

ORIGINAL ARTICLE

# Predicting Early Onset of Male Antisocial Behavior From Preschool Behavior

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**Methods:** Data from a large longitudinal study of boys who were between kindergarten and age 13 years were used to (1) test whether Gray's and Cloninger's personality dimensions measured in kindergarten predicted the early onset of stable, highly delinquent behavior; (2) test whether 1, 2, or 3 dimensions were needed; and (3) test the predictive value of a categorical approach.

**Results:** The impulsivity dimension was the best predictor of the early onset of stable, highly delinquent behavior. Anxiety and reward dependence made significant but weaker contributions. The categorical approach corroborated Cloninger's suggestion that boys who are high in impulsivity, low in anxiety, and low in reward dependence would be more at risk for delinquent involvement. Boys who were high in impulsivity and low in anxiety but high in reward dependence were much less at risk for delinquency. Differences in antisocial behav-

ior among extreme kindergarten personality groups were stable from ages 11 to 13 years.

**Conclusions:** The behavioral activating system appears to be the major dimension underlying the propensity toward early onset of antisocial behavior, but both the behavioral inhibition system and the need for social rewards play important roles. The behavioral style (personality) that results from the interplay of these systems is clearly in place by the kindergarten year. Preventive efforts should target preschool children with at-risk behavior profiles. However, longitudinal-experimental studies with at least yearly assessments between birth and school-entry age are needed to understand the extent to which the behavioral styles are antecedent to preschool disruptive behavior disorders.

(Arch Gen Psychiatry. 1994;51:732-739)

**T**HE IDEA THAT childhood behavior can predict later social behavior is not new. In *The Republic*, Plato argued that the guardians of the state needed to be chosen early in life because of the impact of early education. The 19th century social reformers were convinced that children from the "perishing and dangerous classes" would lead a criminal way of life if they did not receive a proper education.<sup>1,2</sup> The original contribution of the 20th century probably has been the systematic conduction of longitudinal studies in different cultures to verify prospectively the precise value of childhood predictors for later antisocial behavior.<sup>3-11</sup>

In Loeber and Stouthamer-Loeber's review of prospective longitudinal studies,<sup>12</sup> the best predictors of future delinquency were early conduct problems such as aggression, stealing, truancy, lying, and drug

use. These behaviors can be considered early forms of delinquent behavior. Recognizing the stability of deviant behaviors, some<sup>13-15</sup> concluded that childhood conduct problems and delinquency are the expression of the same underlying continuum. The latter could be genetically inherited, the result of a perinatal physiological trauma, acquired in infancy, or the result of interactions between these different causal factors.<sup>14,16-19</sup>

Because most subjects in the studies reviewed by Loeber and Stouthamer-Loeber were between 10 and 15 years of age when the studies started, the results can be re-

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## SUBJECTS AND METHODS

### SUBJECTS

The subjects were boys who had been participating in a longitudinal study since their kindergarten year in 1984. They attended half-day kindergarten classes at French public schools in Montreal, Quebec. To obtain a high base rate of boys at risk for delinquent behavior, the 53 schools with the lowest socioeconomic index were chosen. Teachers were asked to rate each boy in their classes. Teachers normally had a morning and an afternoon group, each containing approximately eight boys and eight girls. Ratings were returned by 87% of the teachers, and 1161 boys were rated. To control for cultural effects, the boys were included in the study only if both of their biological parents were born in Canada and their mother tongue was French. These criteria created a homogeneous low socioeconomic status, white, French-speaking sample. After applying these criteria and eliminating boys whose families refused to participate further in the study or could not be traced after the initial assessment, 1034 boys (89%) remained. The number of boys with self-reported delinquent behavior between 10 and 13 years of age was 915 (88% of the original 1034 subjects). In kindergarten, the majority of the boys lived with both biological parents (67%), 24% lived alone with their mothers, and 5% lived with their mothers and a man who was not the boy's father; the rest (4%) lived in other family arrangements (eg, with grandparents or with father and stepmother). Parents' mean age at the birth of their son was 25.4 years (SD, 4.8 years) for mothers and 28.4 years (SD, 5.6 years) for fathers. This varied from 15 to 45 years for mothers and from 16 to 56 years for fathers. The mean number of years of school completed was 10.5 years (SD, 2.8 years) for mothers and 10.7 years (SD, 3.2 years) for fathers. The majority of the parents were unskilled workers. When in kindergarten, the majority of the boys were thus living with parents who had not completed high school and whose resi-

dence was in the poorest areas of a large metropolitan city. The mean and median family income at age 10 years (1988) was between \$25 000 and \$30 000 (Canadian dollars) (\$19 000 to \$23 000 in US dollars) compared with a median income of \$44 000 (Canadian dollars) for couples with children in Canada in 1987.<sup>45</sup>

### INSTRUMENTS AND PROCEDURE

#### Personality Dimensions and Categories

The boys' kindergarten behaviors were rated by teachers using 28 items from the Preschool Behavior Questionnaire<sup>46</sup> and 10 items from the Prosocial Behavior Questionnaire.<sup>47</sup> Items were selected to measure Gray's<sup>24,26,48</sup> and Cloninger's<sup>33</sup> impulsivity and anxiety dimensions Cloninger's reward-dependence dimension. Items referring to aggressive, oppositional, or antisocial behaviors were not included. For anxiety or harm avoidance, defined by Cloninger as cautious, apprehensive, inhibited behavior, three items were selected: is worried, worries about many things; tends to be fearful or afraid of new things or new situations; and cries easily. The  $\alpha$  value for internal consistency was .72. Test-retest reliability with a 1-month interval from a similar sample was .63. For impulsivity or novelty seeking, defined by Cloninger as impulsive, excitable, and exploratory behaviors, two items were selected: restless, runs about or jumps up and down, and does not keep still, squirmy, fidgety child. The  $\alpha$  value for internal consistency was .89; the test-retest reliability was .69. For reward dependence, defined by Cloninger as warm, sympathetic, sentimental behavior, 10 items were selected: praises others, shows sympathy, helps sick child, helps hurt child, helps child with a difficult task, helps clean up mess, invites bystander, stops quarrels, helps pick up objects, and comforts upset child. The  $\alpha$  value for internal consistency was .91; the test-retest reliability was .70. The correlations between the three dimensions were low ( $r=.12$  for

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garded as a demonstration that the early onset of frequent delinquent behavior (ie, in preadolescence or early adolescence) is a good predictor of the maintenance of such behavior. Investigators are now encouraged to study the links between preschool behavior and the early onset of delinquent behavior in preadolescence.<sup>20,21</sup> In one of the few longitudinal studies that have clearly addressed this issue, White and colleagues<sup>22</sup> analyzed data from the Dunedin Multidisciplinary Health and Developmental Study; assessments at ages 3 and 5 years were used to predict delinquent status at the age of 11 years. It was shown that motor problems and parent-rated behavior problems at ages 3 and 5 years discriminated the children who were rated most delinquent at age 11 years (9.4% of the boys and 2.6% of the girls). The best predictor was parent-rated behavior problems at age 5 years, followed by the mother reporting

the child to be "difficult to manage" at 3 years of age and composite ratings of externalizing behaviors at age 3 years. These results support the hypothesis that very early disruptive behavior is relatively stable and often translates into delinquent behavior in preadolescence.<sup>20,23</sup>

It is hard to believe, however, that children are born with antisocial behavior problems. We need a theory that will explain how infant behaviors are transformed into stable, socially deviant behaviors. Because most of the longitudinal predictive studies of delinquency were looking at the stability of deviant behavior, their theoretical background has generally been limited to the stability hypothesis. A wide range of deviant behaviors were chosen as possible predictors. This shotgun approach was probably used because of the high cost of longitudinal studies and the lack of a clear consensus vis-à-vis a domi-

anxiety and impulsivity,  $r=.10$  for anxiety and reward dependence, and  $r=-.13$  for impulsivity and social dependence;  $N=1034$ ). In labeling the three dimensions (anxiety, impulsivity, and reward dependence), an effort was made to use terms that reflected the theories being tested. Other labels could be used; the impulsivity dimension might be labeled "overactivity," and the reward dependence scale, "prosociality."

Cut-off points for the low and high ends of the dimensions had to be chosen to create Cloninger's eight extreme personality categories. The anxiety and impulsivity dimensions had skewed distributions. For both dimensions, approximately 40% of the subjects had a score of 0. This score was chosen as the low-end cut-off score for both dimensions. The 40th percentile was also used as the low-end cut-off point for the reward dependence dimension. The high-end cut-off point was chosen at the 60th percentile to obtain a similar number of subjects from both ends of the scales. **Table 1** presents the expected and observed distribution of subjects in the eight personality categories. The distribution was marginally similar to chance expectation (likelihood ratio,  $\chi^2=29.2$ ,  $P=.08$ ). The largest deviation from the expected distribution was for the cyclothymic group; 10% of the boys were classified as such, compared with the expected 7%. The "others" group included all of the subjects ( $n=396$ ; 43.2%) who were not at the extreme on at least one of the three dimensions. The number of subjects in each extreme personality category was large enough for statistical analyses ( $n$ , 53 to 91). It can be seen that a large number of subjects are needed to use this approach with a general population-based sample.

#### Self-reported Delinquency

At ages 10 to 13 years, the boys were tested in small groups at their schools between March and May; they answered 27 self-reported delinquency items distributed in a questionnaire about school, family, friends, and leisure

activities. The items were as follows: 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; vandalize car; set a fire; strong-arm; gang fights; use weapon in a fight; fist fight; beat up someone; carry a weapon; and 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 (mean  $\alpha=.88$ ; mean 1-year test-retest reliability, .68). At ages 11 to 13 years, the boys were asked how often they had committed the delinquent behaviors in the past 12 months. At age 10 years, they were asked whether they had ever committed the delinquent behaviors and how often. **Table 2** presents the correlations among the self-reported delinquency scores from ages 10 to 13 years.

To select the boys who had early onset of frequent delinquent behaviors between ages 10 and 13 years, the total delinquency score was first computed for each year. Those above the 80th percentile on that score for a given year were considered to have high delinquency involvement for that year. Those who were found to be among the highly delinquent group for at least two thirds of their ratings were retained as the early-onset frequently delinquent group ( $n=92$ ; 10.6% of the total sample). Of these boys, 80% ( $n=74$ ) reported having ever beaten someone who had not done anything to them compared with 23% for the rest of the sample ( $\chi^2[1]=130.8$ ;  $P<<.001$ ); 90% ( $n=83$ ) compared with 33% reported ever shoplifting ( $\chi^2[1]=109.0$ ;  $P<<.001$ ); 89% ( $n=82$ ) compared with 32% reported ever using a weapon in a fight ( $\chi^2[1]=114.1$ ;  $P<<.001$ ); 71% ( $n=65$ ) compared with 16% reported ever breaking or stealing part of a car ( $\chi^2[1]=146.1$ ;  $P<<.001$ ); and 71% ( $n=65$ ) compared with 25% reported ever having been drunk ( $\chi^2[1]=85.4$ ;  $P<<.001$ ).

nant theory.<sup>20,21</sup> Launching a large-scale longitudinal study based on one theoretical perspective would be a risky enterprise. However, we need to go beyond the simple demonstration that from a long list of predictors, some will predict delinquent behavior and that these predictors are those that are most similar to the outcome criteria.

Personality theorists have regularly generated theories of antisocial behavior, but few have been tested from a developmental perspective with longitudinal data from early childhood onward. Two recent formulations have been the object of some empirical assessment in youths. Gray's model<sup>24-26</sup> has been used recently to explain children's conduct disorder,<sup>27-29</sup> whereas Cloninger's model<sup>30-32</sup> has been tested with reference to children's risk for alcohol abuse.<sup>33</sup>

Gray<sup>24,34</sup> proposed that the neurotic and extroverted dimensions of Eysenck<sup>35</sup> be replaced by anxiety and impulsivity dimensions. Using studies of drug therapies to reduce

anxiety, Gray<sup>25</sup> showed that there is a well-defined physiological locus for behavioral inhibition, ie, the septohippocampal system. In a two-dimensional space, Eysenck<sup>35</sup> placed anxiety in the middle of the quadrant formed by high introversion and high neuroticism. He also placed impulsivity in the middle of the quadrant formed by high extroversion and high neuroticism. Gray's model simply rotated Eysenck's dimensions at a 30° angle. Gray<sup>24,25</sup> argues that this model provides a more parsimonious representation of reality because one dimension (anxiety) is needed instead of two (introversion and neuroticism) to represent a behavioral system (behavioral inhibition system) that has a clear physiological locus (the septohippocampal system) and responds to conditioned stimuli for punishment and the lack of a reward. Impulsivity is linked to a behavioral activation system that controls active approach and avoidance of conditioned stimuli for reward and the lack of punishment, whereas

**Table 1. Distribution of Subjects in the Personality Profiles\***

Profiles	Dimensions			Expected, No. (%)	Observed, No. (%)
	Impulsivity	Anxiety	Reward Dependence		
Antisocial	High	Low	Low	63 (6.9)	54 (5.9)
Histrionic	High	Low	High	68 (7.4)	59 (6.5)
Explosive-schizoid	High	High	Low	68 (7.4)	74 (8.1)
Passive-aggressive	High	High	High	73 (8.0)	69 (7.6)
Schizoid	Low	Low	Low	59 (6.5)	59 (6.5)
Cyclothymic	Low	Low	High	64 (7.0)	91 (10.0)
Obsessive	Low	High	Low	64 (7.0)	58 (6.4)
Passive-dependent	Low	High	High	69 (7.5)	56 (6.1)
Others	NA	NA	NA	386 (42.3)	394 (42.9)

\*Likelihood ratio,  $\chi^2=28.9$ ,  $P=.09$ . NA indicates not applicable.

a third system, the fight/flight system, controls escape and defensive behavior in response to unconditioned signals of punishment and lack of reward.<sup>36,37</sup> Gray's work has focused more on the anxiety dimension than on the impulsivity and fight/flight dimensions. Using Gray's model, Quay<sup>28</sup> suggested that conduct disorder was related to an oversensitive behavioral activation system (see also Newman<sup>38</sup>). On the other hand, Lahey and colleagues<sup>27</sup> used the same model to suggest subtypes of antisocial children, ie, children with conduct disorder with and without anxiety. They thus stressed the importance of taking into account the strength of both the behavioral inhibition system and the behavioral activation system to explain conduct disorder. Quay<sup>29</sup> recently called for studies that would help clarify the separate and joint actions of these systems in cases of conduct disorder.

Cloninger<sup>30,31</sup> proposed a three-dimensional personality model that includes Gray's anxiety and impulsivity dimensions plus aspects of Eysenck's "psychotism" dimension. He labeled the anxiety dimension "harm avoidance." Those high in harm avoidance are cautious, apprehensive, and inhibited; those who are low in this dimension are fearless, carefree, and uninhibited. The impulsivity dimension was labeled "novelty seeking." Exploratory behavior, excitability, and impulsivity typify persons high in this dimension; those low in novelty seeking are described as reflexive, rigid, and stoic. The third dimension was labeled "reward dependence." Highly reward-dependent individuals are described as warm, sentimental, and persistent; those low in reward dependence, as tough-minded, detached, and emotionally cool.

An important difference between Gray's and Cloninger's models is that Gray links impulsivity to reward dependence, whereas Cloninger differentiates these two dimensions by relying on the hypothesis that they are associated with two different neuromodulators: dopamine regulates impulsive behavior, whereas norepinephrine regulates reward dependence.<sup>30</sup> The outcome of interactions between the three postulated dimensions is also an important characteristic of Cloninger's model.<sup>30,31</sup> He sug-

gests that each dimension is controlled by separate brain systems and neuromodulators that interact in such a way that the response based on one system will vary depending on the responses from the other systems. For example, highly harm-avoidant individuals will behave differently depending on whether they are low or high in reward dependence and low or high in novelty seeking. Eight extreme personality patterns (disorders) are generated from the interaction of the three dimensions when the two extremes of the continuum are used. For example, individuals high in novelty seeking, low in harm avoidance, and low in reward dependence would be classified as "antisocial" in the tradition of primary psychopathy,<sup>39,40</sup> whereas individuals with the same pattern except for the reward dependence dimension would be classified as "histrionic," ie, attention seeking, charming, and craving excitement.<sup>31</sup>

It is of interest to note that such an approach is similar to the suggestions made by Hinde and Dennis,<sup>41</sup> Cairns et al,<sup>42</sup> and Magnusson and Bergman<sup>43</sup> to study profiles (a person approach) and not only associations between variables (a variable approach). Cloninger<sup>30</sup> stresses the importance of distinguishing the underlying biogenetic dimensions from the phenotypic structure of personality.

This article addresses three questions concerning Gray's and Cloninger's personality models. First, we wanted to verify to what extent they could be used to characterize kindergarten boys' behavior and predict early onset of delinquency, ie, stable, highly delinquent behavior from pre-adolescence to early adolescence. An effort was made to assess the three personality dimensions with kindergarten behaviors that did not depict antisocial behavior so that the prediction of later delinquency would not be an assessment of the stability of antisocial behavior. Second, we wanted to address a parsimony issue by testing to what extent 1, 2, or 3 personality dimensions were needed to predict early onset of delinquency. Quay,<sup>28</sup> Gottfredson and Hirschi,<sup>13</sup> and Rowe and Osgood<sup>19</sup> argued for one dimension to explain antisocial behavior (impulsivity), Lahey et al<sup>27</sup> argued for two dimensions (impulsivity and anxiety),

**Table 2. Correlations Between Self-reported Delinquency Scores From Ages 10 to 13 Years**

	11 y	12 y	13 y
10 y	.45	.33	.33
11 y	...	.54	.50
12 y	...	...	.58

and Cloninger<sup>31</sup> and Eysenck and Gudjonsson,<sup>44</sup> argued for three dimensions. Finally, we wanted to verify whether, as suggested by Cloninger,<sup>30,31</sup> a categorical approach could correctly classify boys with early onset of high delinquency and how stable was this phenomenon between ages 11 and 13 years.

## RESULTS

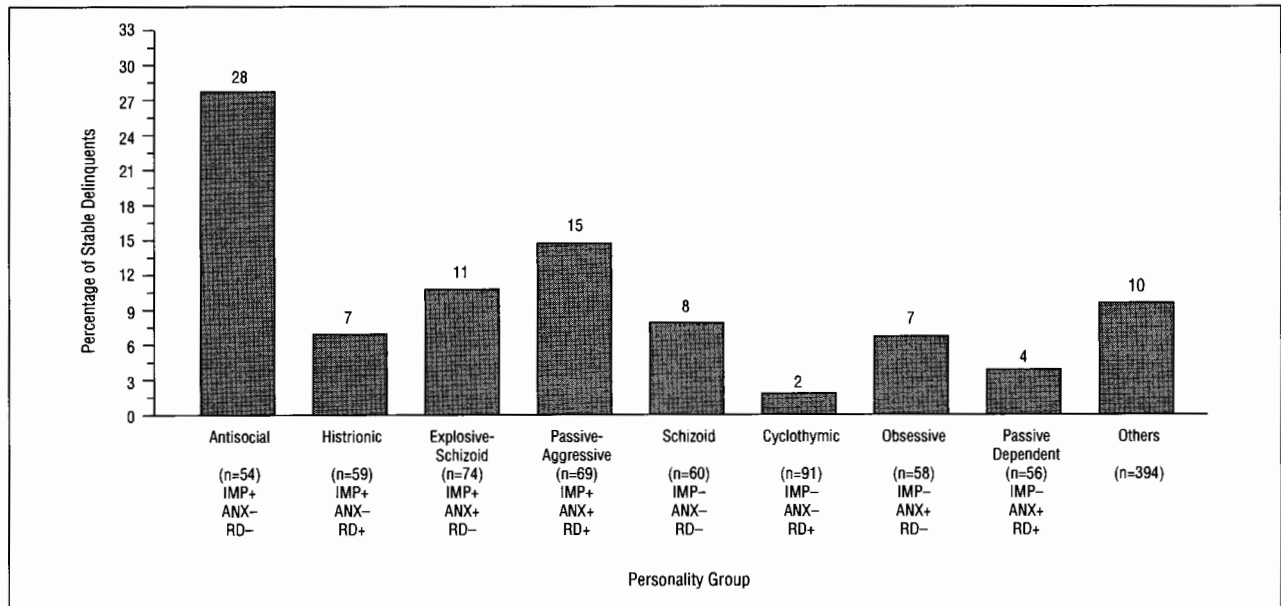
A logistic regression analysis was used to predict the delinquent-not delinquent classification from the three personality dimensions measured on a continuous scale in kindergarten. A backward procedure was used in which the three variables were first entered and then removed if their contribution to the equation was  $P > .15$ . The best predictive model of delinquent behavior (goodness of fit,  $\chi^2[910]=894.62$ ,  $P=.64$ ) included high impulsivity as the strongest predictor (Wald's  $\chi^2[1]=20.1$ ,  $P<.0001$ ), low anxiety as the second-strongest predictor (Wald's  $\chi^2[1]=5.9$ ,  $P<.016$ ), and low reward dependence as a third predictor (Wald's  $\chi^2[1]=4.8$ ,  $P<.029$ ). To check for the contribution of interactions between the three dimensions, a stepwise forward procedure was then used. The three variables were forced in the first step, and the interactions were left free to enter in the next step. No interactions were added to the equation, indicating that no interaction term made a significant contribution after the main effects were accounted for.

The analyses were then performed to check the distribution of delinquents within Cloninger's eight personality categories. **Figure 1** presents the distribution of the 92 frequently delinquent boys among the eight extreme personality categories and the rest of the sample (labeled "others" in the figure). It can be seen that, as predicted, the boys from the antisocial personality group were at highest risk of being classified as frequently delinquent (28%). The passive-aggressive and explosive schizoid groups followed with 15% and 12%, respectively, of their members classified as frequently delinquent. The percentages for each of the other personality categories were all below the base-rate level (10%); the percentage of frequently delinquent boys in the others category was identical to the base rate. The comparison of the proportion of delinquents in the antisocial group with each of the other groups, with a logistic regression model (goodness of fit,  $\chi^2[905]=913.87$ ,  $P=.41$ ), indicated significant differences for each comparison except for the contrast between the antisocial and the passive-aggressive groups. These results also clearly showed that

the boys with high impulsivity ratings in kindergarten were more at risk for early onset of frequent delinquent behavior than were those with low impulsivity ratings, with the exception of those who were also low in anxiety and high in reward dependence, ie, the histrionic group. The difference in the percentage of delinquent boys in the antisocial and the histrionic groups (odds ratio, 4.2) was particularly striking, considering that in kindergarten, they were different in only one dimension, ie, reward dependence. Similar significant differences between personality categories that had identical levels for two of three dimensions could be observed for the antisocial group compared with the schizoid group (odds ratio, 4.2) and for the passive-aggressive group compared with the passive-dependent group (odds ratio, 9.3). These results underline the relative risk for each kindergarten group of being identified among the frequently delinquent group between the ages of 10 and 13 years. It is, however, important to note that 42% (39/92) of the frequently delinquent boys originated from the kindergarten group without an extreme personality profile (ie, the "others" group in Figure 1).

A final set of analyses was conducted to assess the extent to which the association between kindergarten personality categories and early onset of frequent delinquent behavior was a stable phenomenon between the ages of 11 and 13 years.<sup>48</sup> The age of 11 years rather than 10 years was used because the questions for delinquent behavior for 10-year-olds asked if they had ever done the deviant behavior and how often, whereas the questions at ages 11 through 13 years asked if they had done the deviant behavior, and how often, in the past 12 months. The frequency of delinquent behavior was expected to increase from age 11 to 13 years because of the general increase in antisocial behavior during adolescence. The important question was to what extent would the differences among kindergarten personality categories that were observed for the dichotomous variable used in the preceding analysis (stable delinquent vs not stable delinquent between the ages of 10 and 13 years) hold true for two nonaggregated continuous measures taken 2 years apart? **Figure 2** represents the mean total self-reported delinquency score for each of the nine personality categories at ages 11 and 13 years. First, a repeated measures analysis of variance (nine personality categories by two ages) was performed to test the effect of kindergarten personality category and ages on self-reported delinquency. The personality category effect and the age effect were significant ( $F[8,877]=5.42$ ,  $P<.0001$ ;  $F[1,877]=7.78$ ,  $P<.005$ , respectively). The interaction between both factors was not significant ( $F[8,877]=0.58$ ;  $P>.05$ ). Self-reported delinquency increased from age 11 to 13 years for each personality category except for the passive-aggressive category (Figure 2). The antisocial kindergarten category had the highest score, and the passive-dependent category had the lowest score at both ages 11 and 13. To verify the extent to which each personality category had the same relative level of delinquency at both





**Figure 1.** Percentage of stable delinquents between the ages 10 and 13 years for the eight extreme kindergarten personality groups and all other subjects (others). IMP indicates impulsive; ANX, anxious; RD, reward dependent; plus sign, high on the given dimension; and minus sign, low on the given dimension.

ages, two correlation analyses were performed. A Spearman Rank Correlation Coefficient ( $\rho=.90, P<.0001, n=9$ ) and a Pearson correlation coefficient ( $r=.94, P<.0001, n=9$ ) using the personality categories' mean delinquency score indicated that at ages 11 and 13, the relative level of delinquency among groups based on kindergarten personality measures was stable.

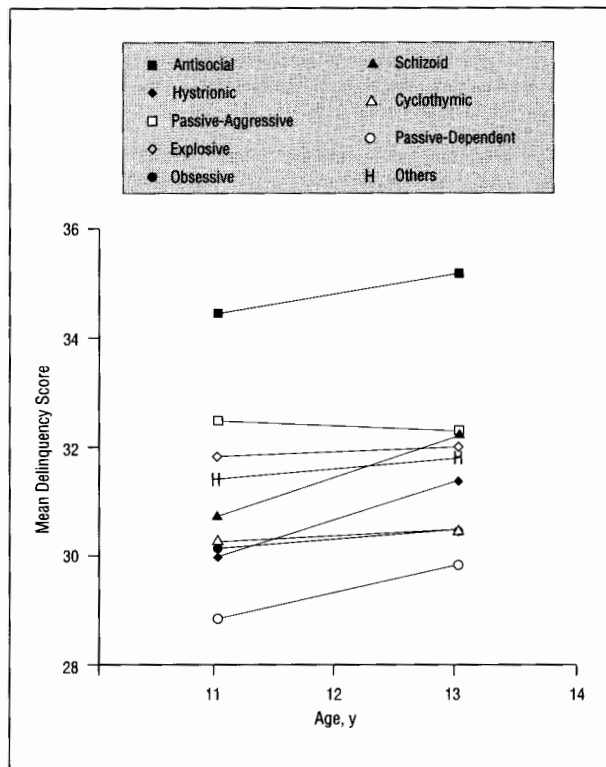
### COMMENT

This article reports on a longitudinal study of inner-city boys from kindergarten to age 13 years, which was used to test the predictive value of kindergarten personality manifestations for early onset of delinquent behavior. Based on Gray's<sup>25,26</sup> and Cloninger's<sup>30,31</sup> models, three personality dimensions were extracted from kindergarten teacher ratings: impulsivity, anxiety, and reward dependence. The results of a logistic regression analysis showed that high impulsivity rated by kindergarten teachers was the personality dimension that best predicted which boys would have the highest self-reported delinquency scores from ages 10 to 13 years. Anxiety and reward dependence also made small independent contributions to the prediction. Thus, the three personality dimensions as rated by kindergarten teachers did contribute to explaining the early onset of delinquent behavior, but impulsivity made the major contribution. As suggested by Quay<sup>28</sup> and Newman,<sup>38</sup> these results confirm that Gray's behavioral activating system may be the major dimension underlying the propensity toward antisocial behavior (see also Gottfredson and Hirschi<sup>13</sup>). As suggested by Lahey and colleagues,<sup>27</sup> the significant anxiety effect, albeit weak, indicates that the behavioral inhibition system can play a role in both preventing and fostering antisocial behavior. Reward dependence

made the smallest contribution but had a meaningful impact when a categorical approach was taken.

The measure of impulsivity in this study was based on items that are generally used to assess hyperactivity. The boys most at risk for antisocial behavior were thus rated overactive in kindergarten. These results corroborate a number of studies that have shown that hyperactivity increases the risk of later antisocial behavior.<sup>49-51</sup> The impulsivity and novelty seeking personality dimensions of Gray and Cloninger clearly overlap with the impulsivity and overactivity of the attention-deficit hyperactivity disorder.<sup>52,53</sup> Longitudinal studies from birth to school-entry age should attempt to sort out the developmental sequence of impulsivity, overactivity, attention-deficit hyperactivity disorder, and antisocial behavior by frequent monitoring of these dimensions for large samples of at-risk subjects.

Using Cloninger's<sup>31</sup> classification of extreme personality types, we verified to what extent boys with stable early onset of delinquent behavior were found in specific personality categories. Results confirmed Cloninger's prediction that subjects who are high in impulsivity, low in anxiety, and low in reward dependence would be the most at risk for antisocial behavior. The proportion of delinquent boys was highest in the antisocial category when compared with all other categories except the passive-aggressive category. It should be noted that the antisocial and passive-aggressive categories shared only the high impulsivity dimension. These results appear to reflect the interaction between impulsivity and anxiety that was predicted by Lahey and colleagues.<sup>27</sup> However, it must be noted that these two categories of boys also differed in the reward dependence dimension. In contrast, the antisocial and histrionic categories shared both the high impulsivity and low anxiety dimensions but had significantly different proportions of highly delinquent boys.



**Figure 2.** Mean self-reported delinquent behavior score at ages 11 and 13 years for the eight extreme kindergarten personality groups and all other subjects (others).

Reward dependence of the histrionic boys did appear to protect them from high involvement in delinquency, although they were highly impulsive and low in anxiety. Thus, the analyses of differences between categories show the important role of the three personality dimensions when extreme personality categories are associated with an extreme behavior such as stable, highly antisocial behavior. Although the logistic regression, which used the whole continuum of each personality dimension, showed only modest predictive values for anxiety and reward dependence and no significant interaction effects, it can be seen that the categorical analyses revealed statistically significant and theoretically meaningful differences between categories of subjects who shared two of three dimensions, including impulsivity. The difference between the antisocial and histrionic groups was remarkable in this respect. This result confirms the usefulness of the person approach in data analysis.<sup>41-43</sup>

The longitudinal data on delinquent behavior were also used to check the extent to which kindergarten personality dimensions were associated with delinquent behavior at the start of puberty (age, 11 years) and during puberty (age, 13 years). Results showed that this association was generally stable at a time when boys go through one of life's most important transitional periods. The increase in reported delinquent behaviors was significant from ages 11 to 13 years, but at both ages, the antisocial group scored highest and the passive-dependent group scored lowest; three of the four highly impulsive groups scored highest, and three of the four

groups low in impulsivity scored lowest. The correlation for the ranking of each group at each age was very high. The schizoid and the histrionic groups deviated from the expected ranking based on their impulsivity score. The schizoid group had higher delinquency scores and the histrionic group had lower delinquency scores than would have been expected based on their impulsivity scores in kindergarten. In the case of the histrionic group, reward dependence could act as a protective factor against the delinquency involvement that would be expected from highly impulsive individuals who are low in anxiety. In the case of the schizoid group, low reward dependence and low anxiety may replace impulsivity as a sufficient disinhibitor of antisocial behavior. Future work should attempt to identify factors that could explain the schizoid subjects' and histrionic subjects' deviation from their expected delinquency involvement. This series of analyses used a continuous measure for the dependent variable and gave results that confirmed the analyses when a dichotomy had been used for the dependent variable (stable delinquent vs not stable delinquent).

The kindergarten teacher ratings used in this study were not the optimum measures of the three personality dimensions. It will be important to replicate this study with behavioral assessments designed to assess these specific personality models. Replications are also needed to determine to what extent the results can be generalized to girls and boys raised in different circumstances. Results, however, confirmed the theoretical basis of the personality dimensions to predict antisocial behavior and showed substantial stability over a long period when boys undergo important developmental changes. Predictive studies of antisocial behavior have shown that antisocial behavior is relatively stable from early childhood to adolescence.<sup>10,22</sup> This study demonstrates that personality dimensions that do not include antisocial behavior were good predictors of later antisocial behavior. One would expect that the personality dimensions and antisocial behavior at age 6 years would be highly correlated. To understand to what extent these personality dimensions are the basis on which antisocial behavior develops, studies are needed in which both the personality dimensions and antisocial behavior are monitored with independent measures from birth to school entry. Alternatively, if the modification of young children's basic personality dimensions could be achieved through early intervention, this would help clarify the extent to which changes in antisocial behavior follow.

*Accepted for publication June 13, 1994.*

*This study was supported by grants from the government of Quebec's Conseil Québécois de la Recherche Sociale (CQRS) and Fonds pour la Formation de Chercheurs et l'Aide à la Recherche (FCAR), Quebec city, the Social Sciences and Humanities Research Council of Canada, Ottawa, Ontario, and the University of Montréal.*

*We thank Pierre Charlebois, PhD, Claude Gagnon, PhD, Serge Larivée, PhD, and Marc LeBlanc, PhD, for par-*

participating in the planning and execution of the longitudinal study; Hélène Beauchesne, MSc, and Lucille David, MSc, for coordinating the data collection; Hélène Boileau; Lyse Desmarais-Gervais, MSc; Diane Héroux; and Maria Rosa for creating the data banks and performing the statistical analyses; Mihn T. Trinh, MSc, for providing the documentation; Bernard Boulerice, MSc, for providing the statistical expertise; and Chantal Bruneau and Francine Ploude, for secretarial assistance. We thank three anonymous reviewers for their suggestions.

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