

## Does low self-control during childhood explain the association between delinquency and accidents in early adolescence?

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**ABSTRACT** Data from a longitudinal study of a large sample of boys followed from kindergarten to high school were used to test two alternative hypotheses concerning the association between delinquency and accidents. The first hypothesis proposes that delinquency and accidents are correlated because they are both the product of a failure to learn self-control during childhood. The alternative hypothesis proposes that self-control during childhood will explain part of the association between delinquency and accidents during adolescence, but delinquency will still increase the risk for accidents. Linear structural equation modelling was used to test the alternative hypotheses with data collected from teachers, mothers and self-reports, at 6, 10, 14 and 15 years of age. Results supported the hypothesis that childhood self-control levels only explain part of the association between driving accidents and delinquency during early adolescence, and delinquency increases the risk of accidents. Results also indicated that the association between delinquency and accidents increased with age, suggesting that the risk of accidents during adolescence increases as involvement in delinquency increases. Details of a case of delinquent behaviour which led to a fatal car accident are given. It was also suggested that longitudinal studies of the association between self-control and antisocial behaviour should focus on their early development during the preschool years.

### INTRODUCTION

Externalising behaviour problems are among the most prevalent disorders of male youths in industrialised societies (Earls, 1986; Offord, et al., 1987). Males with these disorders are physically aggressive and hyperactive, they are often involved in theft, substance use, and show other mental health problems (Elliott, Huizinga & Menard, 1989; Farrington, Loeber & Van Kammen,

1990; Pulkkinen & Tremblay, 1992). Most will not finish high school, they will have an unstable work record, get convicted, have poor relations with their mates, and offer inadequate parenting (e.g. Cairns, Cairns & Neckerman, 1988; Farrington, 1994; Huesmann et al., 1984; Stattin & Magnusson, 1989).

A number of psychological theories have suggested that these adjustment problems are all linked because they are the expression of the same underlying neuro-cognitive-behavioural handicap. Gorenstein and Newman (1980) pointed to the disinhibitory characteristics underlying behaviour problems such as hyperactivity, hysteria, alcoholism, antisocial and impulsive personality. They suggested that these 'disinhibitory psychopathologies' share three basic deficits: failure to inhibit responses which lead to painful consequences, a deficit in fear arousal and a deficit in classical aversive conditioning. The different behavioural manifestations of the disorder would be due to environmental circumstances. Based on Gray's work (1982, 1990), Lahey et al. (1995), as well as Quay (1993), suggested that aggression and other forms of externalising behaviour problems are linked to two interacting neurological systems which control impulsive behaviour: the behavioural activating system and the behavioural inhibiting system.

It is more surprising to see that sociologists have reached a similar conclusion concerning criminal behaviour. In their 'general theory of crime', Gottfredson and Hirschi (1990) argue that individuals who lack self-control will be most at risk of engaging in criminal acts. They stress the fact that self-control is learned during childhood and remains relatively stable throughout life. The stability of low self-control would thus explain the observed continuum between childhood externalising behaviour problems, adolescent delinquency and adult criminality (Farrington, 1994; Mischel, 1984; Moffitt, 1993a, 1993b; Tremblay et al., 1994).

Gottfredson and Hirschi also suggested that low self-control would explain the association between accidents and crime. This association has been shown in a number of studies over the past six decades (Bagley, 1992; Glueck & Glueck, 1950; Klein, 1972; Robins, 1966; Schuman & Peltz, 1972). Recent reviews of the literature on the relation between crime and accidents (Junger 1994, Rivara, 1995) concluded that factors related to accidents are also generally related to criminal behaviour. Globally, the literature shows that accident involvement (among children) is related to health problems and psychiatric problems in the family, education of mother, age of mother, work of mother, marital tensions, mobility rate, family type, home environment, socialisation practices, adverse life events, the influence of individual factors (psychosocial problems, hyperactivity), social disadvantage, sex and ethnic group. In general, these factors are related to crime in the same way. Up to now hardly any study has investigated whether, on an individual basis, accidents and crime have the same predictors.

As self-control assessments of children predict delinquent behaviour in the criminological studies, and accidents in the health studies, one would expect

that Gottfredson and Hirschi's hypothesis would be confirmed in a longitudinal study where assessments of self-control during childhood would be followed by assessments of delinquency and accidents during adolescence. However, there is an alternative hypothesis. Although self-control may be a risk factor for both accidents and delinquency, it may not be sufficient to explain the strength of the association between these two variables. In all likelihood, having a delinquent way of life will put an individual at a higher risk of having an accident (Junger & Wiegersma, 1995; Junger, Terlouw, & van der Heijden, 1995). For example, running away at high speed after having stolen a motor-cycle or a car increases the risk of an accident. The risk of having an accident is also increased by driving a vehicle after having taken drugs. Gottfredson and Hirschi appear to suggest that the delinquents' increased risk of having an accident is already explained by their low self-control, which was present during childhood. To test the alternative hypotheses, longitudinal data are needed to verify whether self-control in childhood does or does not explain most of the shared variance between accidents and crime in adolescence or adulthood.

This paper reports on an attempt to test these alternative hypotheses using linear structural equation modelling (Jöreskog & Sörbom, 1993) with a longitudinal data set of males who were followed from their kindergarten year to adolescence (Tremblay et al., 1994). Figure 1 illustrates the alternative hypotheses. Self-control was measured at 6 and 10 years of age from two different sources of information. This ensured that it preceded delinquent behaviour, and gave an opportunity to test its stability over time. If childhood level of self-control is the underlying variable explaining the association between juvenile delinquency and accidents, this statistical association will disappear in a model where childhood self-control is included. If self-control does not explain the association, then it will remain statistically significant. Self-reported delinquency was assessed twice with a 12-month interval to verify to what extent the results of the first year would be replicated the second year. Because delinquency was assessed during early adolescence, when frequency and seriousness of delinquent acts increase with age (Elliott, 1994; Farrington, 1986; Tremblay et al., 1995), we had an opportunity to test to what extent the model was influenced by the developmental nature of the phenomenon. As they grow older, adolescents increase not only the frequency of their delinquent behaviour but also the frequency of other behaviours which put them at risk of accidents. With age, adolescents use bicycles, motor-cycles and automobiles to increase their territorial range; vehicles are a means of gaining more independence. Rivara (1994) reported that in 1986 the number of youths who died as passengers in motor vehicle accidents, the main cause of death during adolescence in the United States, was 643 for those between age 10 and 14 years, and 5714 for those aged 15 to 19 years, an increase of 888%. If more delinquency leads to more accidents, then the association should increase with age during adolescence.



FIGURE 1: Alternative hypotheses

## METHOD

### Subjects

A large sample of kindergarten boys was recruited for a longitudinal-experimental study of the development of delinquent behaviour (Tremblay et al., 1995; Tremblay et al., 1994). In 1984, teachers of all the kindergarten classrooms in French-speaking schools of the low socioeconomic areas of Montréal were asked to assess the behaviour of their male students. A total of 1161 boys were assessed by 87% of the teachers who were solicited. To control for culture, the sample was restricted to the sons of French-speaking parents born in Canada ( $n = 1037$ ). The subjects who had no missing data on the pertinent variables ( $n = 699$ ) were included in the following analyses. Table 1 presents the demographic and behavioural characteristics of these subjects compared with those who were excluded because of missing data. It can be seen that the majority of the kindergarten boys lived with both parents who had not completed a secondary education, and were below 30 years of age when their son was born. The subjects who were lost because of missing data lived in families with more adverse conditions. They were also rated by kindergarten teachers as fighting more often. These differences indicate that the sample taken from a high-risk population was slightly biased towards better adjusted boys living in less adverse family conditions.

TABLE 1: Demographic and behavioural characteristics of subjects when in kindergarten

		Included subjects	Excluded subjects
Living in an intact family		69.5%	65.1%
Parent's age at child birth	mother*	25.57 (4.60)	24.58 (4.72)
	father	28.49 (5.57)	27.92 (5.62)
Parent's years in school	mother	10.58 (2.85)	10.27 (2.66)
	father*	10.73 (3.36)	10.22 (3.15)
Familial adversity*		0.32 (0.24)	0.37 (0.26)
Teacher's rating	anxiety	2.35 (2.28)	2.47 (2.36)
	inattention	2.62 (2.45)	2.78 (2.27)
	hyperactivity	1.35 (1.40)	1.50 (1.55)
	prosociality	8.08 (5.11)	7.78 (4.60)
	fighting*	1.32 (1.69)	1.58 (1.87)
Standard deviations are included in parentheses			
*Indicates a significant difference at 5% level			

### Procedures and instruments

When the boys were 10 years old, mothers completed a questionnaire on their sons' temperament whilst teachers rated the boys' behaviour. Four and five years later the boys were visited in school and given a questionnaire which included questions on delinquent behaviours and accidents.

#### *Teacher ratings of self-control*

The boys' self-control at 6 and 10 years of age was assessed from teacher ratings of five items from the Social Behaviour Questionnaire (Tremblay et al., 1991): restless, doesn't keep still; gives up easily; poor concentration or short attention span; inattentive; squirmy, fidgety. The alpha measuring internal consistency at ages 6 and 10 was 0.82 and 0.83 respectively.

#### *Mothers' ratings of self-control*

Nine items from the mothers' ratings of the Dimensions of Temperament Survey (Lerner et al., 1982) at age 10 were used: can't be distracted from a task; persists at a task until it's finished; can't be distracted no matter what he does; stays with an activity for a long time; when doing one thing, something else won't get him to stop; does not do any one thing for a long period; things



going on around him take him away from what he is doing; when he takes something up, he stays with it; doesn't keep at an activity when other things are going on. The internal consistency index (alpha) was 0.85.

#### *Self-reports of accidents*

At ages 14 and 15 the boys were asked the following question: In the past 12 months did you have an accident while driving (a bicycle, a motor-cycle, a skidoo, a dune buggy, etc.)? The answer format was the following: 1. No; 2. Yes, but I did not see a doctor; 3. Yes, and I had to see a doctor, but I did not go to the hospital; 4. Yes, and I had to go to the hospital, but I was not operated on; 5. Yes, and I had to go to the hospital, and was operated on.

#### *Self-reported delinquency*

At ages 14 and 15, the boys were given a questionnaire which included questions on how often they had committed the following 27 delinquent acts in the past 12 months: steal from school, from store, from home; keep object worth less than \$10; steal bicycle; sell stolen goods; keep object worth between \$10 and \$100; steal objects worth more than \$100; breaking and entering; enter without paying; trespassing; take drugs, alcohol; get drunk; destroy school material, other material; vandalism at school; destroy objects at home; vandalise car; set a fire; strong-arm; gang fights; use weapon in a fight; fist fight; beat up someone; carry a weapon; throw objects at persons. The 27 items were scored on a scale of 1 to 4 (never, once or twice, often and very often) and were summed to obtain a total delinquency score. The internal consistency alpha was 0.92 at age 14 and 0.93 at age 15.

#### *Data analysis*

To test the two different models, LISREL VIII (Jöreskog & Sörbom, 1993) analyses were used. Because the measured variables typically had non-normal skewed distributions, parameter estimation was performed using a generally weighted least squares (WLS) method. This method of estimation was preferred because it yields distribution-free consistent estimates, and test statistics, provided a sufficiently large sample is available (Bentler, 1983; Browne, 1982). The covariance matrix and its corresponding weight matrix were obtained using PRELIS 2 (Jöreskog & Sörbom, 1993).

The overall fit of the model was assessed with the goodness-of-fit chi-square ( $\chi^2$ ) and the root mean square residuals (RMSR). The model was judged to provide an acceptable fit if the level of significance exceeded 0.15, which falls in the suggested range of Hayduk (1987). The RMSR, which is an overall measure of the magnitude of the fitted residuals, is primarily used to compare the fit of different models, smaller values indicating a better fit. The

standardised residuals were also scrutinised; high positive values are indicative of overestimation of the corresponding observed covariance matrix entry, whilst low negative values indicate underestimation. In general, a good model is also expected to have all but 5% of its standardised residuals exceeding 2.58 in absolute value (Hayduk, 1987).

## RESULTS

### Correlations between the variables

Table 2 presents the correlation matrix for all the variables included in the LISREL analysis. It can be seen that the correlation between teachers' ratings of self-control at age 6 and 10 is 0.43, indicating relative stability of teacher assessed self-control over the first four years of elementary school. It is interesting to note that the correlation between mothers' and teachers' ratings of self-control at age 10 years ( $r = 0.36$ ) is not greatly different from the correlation between mothers' ratings at age 10 and teachers' ratings four years earlier ( $r = 0.30$ ). The magnitude of the correlations between teachers and mothers is similar to those obtained in other studies for similar behavioural dimensions (e.g. Verhulst & Akkerhuis, 1989; Vitaro, Gagnon & Tremblay, 1991). The self-control scores at age 10 were significantly correlated to the self-reported delinquency measures at age 14 and 15 years, but the highest correlation was only  $r = 0.15$ . The correlation between childhood self-control and accidents during adolescence was significant only for teacher-rated self-control at age 10 and self-reported accidents at age 14 years ( $r = 0.11$ ). The highest correlation in the matrix is between self-reported delinquency at 14 and 15 years of age,  $r = 0.69$ . The correlation between self-reported accidents at 14 and 15 years of

TABLE 2: Correlations between the measured variables ( $n = 699$ )

		Self-control rating			Accidents		Delinquency	
		age 6 (teachers)	age 10 (teachers)	age 10 (mothers)	age 14	age 15	age 14	age 15
Self-control rating	T6	1.00	0.43*	0.30*	0.07	0.01	0.10	0.08
	T10		1.00	0.36*	0.11*	0.09	0.11*	0.15*
	M10			1.00	0.09	0.05	0.11*	0.12*
Accidents	14				1.00	0.39*	0.12*	0.14*
	15					1.00	0.15*	0.26*
Delinquency	14						1.00	0.69*
	15							1.00

\* $P < 0.05$

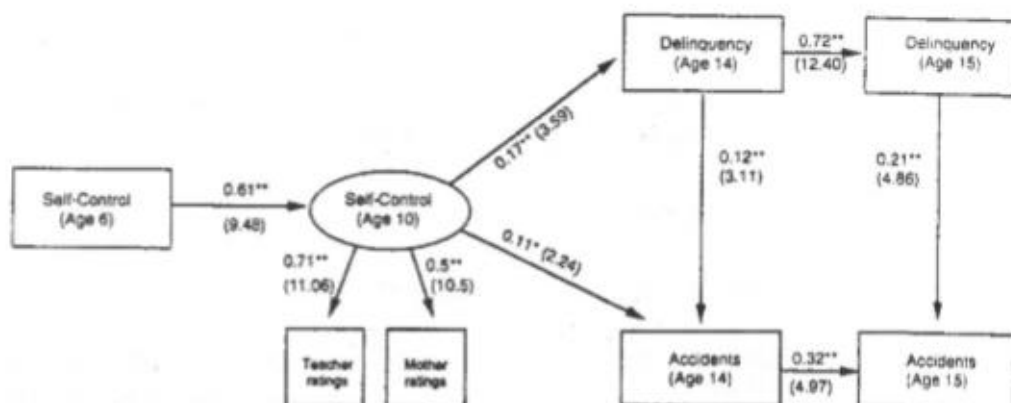


FIGURE 2: Best fitting model from LISREL analysis

age is somewhat lower,  $r = 0.39$ . As expected, the correlations between self-reported accidents and self-reported delinquency were significant, but of a relatively low magnitude. However, the correlation increased substantially from age 14 ( $r = 0.12$ ) to age 15 years ( $r = 0.26$ ).

#### Test of the alternative models

Figure 2 presents the best fitting model from the LISREL analysis. This model corresponds to hypothesis 2: the goodness-of-fit was  $\chi^2 = 15.93$ ,  $df = 13$ ,  $P > 0.24$ ,  $n = 699$ ,  $RMSR = 0.72$ . The standardised residuals were found to be approximately normally distributed with none of the 21 residuals greater than 2.58. Teacher-rated self-control at 6 years of age was strongly correlated to the self-control latent trait assessed four years later by both mothers and teachers. This self-control latent trait at age 10 was, as predicted by Gottfredson and Hirschi (1990), significantly associated with both self-reported delinquency and accidents at 14 years of age. However, contrary to the Gottfredson and Hirschi hypothesis, the LISREL analysis indicated a significant causal path from delinquency to accidents, at both 14 and 15 years of age. It is of interest to note that the strength of that causal path increased from age 14 to age 15. Removing these paths corresponds to hypothesis 1, which did not show an adequate fit,  $\chi^2 = 38.86$ ,  $df = 15$ ,  $P > 0.001$ ,  $n = 699$ ,  $RMSR = 4.54$ , with 50% of the standardised residuals being greater in absolute value than 2.58; thus all the associations between accidents and delinquency are significantly underestimated by hypothesis 1. Before concluding that the association between delinquency and accidents was directional, we tested the possibility that it was bi-directional. The goodness of fit test for the correlational hypothesis was:  $\chi^2 = 24.79$ ,  $df = 13$ ,  $P > 0.024$ ,  $RMSR = 3.03$ , and 20% of the residuals were greater than 2.58.

Self-control at age 10 predicted 2.9% and 1.4% of the variance in self-



reported delinquency at ages 14 and 15 respectively; it also predicted 1.7% and 0.4% of the variance in self-reported accidents at ages 14 and 15 respectively. The total model predicted 3% of the variance in self-reported delinquency at age 14 and 52% at age 15, whilst predicting 3.2% of the variance in accidents at age 14 and 15.7% of the variance at 15 years of age. As expected the path from delinquency at age 14 to delinquency at age 15 was very strong. The path from accidents at age 14 to accidents at age 15 was weaker, but still highly significant.

## DISCUSSION

The aim of this study was to test the hypothesis formulated by Gottfredson and Hirschi (1990) that low self-control during childhood would lead to more delinquency and more accidents in adolescence, thus explaining the association between accidents and crime. This hypothesis was tested against an alternative hypothesis suggesting that lack of self-control may lead to more delinquency and accidents, but a delinquent way of life will increase the probability of being involved in accidents. Care was taken to measure self-control from different sources (two different teachers and the mother), at different points in time during childhood (age 6 and 10 years), and also to measure delinquency and accidents from a third source of information (self-reports) at two different points in time.

Results confirmed that lack of self-control in childhood led to more delinquent behaviour and more driving accidents in early adolescence. The association between low self-control and delinquency was stronger than between low self-control and accidents, but in both cases the explained variance was small (2.9% and 1.7%). It could be argued that better measures of self-control could possibly increase the explained variance. However, White et al. (1994) have shown that behavioural measures of impulsivity such as those used in the present study were better predictors of delinquency than cognitive measures of impulsivity, IQ and SES.

The prediction that childhood self-control would be sufficient to explain the association between accidents and delinquency was not confirmed. Results indicated that delinquency and accidents reported at 14 and 15 years of age were significantly correlated, even after having taken into account the level of self-control during childhood. The magnitude of the association increased from age 14 to age 15, and was greater than the association between childhood self-control and accidents at age 14. The best fitting causal model also indicated that the association between delinquency and accidents could be interpreted as a causal path from delinquency to accidents. These results suggest that delinquent behaviour during adolescence increases the risk for driving accidents, after having taken into account the level of self-control from 6 to 10 years of age. The increase in the association between delinquency and accidents from 14 to 15 years of age also suggests that, as they grow

older, the increase in adolescent delinquency increases the risk of accidents.

There was one subject in the longitudinal cohort who was an extreme example of how early adolescent delinquent behaviours can lead to serious accidents. Pierre was one of the 1161 boys originally assessed in kindergarten. He was living with both his biological parents. His father was a blue-collar worker with a permanent position and his mother a part-time blue-collar worker. Pierre was born when his mother was in her early 20s, and his father in his middle 30s. His father previously had four children with another woman. Pierre's kindergarten teacher ratings indicated no sign of low self-control. He showed no sign of opposition, but was rated relatively high (at the 63rd percentile) on the fighting scale, low (28th percentile) on the anxiety scale, and low (23rd percentile) on the prosocial scale. At age 10 he was at the median on the regression score estimate of the latent self-control variable based on teacher and mother ratings. Pierre's self-report at age 10 indicated that he was already highly involved in delinquent behaviours. He had started to drink alcohol, he was stealing, vandalising and fighting much more than the majority of the boys from the cohort; his total delinquency score placed him at the 94th percentile of the sample. At age 13 and 14 he was still reporting much more delinquent behaviours than his same-age peers; his total delinquency score placed him at the 87th percentile at 13 years of age, and at the 98th percentile at 14 years of age. In the fall of 1990, at age 12, he should have started his first year of high school, but was held back in elementary school. He went to high school the following year, at age 13 years.

At the end of that first year in high school, in the spring of 1992, at age 14, Pierre filled in our annual questionnaire and reported that he had run away from home once or twice over the past year. In July of that year he came to our laboratory for our annual one-day testing session. Three months later one of the authors of this paper (L.A.) read in a newspaper that Pierre had stolen a car with a friend, and had run into a tree. Pierre had managed to get out of the car, but fell off a cliff. He was accidentally found dead at the bottom of the cliff only three weeks after the car accident.

This case study clearly shows how a delinquent way of life can lead to fatal accidents, even when there is no clear history of low self-control. The results from the present study do confirm that low self-control during childhood does increase the risk for delinquency and accidents, but the explained variance is small, and a delinquent way of life will increase the likelihood of accidents. There is clearly more than one path to delinquency (Loeber et al., 1993), as there is probably more than one path to accidents. Future studies need to focus on sorting out the different paths which lead to common and different outcomes. This will require very large population samples followed frequently over many years. Because the behaviours (e.g. self-control and disruptive behaviours) which appear to lead to, or prevent, delinquency and other negative outcomes are learned during the first two or three years of life (Cummings, Iannotti & Zahn-Waxler, 1989; Mischel, 1984; Shaw & Bell,

1993), longitudinal studies need to start with birth cohorts if we are to understand the roots of antisocial behaviour and its correlates. Preschool boys, like Pierre, who show good self-control, who are physically aggressive towards their peers, show no anxiety (fearless) and no prosocial behaviours, may be those most at risk of a 'successful' criminal career (Tremblay et al., 1994), until they get into a serious accident. Understanding how a psychopathic personality can develop within the first five years of life is an important challenge, if preventive interventions are to be successful.

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