Several theories have proposed that individual differences in enduring behavioral dispositions, often conceptualized as personality traits (Tellegen, 1988), could explain the continuity in conduct problems. Within these models, hyperactivity, fearlessness, and lack of empathy often emerge as the behavioral dispositions that underlie antisocial psychopathologies such as conduct disorder (CD) (Cloninger et al., 1997; Eysenck, 1998; Lahey et al., 1999; Quay, 1993).

Biological theories of personality and psychopathology have viewed these dimensions as part of biologically based behavioral systems (e.g., Cloninger, 1987; Eysenck, 1998; Gray, 1982; Quay, 1993). For instance, Gray (1982) postulated that hyperactive or impulsive behaviors originate from an oversensitive behavioral activation system and that fearlessness results from a weak behavioral inhibition system. It was also suggested that an antisocial profile includes a third dimension, reflecting different conceptualizations of lack of empathy, such as low (social) reward dependence (Cloninger, 1987), callousness (Christian et al., 1997; Frick and Ellis, 1999; Frick et al., 1994), or low levels of helpful behaviors (Kerr et al., 1997; Lahey et al., 1999; Tremblay et al., 1994).

The role of each dimension or combination of dimensions has been differentially emphasized across theories. For instance, Quay (1993) stressed the role of a dominant behavioral activation system (impulsivity), while Cloninger (1987) pointed to the combination between sex-specific childhood behavioral profiles that represented risk for CD in adolescence.
high activation (hyperactivity), low inhibition (fearlessness), and low reward dependence. In addition, hyperactivity (Lynam, 1996), lack of fear (Frick et al., 1999; Lahey et al., 1999), and callousness (Christian et al., 1997; Frick et al., 1994) were proposed to distinguish subtypes of CD children.

Support has been demonstrated for the association of a single childhood dimension (lack of control; Caspi et al., 1995; impulsivity: e.g., Loerber et al., 1993; Taylor et al., 1996; White et al., 1994; and of a combination between two (high impulsivity and low levels of fear: e.g., Matthys et al., 1998) or three dimensions (high hyperactivity, low fear and low reward dependence: e.g., Sigvardsson et al., 1987; Tremblay et al., 1994) with antisocial behaviors. However, several questions remain. First, it is unclear whether children with all three behavioral dimensions (representing risk) are more likely to exhibit antisocial behaviors later in life than children with combinations of two, or children with a single dimension. For instance, are children who are hyperactive, fearless, and callous at higher risk than children who are (only) hyperactive?

Second, the hypotheses linking childhood behavioral dimensions to antisocial psychopathology were almost exclusively tested with males, and their relevance for females has received little attention. Testing this link among children and adolescents of both sexes is necessary to examine (1) whether the childhood behavioral dimensions predictive of CD in adolescent males are also predictive for females and (2) whether males’ higher prevalence of CD (Eme and Kavanaugh, 1995; Robins and Price, 1991) can be related to males’ higher prevalence of childhood risk (Moffitt et al., 2001). In turn, identifying sex differences in the behavioral dimensions representing risk for CD may point to sex differences in the etiology of this disorder and to a need for sex-specific prevention or treatment strategies.

The general aim of this study was to examine the predictive value of sex-specific childhood behavioral profiles theoretically representing risk for CD. Specifically, a person-oriented approach was used to examine, separately for boys and girls, how elementary school children with distinct combinations of hyperactivity, fearlessness, and helpfulness (behavioral profiles) were at different levels of risk for CD when assessed at 16 years of age. The behavioral dimensions were based on seven childhood assessments from 6 to 12 years of age. To our knowledge, no previous study has used such an extensive period of assessment to create childhood behavioral profiles. In addition, we examined whether the profiles predicted CD after controlling for other important predictors of conduct problems, i.e., early antisocial behaviors (e.g., Haapasalo et al., 2000; Nagin and Tremblay, 1999), family status, and socioeconomic level (e.g., Pagani et al., 1999).

METHOD

Subjects

The participants were selected from a large sample of boys and girls who were first assessed when they were attending kindergarten in the province of Quebec’s French-speaking public schools in 1986–1987. The total sample comprised (1) 66.5% (957 boys and 946 girls) of children representative of Quebec and selected randomly and (2) 33.5% (516 boys and 444 girls) of children who, in kindergarten, scored at the 80 percentile or above on disruptive behaviors items from the (teacher- and/or parent-rated) Social Behavior Questionnaire (SBQ) (Tremblay et al., 1991). Highly disruptive children were oversampled to obtain a large enough number of participants who were at risk for antisocial behaviors. The effect of oversampling was accounted for in the analyses predicting CD (see section on control variables). The 2,863 children (1,473 boys and 1,390 girls) were approached for assessment in the spring of each year between kindergarten and grade 6 and again in adolescence (mean = 15.7 years) (Côté et al., 2001; Zoccolillo et al., 1999).

Attrition and Missing Data

A minimum of three assessments over the seven elementary school years was required to estimate the childhood trajectory dimensions. A total of 1,364 (92.6%) boys and 1,313 (94.5%) girls were included in the hyperactivity models, while 1,366 (92.7%) boys and 1,312 (94.4%) girls were included in the fearfulness or helpfulness models. The participants who were excluded from the trajectory analyses (more than four missing childhood assessments) did not differ significantly from those who were included on hyperactivity, fearfulness, or helpfulness.

When invited to participate in the adolescent assessment, 903 (59.6%) boys and 931 (66.8%) girls consented. CD diagnosis was available for 1,721 children (834 boys and 887 girls). The final sample included 749 boys and 820 girls with complete childhood (trajectory) and adolescent (CD) information. Seventy-two percent were from the representative sample. This proportion was larger than the proportion of representative children in the original sample (72%) versus 66.5%, \( \chi^2 = 46.81, p < .001 \). Participants in the final sample were less disruptive than those from the original sample (mean [SD] = 4.4 [5.4] versus 5.2 [5.7], \( t_{2,861} = -4.1, p < .001 \), less hyperactive (mean [SD] = 1.08 [1.34] versus 1.24 [1.41], \( t_{2,855} = -3.16, p < .05 \), more prosocial (mean [SD] = 7.25 [4.44] versus 6.6 [4.64], \( t_{2,858} = 3.86, p < .05 \), and came from families with lower adversity scores (mean [SD] = 0.27 [0.25] versus 0.34 [0.27], \( t_{2,760} = 6.22, p < .05 \). To examine the effect of attrition, we repeated the analyses using weights.

The majority of participants were French-speaking (97.1%) and white (96.9%). Most adolescents were living with both biological parents (66.6%). Some were living with their mother only (15.9%), with their mother and her spouse (10.31%), or in other family arrangements such as with their father (6.2%) or with adoptive parents (0.9%).

Measures

Childhood Behavioral Dimensions and Profiles. The teachers rated the children’s behaviors on the SBQ (Tremblay et al., 1991) every year during the seven elementary school years, i.e., seven times between kindergarten and grade 6. The items included on the SBQ were origi-
 Initially from the Prosocial Behavior Questionnaire (Weir and Duveen, 1981) and from the Preschool Behavior Questionnaire (Behar and Stringfield, 1974).

In the present study, the seven SBQ scores were used to model developmental trajectories on each childhood dimension. Thus teacher ratings were used to assess hyperactivity (restless; runs about or jumps up and down) (mean α over 7 years, boys = 0.88, girls = 0.83); fearfulness (tends to be fearful or afraid of new things; is worried about many things; cries easily) (mean α over 7 years, boys = 0.69, girls = 0.7); and helpfulness (shows sympathy; praises others; helps sick child; helps hurt child; helps child with a difficult task; helps clean up mess; invites bystanders; stops quarrels; helps pick up objects; and comforts upset child) (mean α over 7 years, boys and girls = 0.9). The possible ratings for the items ranged from 0 ("never applies") to 2 ("frequently applies").

Conduct Disorder in Adolescence. A French version (Breton et al., 1998) of the Diagnostic Interview Schedule for Children Version 2 (DISC-2) (Shaffer et al., 1996) was administered to the adolescents by trained interviewers. The DISC-2 is a structured psychiatric interview designed to assess DSM-III-R (American Psychiatric Association, 1987) childhood psychiatric disorders. Current CD diagnosis based on adolescents’ self-reports was the dependent variable, since adolescents are generally recognized as the most valid informants of their own antisocial behaviors (e.g., Moffitt et al., 2001). There were 72 (9.6%) boys and 28 (3.4%) girls with CD. The CD rate was 5.3% in the representative sample and 9.1% in the sample of highly disruptive kindergartners.

Control Variables. Three control variables were used. The first was a dummy variable indexing sample membership, i.e., representative subjects versus oversampled for disruptive behaviors. The second was a family adversity index ranging from 0 to 4, including the following: (1) the parents’ ages when the first child was born, (2) the parents’ levels of education, (3) the family socioeconomic status, and (4) the family living arrangement (e.g., living with biological parents). Families at or below the 30th percentile in one of these areas (or nonintact families) were coded as having one adversity point. Higher scores indicated lower age of the parents at the birth of the first child, lower education, lower income, or separated parents. Finally, the third control variable was a teacher-rated kindergarten antisocial behavior scale, comprising 11 items from the SBQ: Fights with other children; Bullies other children; Kicks, bites or hits other children; Irritable, quick to “fly off the handle”; Is disobedient; Doesn’t share; Blames others; Inconsiderate of others; Destroys own or others’ belongings; Not much liked by others; and Tells lies. Kindergarten family adversity was used because most of the variables in this index are either very stable in time (e.g., parent education) or invariant in time (e.g., parents’ ages at the birth of the first child). Kindergarten antisocial behavior was used because it is indicative of an early onset of antisocial behaviors, and its control allowed us to examine whether the childhood profiles predicted CD over and above early disruptiveness.

Data Analysis

Estimating Childhood Personality Trajectory Models. There were two main parts to the analyses. First, semiparametric mixture models for hyperactivity, fearfulness, and helpfulness were estimated separately for boys and girls with the SAS-based procedure TRAJ (Jones et al., 2001; Nagin, 1999). The method provided the capacity to (1) identify groups of boys and girls following trajectories with distinct levels of behaviors over time, (2) estimate the proportion of children in each of the identified trajectory groups, and (3) estimate the patterns of stability and variations in trajectories. In the present study, the TRAJ results served to identify groups of boys and girls who would be on high hyperactivity, low fearfulness, and low helpfulness trajectories compared with children on other trajectories.

Censored normal models were estimated for each dimension. Models with the optimal number of groups were selected on the basis of the Bayesian information criterion (Nagin, 1999). Therefore, the identification of children on the high hyperactive, low fearfulness, and low helpfulness trajectories was based on a statistical and objective criterion and on patterns of behaviors that had been observed over the seven elementary school years.

Creating the Childhood Trajectory-Based Profiles. The profiles were created in two steps. First, the trajectory groups were dichotomized; children on the highest hyperactivity trajectory were coded as “hyperactive,” those on the lowest fearfulness trajectory as “fearless,” and those on the lowest helpfulness trajectory as “unhelpful.” Because the remaining children were on any other trajectory level (e.g., medium- or high-level helpfulness), they were coded as “not hyperactive,” “not fearless,” and “not unhelpful” for the purpose of this study. Second, the binary trajectory groups for each dimension were combined so that children fell into one of eight categories (2³). The profiles and the proportions of children in each category are presented in Table 1. The behavioral profiles reflect the childhood trajectories followed on the three dimensions simultaneously. For example, children in profile 1 (hyperactive, not fearless, not unhelpful) followed the high hyperactivity trajectory between the ages of 6 and 12 and were not on the fearless trajectory and not on the unhelpful trajectory.

### TABLE 1

<table>
<thead>
<tr>
<th>Behavioral Profiles Created by Combining Membership in the Childhood Trajectories</th>
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<tr>
<td>Childhood Trajectories of Risk</td>
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<tr>
<td><strong>Profiles</strong></td>
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<td>1. Hyperactive, not fearless, not unhelpful</td>
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<td>2. Hyperactive, fearless, not unhelpful</td>
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<td>3. Hyperactive, not fearless, unhelpful</td>
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<td>4. Hyperactive, fearless, unhelpful</td>
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<td>5. Not hyperactive, fearless, not unhelpful</td>
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<td>7. Not hyperactive, not fearless, unhelpful</td>
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<td>8. Not hyperactive, not fearless, not unhelpful</td>
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*Note:* + = on a trajectory representing risk for conduct disorder; – = not on a trajectory representing risk for conduct disorder (e.g., children not low on fearfulness can be on the middle or high trajectory).
Predicting Conduct Disorder in Adolescence From Childhood Profiles.

Three sets of logistic regressions were performed. In the first, memberships in the profiles were entered into logistic regressions predicting CD. Profile 8 (not hyperactive, not fearless, not unhelpful) was the reference category because it comprised children who were on none of the trajectories of hypothetical risk. Profile 4 (hyperactive, fearless, unhelpful) could not be used for the prediction analyses with girls because there were only three cases. In the second set of logistic regressions, the effect of the profiles was examined after having entered the three control variables: sample type, family adversity, and antisocial behaviors in kindergarten. Third, these analyses were repeated using weights that corrected for attrition of subjects over time. Specifically, each adolescent who was included in the final analyses was assigned a weight according to his or her probability of being in the original (kindergarten) sample, conditional on the variables used in the analyses.

RESULTS

Figure 1 presents the trajectories for boys and girls between kindergarten and grade 6 on the three behavioral dimensions. First, trajectory models with four groups best fitted the data for hyperactivity: (1) 16.9% of boys and 35.9% of girls exhibited no hyperactivity; (2) 35.8% of boys and 25.3% of girls had declining levels; (3) 10.9% of boys and 21% of girls had slightly increasing or low stable levels; and (4) 36.5% of boys and 17.8% of girls were on the highest hyperactivity trajectory. Thus the highest trajectory group comprised children who entered and finished primary school with high levels of hyperac-
tivity relative to their same-sex peers. These children were coded as “hyperactive.” Second, models with three relatively stable trajectories were identified for fearfulness: a low, medium, and high trajectory group. The 32.7% of boys and 20.7% of girls in the low group were coded as “fearless.” Finally, three mostly stable trajectories were identified for helpfulness: a low, medium, and high trajectory group. The 40.9% of boys and 23% of girls in the low group were coded as “unhelpful.” Then, membership in the trajectory groups, coded as binary variables, was used to categorize subjects into one of eight trajectory profiles (Table 1).

The upper panel of Figure 2 illustrates the proportion of boys with specific behavioral profiles who later developed CD; the lower panel presents the results for girls. Logistic regressions were performed to test whether the prevalence of CD in adolescence differed across the childhood profiles. Profile 8 (not hyperactive, not fearless, not unhelpful) was used as the reference group. The significant findings were the same when we controlled for sample type, family adversity, and kindergarten antisocial behavior, or when using weights. Table 2 presents the results with the control variables on the unweighted scores.

**Fig. 2** Proportion of children with specific personality profiles who later developed conduct disorder (CD). *Differ from profile 8 (not impulsive, not fearless, not unhelpful), p < .05.
The results for boys revealed that three childhood profiles were associated with a significant risk for adolescent CD. The odds ratio (OR) for profile 1 (hyperactive, not fearless, not unhelpful) was 4.27 (95% confidence interval [CI], 1.8–10.16). For profile 3 (hyperactive, not fearless, unhelpful) the OR was 2.83 (CI, 1.07–7.46). Finally, for profile 4 (hyperactive, fearless, unhelpful) the OR was 3.93 (CI, 1.27–12.17). An additional follow-up logistic regression indicated that there were no significant risk differences among these three profiles.

Results of the analyses for the sample of girls revealed that only those in profile 3 (hyperactive, not fearless, unhelpful) had a significantly higher proportion of CD cases compared with those in profile 8 (not hyperactive, not fearless, not unhelpful). The OR was 4.61 (CI, 1.31–16.24).

**DISCUSSION**

The study examined the links between children’s trajectory-based behavioral profiles and CD in adolescent males and females. We found that a specific combination of dimensions was necessary to predict CD in girls, while for boys the effect was mainly related to one dimension: hyperactivity. Specifically, boys at risk were either hyperactive only (profile 1: OR = 4.27); hyperactive and unhelpful (profile 3: OR = 2.83); or hyperactive, fearless, and unhelpful (profile 4: OR = 3.93), compared with boys who were not hyperactive, not fearless, and not unhelpful (profile 8). Since the three profiles did not differ from each other, the results suggest that hyperactivity, presumably indexing an oversensitive behavioral activation system (Gray, 1987; Quay, 1993), is sufficient to substantially increase males’ risk of CD in mid-adolescence. The hyperactivity items measured in this study are part of the attention-deficit/hyperactivity disorder (ADHD) diagnosis as measured in the *DSM-IV*. Therefore, this finding is in line with previous research having shown the importance of childhood hyperactivity as a risk factor for antisocial disorders in males (Lynam, 1996; Rutter et al., 1998). In contrast, girls’ higher risk for CD was observed for only one profile: high hyperactivity and low helpfulness (OR = 4.61). However, the risk level for this group of girls was notably high.

The present study cannot explain why high hyperactivity during elementary school was a sufficient CD risk for boys and not for girls. However, it clearly corresponds to the sex differences in the childhood hyperactivity trajectories. Specifically, boys’ high hyperactivity trajectory was higher than girls’ high hyperactivity trajectory. Boys’ higher hyperactivity may be a marker for neuropsychological deficits that increase the risk for antisocial behavior (Lynam, 1996; Moffitt, 1993; Moffitt et al., 2001; Rutter et al., 1998; Séguin et al., 1999). Studies of sex differences in ADHD are in line with this notion. Hence, it was shown that ADHD boys in the general population have more impairment (Carlson et al., 1997), more severe hyperactivity symptoms, and higher rates of externalizing behaviors compared with ADHD girls (Gaub and Carlson, 1997). Therefore, boys’ higher hyperactivity levels may reflect a higher risk for CD.

Given their lower levels of hyperactivity (compared with boys), girls appear to need additional risk factors to
increase the odds for CD during adolescence. It is interesting that the additional factor that puts girls at risk for CD, low helpfulness, is less frequent in girls than in boys. Girls tend to be more helpful (Côté et al., 2002), empathic, competent, and verbal than boys from the preschool years onward (Keenan and Shaw, 1997; Kochanska et al., 2000; Maccoby, 1998). Our results show that stable low-level helpful behavior (rare in girls), in combination with stable high-level hyperactivity (rare in girls), is indeed a rare combination (3.8% of sample compared with boys' 11.5%) that involves an important risk of CD for girls. Note that our results also indicate that it is still less likely to find elementary school–age girls who are hyperactive, unhelpful, and fearless (0.4% compared with boys' 4.8%). Thus, although our sample of girls is one of the largest used to predict CD diagnosis, it was still too small to determine the risk of a hyperactive, unhelpful, fearless profile.

The identified high-risk behavioral profiles are likely to be the continuation of a preschool development associated with difficult temperament, neurodevelopmental deficits, poor emotional regulation, poor executive functioning, and poor socialization practices (Keenan and Wåkschlag, 2000; Lavigne et al., 1998; Moffitt et al., 2001; Olson and Hoza, 1993; Rutter, 1996; Stattin and Klackenberg-Larsson, 1993; Tremblay, 2000; Zelazo et al., 1996). Longitudinal studies from early childhood to late adolescence with frequent assessments of the interplay between these factors are needed to understand more fully the different trajectories that lead girls and boys to CD.

The sex differences in the prevalence of childhood risk profiles are striking. Almost eight times more boys than girls exhibited a sex-specific risk profile (30.3% of boys were in profile 1, 3, or 4 while only 4% of girls were in profile 3), and almost three times more boys had a CD diagnosis in adolescence (9.6% of boys versus 3.4% of girls) or exhibited violent CD symptoms (7.1% of boys and 2.2% of girls). Thus a higher proportion of boys were on highly stable risk trajectories from kindergarten on, and this may partly explain their higher prevalence of CD in adolescence. This interpretation is in line with results showing that sex differences in the prevalence of childhood risk factors (such as hyperactivity) account for a large part of the sex differences in the prevalence of persistent antisocial behaviors (Moffitt et al., 2001).

Previous studies conducted on segments of this sample and on other samples have identified groups of girls (Côté et al., 2001) and boys (Broidy et al., in press) who followed high trajectories of antisocial behaviors during childhood representing risk for adolescent delinquency. Results from Broidy et al. (in press) and Nagin and Tremblay (1999) specifically showed that, compared with trajectories of hyperactivity, male trajectories of physical aggression were better predictors of physically violent behavior in adolescence, while male trajectories of opposition were better predictors of nonviolent delinquency. Additional studies are needed to investigate the extent of the overlap between high trajectories of antisocial behaviors (previously identified) and the trajectory profiles of risk identified in the present study. Examining this question will help clarify the relations between what we conceptualize, on the one hand, as childhood profiles within the context of personality theories, and antisocial/disruptive behaviors on the other. In addition, it will be important to examine the extent to which the same type of predictors lead to forms of antisocial behavior that may be more typical of girls, such as relational or indirect aggression (Crick and Grotpeter, 1995; Lagerspetz et al., 1988; Osterman et al., 1998; Tremblay et al., 1995).

Limitations

The subjects’ sampling procedure can be seen as a limitation, inasmuch as children with high rates of disruptive behavior in kindergarten were oversampled. However, oversampling also represented a strength in that it increased the number of CD cases and thus allowed a study of the predictors of CD among a nonclinical population. It was especially important for studying CD in girls. To ensure the external validity of the findings, sample membership was used as a control variable in the analyses predicting CD. Thus it is argued that the oversampling was useful in providing more statistical power for the prediction of CD, without having distorted the results. Another limitation was the sample attrition between the childhood and adolescent assessments. The attrition analyses suggested that attrition was higher among the children most at risk. It is possible that this led to an underestimation of the magnitude of the risk ratios. However, oversampling for disruptive children may have corrected this effect. The replication of the results using weights indicates that the findings are not explained by attrition. Finally, the participants were French–Canadian children, which limits the generalization of the findings to other populations. The replicability of the results among other samples, and particularly among girls, deserves to be investigated.
Clinical Implications

The results support the notion that prevention strategies aiming at enhancing children’s capacity for self-control and social skills would be efficient means of reducing risk for antisocial behaviors. However, we have little information about the effectiveness of such strategies among girls, and studies investigating the effect of prevention programs for CD among children of both sexes are needed. Finally, children with both behavioral and environmental risks (e.g., disorganized family, or school environment) may present the highest likelihood for antisocial disorders (Lynam et al., 2000) and may most benefit from prevention strategies.

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