0.013)
Nonwhite			-0.100***			0.019
			(0.020)			(0.020)
Proportion who engage in behaviour	21.20%	21.20%	21.20%	22%	22%	22%
Observations	6312	6312	6312	6432	6432	6432
R-squared	0.00	0.01	0.16	0.00	0.01	0.16

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Controls used in the model but not presented include, survey year, provincial dummies, family income and language dummies.

A child that belongs to a not intact family means that the child does not live with both biological parents.

Social Assistance is a dichotomous variable equal to one if the child's family has received social assistance.

Table 7 Extension 1- Males

	Ever Smoked Cigarettes	Been Drunk In Previous Year	Smoked Marijuana In Previous Year	Sold Drugs in Previous Year
	(1)	(2)	(3)	(4)
Middle Born Child	-0.006	0.013	0.025	0.009
	(0.019)	(0.018)	(0.017)	(0.011)
Last Born Child	0.044***	0.026*	0.048***	0.046***
	(0.015)	(0.015)	(0.014)	(0.009)
Only Child	0.006	0.015	0.007	0.002
	(0.016)	(0.015)	(0.014)	(0.009)
Three-child household	0.005	-0.016	-0.027**	-0.005
	(0.014)	(0.014)	(0.013)	(0.009)
Four-child household	-0.001	-0.050**	-0.049**	-0.008
	(0.025)	(0.024)	(0.023)	(0.015)
Five or more child household	0.005	-0.030	-0.089**	-0.029
	(0.039)	(0.038)	(0.035)	(0.023)
Age12	-0.255***	-0.331***	-0.230***	-0.089***
	(0.020)	(0.019)	(0.018)	(0.012)
Age13	-0.189***	-0.301***	-0.201***	-0.079***
	(0.019)	(0.018)	(0.017)	(0.011)
Age14	-0.088***	-0.157***	-0.092***	-0.042***
	(0.017)	(0.016)	(0.015)	(0.010)
Age16	0.120***	0.188***	0.070***	0.034***
	(0.017)	(0.017)	(0.015)	(0.010)
Age17	0.169***	0.270***	0.186***	0.047***
	(0.017)	(0.017)	(0.016)	(0.010)
PMK is college educated	-0.028***	0.016*	0.026***	-0.001
	(0.009)	(0.009)	(0.009)	(0.006)
Lives in urban area	-0.001	-0.012	0.046***	0.015*
	(0.015)	(0.015)	(0.014)	(0.009)
Social Assistance	0.053*	-0.041	0.041	0.066***
	(0.030)	(0.028)	(0.027)	(0.018)
Mother's age at birth	-0.001**	-0.001*	-0.000	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Not intact family	0.132***	0.087***	0.097***	0.041***
	(0.013)	(0.012)	(0.012)	(0.008)
Nonwhite	-0.171***	-0.192***	-0.104***	-0.038***
	(0.022)	(0.021)	(0.020)	(0.013)
Observations	6339	6349	6312	6318
R-squared	0.15	0.26	0.16	0.06

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Controls used in the model but not presented include, survey year, provincial dummies, and family income and language dummies.

A child that belongs to a not intact family means that the child does not live with both biological parents.

Social Assitance is a dichotomous variable equal to one if the child's family has recived social assistance.

Table 8 Extension 1 -Females

	Ever Smoked Cigarettes	Been Drunk In Previous Year	Smoked Marijuana In Previous Year	Sold Drugs in Previous Year
	(1)	(2)	(3)	(4)
Middle Born Child	0.072***	0.049***	0.026	-0.000
	(0.019)	(0.019)	(0.017)	(0.009)
Last Born Child	0.010	0.049***	-0.015	-0.005
	(0.016)	(0.016)	(0.014)	(0.007)
Only Child	0.028*	0.037**	-0.015	0.004
	(0.016)	(0.016)	(0.014)	(0.007)
Three-child household	-0.055***	-0.077***	-0.036***	-0.014**
	(0.015)	(0.015)	(0.013)	(0.007)
Four-child household	-0.053**	-0.097***	-0.066***	-0.031***
	(0.022)	(0.021)	(0.019)	(0.010)
Five or more child household	-0.126***	-0.188***	-0.088***	-0.033**
	(0.035)	(0.034)	(0.031)	(0.016)
Age12	-0.265***	-0.360***	-0.224***	-0.041***
	(0.020)	(0.020)	(0.018)	(0.009)
Age13	-0.220***	-0.307***	-0.181***	-0.025***
	(0.020)	(0.019)	(0.018)	(0.009)
Age14	-0.127***	-0.160***	-0.097***	-0.018**
	(0.018)	(0.017)	(0.016)	(0.008)
Age16	0.061***	0.112***	0.069***	-0.002
	(0.018)	(0.017)	(0.016)	(0.008)
Age17	0.173***	0.190***	0.137***	0.040***
	(0.018)	(0.017)	(0.016)	(0.008)
PMK is college educated	-0.042***	-0.035***	-0.037***	-0.011**
	(0.010)	(0.010)	(0.009)	(0.004)
Lives in urban area	-0.013	-0.036**	0.001	-0.001
	(0.016)	(0.015)	(0.014)	(0.007)
Social Assistance	0.118***	0.048*	0.103***	-0.000
	(0.028)	(0.027)	(0.025)	(0.013)
Mother's age at birth	-0.000	-0.001*	-0.001*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Not intact family	0.118***	0.121***	0.120***	0.035***
	(0.013)	(0.013)	(0.012)	(0.006)
Nonwhite	0.016	-0.088***	-0.046**	0.011
	(0.020)	(0.020)	(0.018)	(0.009)
Observations	6463	6459	6432	6441
R-squared	0.16	0.23	0.13	0.04

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Controls used in the model but not presented include, survey year, provincial dummies, and family income and language dummies.

A child that belongs to a not intact family means that the child does not live with both biological parents.

Social Assitance is a dichotomous variable equal to one if the child's family has recived social assistance.

Table 9 Extension 2 - Males

	Ever Smoked Cigarettes	**Been Drunk In previous Year**	**Smoke Marijuana In Previous Year**	**Sold Drugs In Previous Year**
	(1)	(2)	(3)	(4)
Two-child households				
Second-born	0.040***	0.043***	0.072***	0.049***
	(0.015)	(0.015)	(0.014)	(0.010)
Proportion who engage	27.8%	32.6%	22.1%	7.6%
Observations	3135	3137	3121	3122
Three-child households				
Second-born	0.029	0.037	0.050**	0.009
	(0.024)	(0.024)	(0.022)	(0.014)
Third-born	0.106***	0.074***	0.102***	0.045***
	(0.028)	(0.027)	(0.025)	(0.016)
Proportion who engage	26.8%	30.8%	19.5%	7.0%
Observations	3135	3137	3121	3122
Four-child households				
Second-born	0.064	0.100*	0.040	0.097***
	(0.056)	(0.054)	(0.046)	(0.031)
Third-born	-0.117**	0.006	-0.003	0.050
	(0.058)	(0.055)	(0.048)	(0.031)
Fourth-born	-0.063	-0.057	-0.070	0.020
	(0.069)	(0.066)	(0.058)	(0.038)
Proportion who engage	22%	22.6%	13.1%	5%
Observations	391	392	388	387

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Regessions are run using full list of controls.

Table 10 Extension 2 - Females

	Ever Smoked Cigarettes	**Been Drunk In previous Year**	**Smoke Marijuana In Previous Year**	**Sold Drugs In Previous Year**
	(1)	(2)	(3)	(4)
Two-child households				
Second-born	0.028*	0.020	-0.016	-0.012
	(0.016)	(0.016)	(0.015)	(0.007)
Proportion who engage	33.2%	36.6%	22.9%	4.4%
Observations	3166	3163	3153	3153
Three-child households				
Second-born	0.135***	0.123***	0.093***	0.033***
	(0.026)	(0.025)	(0.023)	(0.010)
Third-born	0.114***	0.060**	0.055**	0.008
	(0.029)	(0.028)	(0.026)	(0.012)
Proportion who engage	28.3%	29.2%	19.8%	2.9%
Observations	1524	1527	1513	1515
Four-child households				
Second-born	0.024	0.013	0.073	-0.017
	(0.057)	(0.053)	(0.047)	(0.015)
Third-born	0.000	-0.101**	-0.009	-0.026*
	(0.054)	(0.050)	(0.045)	(0.014)
Fourth-born	-0.059	-0.071	0.090	-0.024
	(0.068)	(0.063)	(0.056)	(0.018)
Proportion who engage	29.4%	27.8%	16.7%	1.3%
Observations	500	503	498	501

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Regessions are run using full list of controls.

Appendix 1 Determinants of Risky Behaviour for Males Probit

	Smoking	Alcohol	Marijuana	Sold Drugs
Has Older Siblings	0.149***	0.143***	0.181***	0.200***
	(0.041)	(0.043)	(0.047)	(0.064)
Only Child	0.096*	0.120**	0.134**	0.192**
	(0.054)	(0.056)	(0.059)	(0.078)
Three-child household	0.013	-0.002	-0.072	-0.063
	(0.045)	(0.047)	(0.051)	(0.070)
Four-child household	-0.081	-0.235***	-0.200**	-0.136
	(0.081)	(0.087)	(0.096)	(0.133)
Five or more child household	-0.121	-0.325**	-0.468***	-0.026
	(0.134)	(0.146)	(0.172)	(0.197)
Age12	-1.107***	-1.913***	-1.554***	-1.070***
	(0.078)	(0.120)	(0.123)	(0.150)
Age13	-0.704***	-1.231***	-1.003***	-0.762***
	(0.065)	(0.075)	(0.082)	(0.113)
Age14	-0.284***	-0.525***	-0.468***	-0.424***
	(0.056)	(0.056)	(0.063)	(0.089)
Age16	0.308***	0.491***	0.246***	0.048
	(0.055)	(0.054)	(0.058)	(0.078)
Age17	0.524***	0.777***	0.514***	0.245***
	(0.057)	(0.057)	(0.058)	(0.077)
pmkcolleduc	-0.083**	-0.022	0.012	-0.013
	(0.033)	(0.034)	(0.036)	(0.051)
urban	-0.061	-0.139***	0.130***	0.038
	(0.043)	(0.045)	(0.050)	(0.067)
socialassist	0.155*	-0.250**	0.095	0.211
	(0.093)	(0.106)	(0.106)	(0.130)
motherageatbirth	-0.002*	-0.001	-0.000	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
notintact	0.430***	0.362***	0.387***	0.315***
	(0.044)	(0.046)	(0.048)	(0.064)
nonwhite	-0.299***	-0.486***	-0.252**	-0.152
	(0.111)	(0.121)	(0.127)	(0.170)
Proportion who engage	28.10%	32.50%	21.20%	7.20%
Observations	6339	6349	6312	6318

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Controls used in the model but not presented include, survey year, provincial dummies, family income and language dummies.

A child that belongs to a not intact family means that the child does not live with both biological parents.

Social Assistance is a dichotomous variable equal to one if the child's family has received social assistance.

Appendix 2 Determinants of Risky Behaviour for Females Probit

	Smoking	Alcohol	Marijuana	Sold Drugs
Has Older Siblings	0.146***	0.160***	0.092**	-0.007
	(0.041)	(0.042)	(0.045)	(0.076)
Only Child	0.209***	0.128**	0.056	-0.050
	(0.052)	(0.053)	(0.056)	(0.087)
Three-child household	-0.002	-0.135***	-0.017	-0.203**
	(0.045)	(0.047)	(0.051)	(0.089)
Four-child household	0.007	-0.186**	-0.145*	-0.320**
	(0.070)	(0.073)	(0.081)	(0.154)
Five or more child household	-0.187	-0.558***	-0.318**	-0.408
	(0.134)	(0.143)	(0.159)	(0.308)
Age12	-1.248***	-1.936***	-1.615***	-1.429***
	(0.077)	(0.106)	(0.126)	(0.313)
Age13	-0.768***	-1.229***	-0.924***	-0.692***
	(0.063)	(0.068)	(0.077)	(0.138)
Age14	-0.302***	-0.469***	-0.341***	-0.297***
	(0.054)	(0.053)	(0.060)	(0.101)
Age16	0.247***	0.331***	0.229***	0.060
	(0.054)	(0.053)	(0.057)	(0.091)
Age17	0.528***	0.603***	0.441***	0.177**
	(0.056)	(0.056)	(0.058)	(0.089)
pmkcolleduc	-0.147***	-0.045	-0.064*	-0.061
	(0.033)	(0.035)	(0.037)	(0.064)
urban	-0.041	-0.062	0.066	0.167**
	(0.043)	(0.044)	(0.049)	(0.085)
socialassist	0.257***	0.138	0.206**	0.101
	(0.089)	(0.093)	(0.095)	(0.145)
motherageatbirth	-0.000	-0.002	-0.003***	-0.001
	(0.001)	(0.001)	(0.001)	(0.002)
notintact	0.497***	0.475***	0.574***	0.495***
	(0.042)	(0.043)	(0.045)	(0.073)
nonwhite	0.043	-0.168*	-0.055	0.179
	(0.092)	(0.098)	(0.105)	(0.150)
Proportion who engage	33.20%	34.80%	22%	4.10%
Observations	6463	6459	6432	6441

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Controls used in the model but not presented include, survey year, provincial dummies, family income and language dummies.

A child that belongs to a not intact family means that the child does not live with both biological parents.

Social Assistance is a dichotomous variable equal to one if the child's family has received social assistance.

Appendix 3 Testing the Hypotheses

	Males $t_{\hat{\beta}_1} = \hat{\beta}_1 / se(\hat{\beta}_1)$	t Statistic	**Females** $t_{\hat{\beta}_1} = \hat{\beta}_1 / se(\hat{\beta}_1)$	t Statistic
Baseline Model				
Has an Older Sibling				
Smoking	0.041/(0.012)	3.42**	0.056/(0.013)	4.31**
Alcohol	0.046/(0.012)	3.83**	0.034/(0.012)	2.83**
Marijuana	0.066/(0.011)	6**	0.019/(0.011)	1.72*
Sold drugs	0.036/(0.007)	5.14**	-0.001/0.006	-0.167
Extension 1				
Middle Born				
Smoking	-0.006/(0.019)	-0.32	0.072/(0.019)	3.79**
Alcohol	0.013/(0.018)	0.722	0.049/(0.019)	2.58*
Marijuana	0.025/(0.017)	1.47	0.026/(0.017)	1.53
Sold drugs	0.009/(0.011)	0.818	0.000/(0.009)	0
Last Born				
Smoking	0.044/(0.015)	2.93**	0.010/(0.016)	0.625
Alcohol	0.026/(0.015)	1.73*	0.049/(0.016)	3.06**
Marijuana	0.048/(0.014)	3.43**	-0.015/(0.014)	-1.07
Sold drugs	0.046/(0.009)	5.11**	-0.005/(0.007)	-0.714

Using Standard normal critical values, the 5% critical value is 1.65 and the 1% critical value is 2.33

**Statistically greater than zero at the 1% level

* Statistically greater than zero at the 5% level

Appendix 4 Testing the joint significance of being middle and last born

	Smoking	Alcohol	Marijuana	Solddrugs
Male				
F Statistic	F(2, 6308) = 4.52*	F(2, 6318)=1.55	F(2,6281)=6.12*	F(2,6287)=12.22*
Prob>F	0.011	0.2125	0.0022	0
Female				
F Statistic	F(2,6432)=6.91*	F(2,6428)=6.98*	F(2,6401)=2.11	F(2,6410)=0.28
Prob>F	0.001	0.009	0.1216	0.7547

Testing the null hypothesis that middleborn and lastborn are equal to 0 in the second extentsion to the baseline model, Tables 7 & 8.
*Jointly significant at any conventional level