

# Behavioral Observations at Age 3 Years Predict Adult Psychiatric Disorders

## Longitudinal Evidence From a Birth Cohort

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**Background:** This study provides, to our knowledge, the first empirical test of whether behavioral differences among children in the first 3 years of life are linked to specific adult psychiatric disorders: anxiety and mood disorders, antisocial personality disorder, recidivistic and violent crime, alcoholism, and suicidal behavior.

**Methods:** In a longitudinal-epidemiological study, 3-year-old children were classified into groups based on examiner observations of their behavior. At age 21 years, they were reassessed for psychopathologic functioning using standardized interviews based on DSM-III-R criteria.

**Results:** Although effect sizes were small, *undercontrolled* (includes children who are impulsive, restless, and distractible) and *inhibited* (includes children who are shy,

fearful, and easily upset) children differed significantly from comparison children in young adulthood. Undercontrolled 3-year-olds were more likely at 21 years to meet diagnostic criteria for antisocial personality disorder and to be involved in crime. Inhibited 3-year-olds were more likely at 21 years to meet diagnostic criteria for depression. Both groups were more likely to attempt suicide, and boys in both groups had alcohol-related problems. Controls for family social class did not change the findings.

**Conclusion:** Some forms of adult psychopathologic abnormality are meaningfully linked, albeit weakly, to behavioral differences observed among children in the third year of life.

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**D**EVELOPMENTAL theories hypothesize that the origins of many adult mental disorders can be identified in behavioral characteristics that appear already in the first few years of life.<sup>1,2</sup> A scientific test of this hypothesis is difficult because it requires costly longitudinal studies from birth to adulthood. Thus, empirical evidence about continuities from behavioral characteristics in early childhood—from the first 3 years of life—to psychopathologic abnormality in adulthood is practically nonexistent.<sup>3</sup> Several longitudinal studies have linked behavioral characteristics in late childhood to adult adjustment problems.<sup>4-8</sup> Other longitudinal studies, involving preschool samples followed up into adolescence, have linked behavioral characteristics in early childhood to adjustment problems in early-adolescence<sup>9</sup> and mid-adolescence.<sup>10</sup> As part of a longitudinal investigation of a large representative sample of children studied from age 3 to 21 years, this article provides, to our knowledge, the first empirical test of whether behavioral differences in early childhood are differentially linked to specific adult psychiatric disorders: anxiety,

depression, mania, antisocial personality disorder, recidivistic and violent crime, alcoholism, and suicidal behavior.

The predictor variables for this study were introduced previously.<sup>11</sup> We reported that, on the basis of behavioral observations at age 3 years, children in our study could be reliably classified into 1 of 5 distinct groups. The first 3—labeled *undercontrolled*, *inhibited*, and *well-adjusted*—resemble groups identified by Chess and Thomas<sup>12</sup> in their pioneering studies of child temperament. The undercontrolled type, resembling the Chess-Thomas *difficult* type, includes children who are impulsive, restless, and distractible. The inhibited type, resembling the Chess-Thomas *slow-to-warm-up* type, includes children who are shy, fearful, and easily upset. The well-adjusted type, resembling the Chess-Thomas *easy* type, includes children who are capable of self-control when it is demanded of them, are adequately self-confident, and do not

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## SUBJECTS AND METHODS

### SAMPLE

Participants are members of the Dunedin Multidisciplinary Health and Development Study. Silva<sup>26</sup> has described the study's history. It is a longitudinal investigation of a complete cohort born between April 1, 1972, and March 31, 1973, in Dunedin, a city of approximately 120 000 on New Zealand's South Island. Perinatal data were obtained at delivery, and when the children were traced for follow-up at age 3 years, 91% of the eligible births participated in the assessment, providing a base sample of 1037 (52% male) for longitudinal study. The children's fathers were representative of the social class distribution in the general population of similar age in New Zealand. The study members were of predominantly European ancestry. Fewer than 7% identified themselves as Maori or Polynesian, which matches the ethnic distribution of the South Island.

The Dunedin cohort has been reassessed at ages 3, 5, 7, 9, 11, 13, 15, 18, and 21 years. The basic procedure involves bringing participants to the research unit within 60 days of their birthday for a full day of individual data collection. The various research topics are presented as standardized modules, each administered by a different trained examiner in counterbalanced order (eg, physical examination, mental health interview, delinquency interview, injury risk assessment). At each assessment, interview data are supplemented by a search of official records and questionnaires are mailed to informants who know each study member well.

### Assessment of Behavior Styles in 3-Year-Olds

At age 3 years, children participated in a 90-minute testing session involving cognitive and motor tasks. Each child was tested by 1 of 10 examiners who had no knowledge of the child's behavioral history. Following the testing, the examiner rated the child's behavior on 22 behavioral characteristics, based on scales derived from the Collaborative Study on Cerebral Palsy, Mental Retardation, and Other Neurological Disorders of Infancy and Childhood.<sup>27</sup> Factor- and cluster-analyses of the examiners' behavioral ratings revealed 5 reliable, homogeneous, and mutually exclusive clusters of children at age 3.<sup>11,27</sup> Undercontrolled children (n=106, 62% male) were described as irritable, impulsive, and imperistent; they had difficulty sitting still, were rough and uncontrolled in their behavior, and labile in their emotional responses. Inhibited children (n=80, 40% male) were socially reticent (fearful and limited communication), inhibited in the testing situation, upset by strangers, and had difficulty concentrating on tasks. The behavior of well-adjusted children (n=405, 48% male) was rated by examiners as within normal limits for their age.

become unduly upset when confronting new people and situations. Typological research has identified these 3 types of children using different sources of information (eg, parent reports or observations), different statistical methods (eg, inverse factor analysis or cluster analysis), in different parts of the world (eg, United States, the Netherlands or New Zealand), and in different age groups (eg, early childhood or early adolescence),<sup>13</sup> suggesting that these 3 types are the best candidates for inclusion

Confident children (n=281, 52% male) were zealous, eager to explore the testing materials, and adjusted to the testing situation quickly. Reserved children (n=151, 48% male) were timid and somewhat uncomfortable in the testing session; however, unlike inhibited children, their response disposition was not extreme, and their caution did not interfere with their task orientation.

### Assessment of Mental Health Problems at Age 21 Years: Psychiatric Diagnosis

The Diagnostic Interview Schedule (DIS), developed by the National Institute of Mental Health for the Epidemiological Catchment Area program,<sup>28</sup> was used to obtain diagnoses of mental disorder in the last 12 months. The Dunedin version of the DIS was modified to use only those items that were criteria for DSM-III-R<sup>29</sup> classifications, to omit lifetime prevalence questions, and to score items as 0, no; 1, sometimes; and 2, yes, definitely. In identifying disorder, only scores of 2 were used to indicate a symptom (commensurate with a 5 in the original DIS). Diagnoses were determined by computer-assisted algorithms that followed explicit criteria specified by DSM-III-R. The measurement and prevalence of mental disorders in the Dunedin study is reported elsewhere.<sup>30</sup>

For this study, we examined the following groupings of psychiatric disorder: (1) anxiety disorders (n=195) consisting of generalized anxiety disorder, obsessive-compulsive disorder, panic disorder, agoraphobia, social phobia, simple phobia, or any combination of these disorders; (2) depressive disorders (n=172) consisting of major depressive episode, dysthymia, or both; (3) manic episode (n=19), consisting of study members who experienced a manic episode in the past 12 months; (4) antisocial personality disorder (n=31); and (5) alcohol dependence (n=94).

### Clinical Significance of Impairment Associated With Mental-Health Problems

Using a reporting period of the past 12 months, we assessed 6 indexes of impairment associated with mental health problems. These included reports of treatment seeking for psychiatric symptoms, hospitalizations for psychiatric symptoms, use of psychotropic medication, reports of suicide attempts, and court convictions for criminal offenses exclusive of traffic violations. In addition, respondents who reported symptoms in any of the modules of the DIS reported whether they experienced functional interference in work and daily activities associated with those symptoms. We created an overall impairment scale by summing these 6 indexes of impairment.

### Informant Index of Mental Health

This index was based on the endorsement of symptoms of mental-health problems in a mailed questionnaire completed

in a generalizable classification of temperament. We also found 2 types of children not anticipated by Chess and Thomas: the *confident* type that included children who at 3 years were zealous and friendly and the *reserved* type that included children who at 3 years were slightly cautious.

We previously reported that these behavior styles at age 3 years predict personality traits at age 18 years,<sup>11</sup> adding to a growing body of longitudinal research about

by a significant other nominated by the study member as someone who knew them well. Of the 961 participants at age 21 years, 914 (95.1%)-nominated informants returned valid questionnaires. The questionnaire asked the informant to rate the study member on a series of positive and negative attributes. Thirteen of the items represented signs of mental disorders for each of the major categories of the DIS, worded in a general manner such as "Feeling depressed, miserable, sad or unhappy," or "Problems related to the use of alcohol."<sup>30</sup> Informants rated items as 0, does not apply; 1, applies somewhat; and 2, definitely applies.

#### Measures of Criminality

Computerized records of participants' cumulative court convictions at all courts in New Zealand and Australia were obtained by searching the central computer systems of the New Zealand police. Conviction records excluded traffic offenses, with the exception of driving under the influence of alcohol or criminally negligent driving. Informed consent for the search was obtained at age 21 years. For this study, we examined 2 variables. The criminal recidivism group (n=80) included individuals who had been convicted of 2 or more criminal offenses. The violent offender group (n=44) included individuals who had been convicted of at least 1 of the following offenses: inciting violence, cruelty to an animal, using an attack dog on a person, possession of an offensive weapon, threatening a police officer, rape, manual assault, assault on a police officer, assault with a deadly weapon, manslaughter, and aggravated robbery.

#### Suicidality

As part of the mental-health interview, participants were asked about suicide attempts they had made during the past 12 months. Attempts were counted whether or not they had required medical attention.

#### Attrition

At age 21 years, mental-health interviews were missing for 76 members (7.3%) of the original sample of 1037; 17 persons died since age 3 years, 9 persons were not located, 19 refused to participate, and 31 were interviewed by telephone, but were not asked questions about mental health. The 76 nonrespondents did not differ from the 21-year-old participants on family social class ( $t[939]=1.35$ ,  $P=.18$ ), race ( $\chi^2 [1]=.41$ ,  $P=.52$ ), or sex ( $\chi^2 [1]=1.26$ ,  $P=.26$ ). Missing data were not disproportionately concentrated among any of the 5 temperament groups ( $\chi^2 [4]=6.25$ ,  $P=.18$ ). These results suggest that our findings are not compromised by attrition bias.

the coherence of personality development beginning in early childhood.<sup>14,15</sup> At 18 years, undercontrolled children described themselves as danger-seeking, impulsive, prone to respond with strong negative emotions to everyday events, and enmeshed in adversarial relationships. At 18 years, inhibited children described themselves as overcontrolled, harm-avoidant, and nonassertive. The behavior style of well-adjusted 3-year-olds was still discernible at 18 years, when, statistically, they de-

#### STATISTICAL ANALYSIS

Contingency tables and analyses of variance (ANOVA) were used to test the hypothesis that undercontrolled and inhibited 3-year-olds would have more mental health problems at age 21 years than other types of children. In addition, multivariate logistic regressions were used to examine specific continuity between behavior styles at age 3 years and particular types of adult psychiatric disorders at 21 years. Each regression equation contained a dummy variable representing undercontrolled children and a dummy variable representing inhibited children. The contrast or reference group in each regression equation was the well-adjusted group. After entering these 2 main effects and the main effect of sex, we added 2 interaction terms to test whether the association between undercontrolled and inhibited behavior at age 3 years and specific disorders at 21 years differed for male subjects and female subjects. We examined whether a model with sex interaction terms yielded significant improvements in the fit of the model to the data than a model with main effects only. In presenting the results, we report odds ratios (ORs) and the  $P$  values associated with the regression coefficients for the undercontrolled and inhibited dummy variables. The ORs indicate the factor by which the odds of a specific outcome occurring increased for undercontrolled and inhibited children relative to well-adjusted children. When there was no significant sex-by-temperament interaction effect, we report combined results for male and female subjects because this model constitutes a better form for the estimation of relative risk for undercontrolled and inhibited children. When there was a significant interaction at  $P<.05$ , results are reported separately by sex. To establish that the associations between behavior styles at age 3 years and adult disorders are independent of the family circumstances in which the study members grew up, we included a measure of family social class<sup>31</sup> as a covariate in all regression models. All reported ORs are adjusted for family social class. All significance tests are 2 tailed.

In performing the regression analyses we had to choose between a reference group of well-adjusted children or a reference group combining well-adjusted, reserved, and confident children. We performed the analyses using both options and the statistical and substantive findings did not change significantly. We report analyses using well-adjusted children as the reference group because, as noted in the introduction, this group provides an interpretive fit with previous studies about the structure of temperament. In contrast, the generality of additional types, such as the reserved and confident groups, has yet to be replicated in other samples to test whether they constitute independent types or whether they can be subsumed within the 3 replicable types.

finned normal, average young adults. The confident and reserved children resembled the well-adjusted children in their personality profile at age 18 years.

This article extends the study of development and tests 2 hypotheses about links between behavior styles at age 3 years and psychopathologic abnormality at 21 years. First, we tested whether undercontrolled and inhibited children are more likely to have psychiatric problems than other children. This hypothesis follows Thomas et al<sup>16</sup> who re-

**Behavior Styles at 3 Years of Age and DSM-III-R Diagnoses, Level of Impairment Associated With Psychiatric Symptoms, and Informant-Observed Problems at 21 Years of Age**

Outcome at Age 21 Years	Sample Base Rate at Age 21 Years	Behavior Styles at Age 3 Years*					$\chi^2$ or F (P)
		Well-adjusted (n=375)	Undercontrolled (n=94)	Inhibited (n=73)	Reserved (n=142)	Confident (n=268)	
Any disorder, %	40	38†	46	53‡§	37†	42	$\chi^2=8.5$ (.07)
Multiple disorders, %	19	15†	27‡	29†	21	18†	$\chi^2=12.4$ (.01)
Mean (SD) Impairment scale	0.76 (0.98)	0.65 (0.83)†	0.99 (1.27)‡§	0.93 (1.12)†	0.70 (0.94)	0.81 (1.01)†	F=3.14 (.01)
Mean (SD) informant scale	3.98 (3.67)	3.75 (3.37)	4.82 (4.12)‡†	4.69 (4.11)†	3.87 (3.67)	3.58 (3.74)	F=2.76 (.03)

\*Although 961 sample members participated in the mental health interview at 21 years of age, a few were missing complete information across all the Diagnostic Interview Schedule modules; hence N=952.

†P<.05, pairwise contrast with the inhibited group.

‡P<.05, pairwise contrast with the well-adjusted group.

§P<.05, pairwise contrast with the reserved group.

||P<.05, pairwise contrast with the undercontrolled group.

|||P<.05, pairwise contrast with the confident group.

ported that of the 141 children in their study, difficult and slow-to-warm-up children required more psychiatric attention by early adolescence than easy children. Second, we tested whether behavioral characteristics of 3-year-olds provide discriminant validity in predicting specific psychiatric outcomes in adulthood.<sup>17</sup> We expected that inhibited children would be at risk for anxiety disorders and for depressive disorders. We expected that undercontrolled children would be at risk for antisocial personality disorder and criminal behavior. Regarding alcohol-related problems and suicidal behavior, we expected that both undercontrolled and inhibited children would be at increased risk, although for different reasons. Research suggests that undercontrolled children may be attracted to the "good time" they associate with alcohol's disinhibiting effects, whereas inhibited children may use alcohol as a "self-medicating" strategy, to escape dysphoria.<sup>18</sup> This hypothesis is consistent with the notion that there may be at least 2 distinct temperamental-developmental pathways to adult alcohol problems.<sup>19,20</sup> Similarly, research has shown that impulsive behavior and depressive disorders are independently linked to suicide attempts, suggesting that undercontrolled and inhibited childhood behaviors may also represent distinct risks for suicidal behavior in later life.<sup>21,22</sup>

The current study offers several advantages for testing these hypotheses. First, it combines long-term follow-up with an epidemiological sampling frame. We can thus capture the full range of population variation on measures of toddler behavior and adult psychopathologic abnormality. Previous shorter-term studies have examined small or homogeneous samples, or clinic-referred samples, and the generalizability of results from such studies may be compromised by their selectivity.<sup>23</sup> Second, the current study uses a well-established diagnostic interview enabling us to differentiate between adult psychiatric outcomes. Previous shorter-term studies have focused on nonspecific measures of psychopathologic functioning or on global measures of maladjustment, which may obscure meaningful differences in the developmental importance of distinct behavior styles.<sup>24</sup> Third, the current study uses multiple data sources to test longitudinal predictions. Studies that rely on a single data source to measure both predictor and outcome variables cannot separate true prediction from

confounded method variance. The only unconfounded strategy is to gather data from different sources at different ages.<sup>25</sup> We use behavioral observations at age 3 years to predict outcomes at age 21 years, measured via self-reports, informant reports, and official records.

With independent data sources, we offer the first test in an epidemiological sample of the hypothesis that behavior in early childhood is linked to adult psychopathologic functioning. Our study constitutes a rigorous test in that it spans 18 years, uses independent data sources, and seeks to predict specific psychiatric disorders at age 21 years from behavioral observations made by an examiner after only 90 minutes of interaction with each child at age 3 years. Because the time span is long and the behavioral observations brief, this test provides a conservative estimate of the extent to which individual differences in early childhood influence adult mental health, and we expected modest effect sizes.

## RESULTS

### ARE UNDERCONTROLLED AND INHIBITED CHILDREN MORE LIKELY TO HAVE PSYCHIATRIC PROBLEMS?

The **Table** gives the association between behavior styles at age 3 years and mental health problems at age 21 years. As shown in the Table, the 1-year prevalence rate of psychiatric disorder, assessed by diagnostic interview at age 21 years, was 40%. This estimate is consistent with prevalence data for this age group in the National Comorbidity Survey,<sup>32</sup> in which the 12-month prevalence rate of any psychiatric disorders among 15- to 24-year-olds was 37%.

The Table also shows that, as predicted, undercontrolled and inhibited children were the most likely to have a psychiatric disorder, and were also the most severely impaired by their condition. The likelihood of any psychiatric disorder at 21 years was weakly linked to behavior styles at age 3 years ( $\chi^2 [4]=8.5, P=.07$ ). As expected, undercontrolled (46%) and inhibited (53%) children were the most likely to be diagnosed with a psychiatric disorder. The likelihood of multiple disorders at 21 years was significantly linked to behavior styles at age

3 years, ( $\chi^2 [4]=12.4, P=.01$ ). Undercontrolled (27%) and inhibited (29%) children were significantly more likely to suffer from multiple disorders. An ANOVA of the impairment scale at age 21 years, with the behavior styles at age 3 years as the independent factor, also revealed a significant effect [ $F(4,947)=3.14, P=.01$ ]. Undercontrolled and inhibited children were the most impaired. Finally, an ANOVA of the informant reports of mental health problems at age 21 years, with the behavior styles at age 3 years as the independent factor, revealed a significant effect [ $F(4,878)=2.76, P=.03$ ]. According to informants, undercontrolled and inhibited children had the most mental health problems at age 21 years, corroborating the results based on clinical interviews with the sample members themselves.

In summary, across 18 years and across 3 different data sources—observer ratings, diagnostic interviews, and informant reports—the results provide support for the hypothesis that undercontrolled and inhibited children are at increased risk of psychiatric problems. By contrast, well-adjusted, reserved, and confident children were not distinguishable and had better mental health outcomes at age 21 years.

#### DO BEHAVIOR STYLES AT AGE 3 YEARS PREDICT SPECIFIC ADULT PSYCHIATRIC OUTCOMES?

##### Anxiety Disorders

**Figure 1** shows the association between behavior styles at age 3 years and anxiety disorders at 21 years. The Figure shows the 1-year prevalence rates (ie, cohort base rates) of specific disorders in the Dunedin sample as a whole, and the rates for well-adjusted, undercontrolled, and inhibited children. Because the sample is an unselected birth cohort, the sample rates may be treated as estimates of population rates among young adults in New Zealand.

Figure 1 shows that behavior styles at age 3 years could not significantly distinguish persons at risk for developing an anxiety disorder. However, before concluding that behavior styles do not constitute risk for anxiety disorders we conducted 3 additional tests. First, we tested the possibility that behavior styles at age 3 years could distinguish persons at risk for developing 2 or more anxiety disorders, but this test was not significant. Second, we tested whether behavior styles at age 3 years could predict specific subtypes of anxiety disorders (eg, social phobia, agoraphobia, or obsessive-compulsive disorder), but these tests were not significant. Third, because categorical data are less sensitive than continuous measures, we examined scores on an anxiety symptom scale, consisting of 19 items from the DIS. An ANOVA of the number of anxiety symptoms at age 21 years did not show the predicted relation between inhibited behavior at age 3 years and anxiety at age 21 years. Rather, there was weak indication that, relative to well-adjusted children (mean  $\pm$  SD,  $2.6 \pm 5.2$ ), undercontrolled (mean  $\pm$  SD,  $3.9 \pm 6.9$ ) and inhibited (mean  $\pm$  SD,  $3.6 \pm 6.7$ ) children had slightly elevated anxious symptomatology [ $F(2,538)=2.54, P=.08$ ]. This association was not conditioned by sex [ $F(2,538)=0.66$ , insignificant].

The center panel in Figure 1 shows the link between behavior styles at age 3 years and depressive disorders at 21 years. As predicted, inhibited children were significantly more likely to be diagnosed with depression at age 21 years (OR=2.2,  $P<.01$ , 95% confidence interval [CI]=1.2-3.9). Undercontrolled children were not significantly more likely to be diagnosed with depression. Although manic episodes could not be predicted from behavior styles at age 3 years, none of the inhibited children experienced mania, which is characterized by symptoms of increased activity, inflated self-esteem, and impulsive behaviors. Thus, inhibition showed predictive specificity within the family of mood disorders. There were no significant interaction effects between behavior style and sex in predicting mood disorders.

##### Antisocial Behavior and Criminality

**Figure 2** shows the association between behavior styles at age 3 years and antisocial outcomes at age 21 years. As predicted, undercontrolled children were significantly over-represented in every outcome examined. They were 2.9 times as likely to be diagnosed with antisocial personality disorder ( $P<.05$ , 95% CI, 1.1-8.1), 2.2 times as likely to be recidivistic offenders ( $P<.05$ , 95% CI, 1.1-4.7), and 4.5 times as likely to be convicted for a violent offense ( $P<.01$ , 95% CI, 1.8-10.9). There were no sex interaction effects.

Unexpectedly, inhibited children were also significantly more likely to be convicted for a violent offense (OR=2.9,  $P<.05$ , 95% CI, 1.0-8.4). However, this association was moderated by an interaction effect; inhibited boys (OR=5.7, 95% CI, 1.6-20.1), but not girls (OR=0.84, 95% CI, 0.09-7.9), were more likely to have been convicted for a violent offense.

##### Alcohol-Related Problems

**Figure 3** shows the association between behavior styles at age 3 years and alcohol dependence at age 21 years. Undercontrolled children were 2.2 times as likely to be diagnosed with alcohol dependence ( $P<.05$ , 95% CI, 1.1-4.4). However, this association was moderated by an interaction effect; undercontrolled boys (OR=2.7, 95% CI, 1.2-6.2), but not girls (OR=0.53, 95% CI, 0.06-4.4), were more likely to have alcohol dependence. As predicted, inhibited children also had elevated rates of alcoholism, but this result did not attain statistical significance (OR=1.8,  $P=.15$ , 95% CI, 0.80-4.1).

To further explore the relation between childhood behavior styles and alcohol-related problems, we examined scores on an alcohol abuse symptom scale, consisting of 23 items from the DIS. An ANOVA of the number of alcohol symptoms at age 21 years, with behavior styles at age 3 years as the independent factor, revealed a significant effect [ $F(2,531)=6.72, P=.01$ ]. Both undercontrolled and inhibited children had significantly more alcohol-related problems. However, this main effect was moderated by an interaction effect with sex [ $F(2,531)=5.80, P=.01$ ]. As shown in **Figure 4**, both undercontrolled and inhibited boys, but not girls, had significantly more alcohol-related problems. Thus, whereas inhibited boys did not meet the

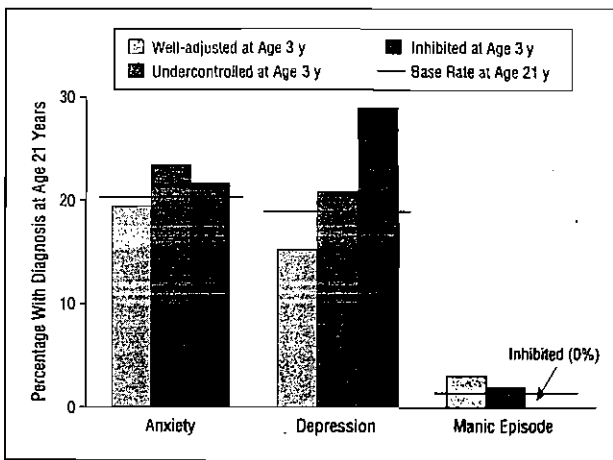


Figure 1. The association between behavior styles at age 3 years and adult anxiety and mood disorders.

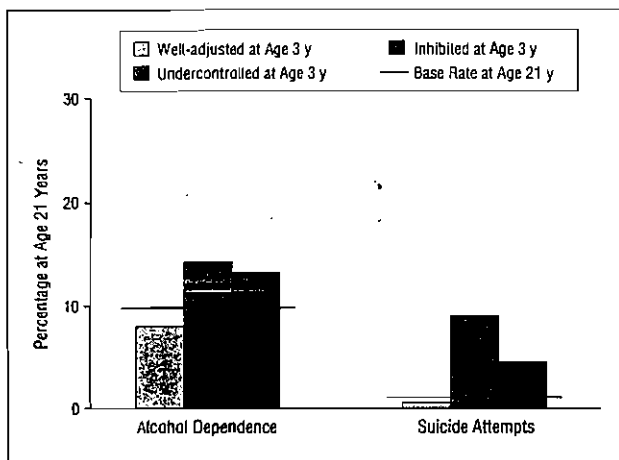


Figure 3. The association between behavior styles at age 3 years and adult alcohol dependence and suicide attempts.

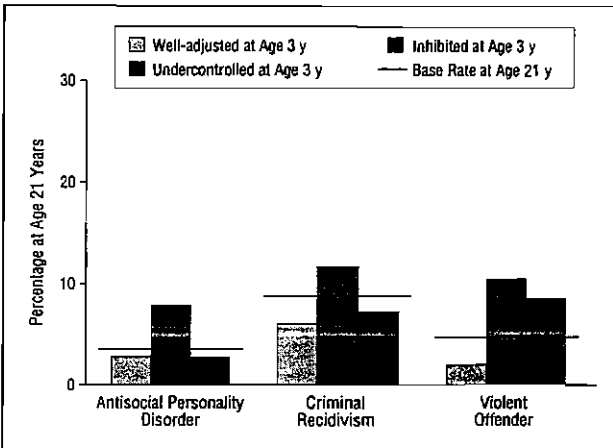


Figure 2. The association between behavior styles at age 3 years and adult criminal behavior.

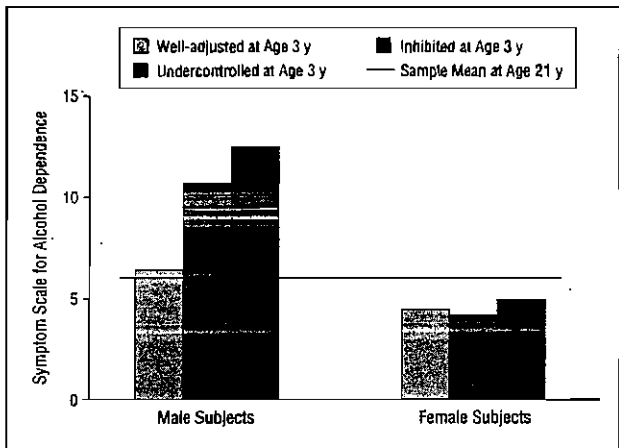


Figure 4. Scores on Diagnostic Interview Schedule alcohol abuse symptom scale at age 21 years as a function of behavior styles at age 3 years and sex.

DSM-III-R diagnostic cut-off for alcohol dependence, they did experience more problems associated with alcohol.

### Suicide Attempts

Figure 3 shows the association between behavior styles at age 3 years and suicide attempts at 21 years. Suicide attempts were significantly more concentrated among undercontrolled and inhibited children; undercontrolled children were 16.8 times ( $P < .01$ , 95% CI, 3.5-81.7) and inhibited children were 6.5 times as likely ( $P < .05$ , 95% CI, 1.1-39.8) to report attempting suicide. There were no sex interaction effects.

### COMMENT

Results from the Dunedin study suggest that behavior styles observed in the third year of life are significantly related to mental-health problems at age 21 years. These relations were obtained even with adjustments for social class characteristics. The empirical connections represent small effect sizes, but they span 18 years and distinct data sources, from observer ratings after a 90-minute exposure to the child at age 3 years to mental health information gathered from clinical interviews with the sample members at 21 years.

Although small cell sizes in some analyses may render some statistical estimates unstable, the patterns of associations reported were corroborated across independent data sources such as clinical interviews, informant reports, and official records. Still, the present results should be regarded with caution until they are replicated in other samples.

The results provide evidence that specific behavior styles in early childhood are connected to specific psychiatric problems in adulthood. Undercontrolled children were characterized by an impulsive, undercontrolled behavior style at age 3 years. At 21 years, they were more likely to meet the criteria for antisocial personality disorder and to be involved in criminal activities. Inhibited children were shy, fearful, and easily upset in novel settings at age 3 years. At 21 years, they were significantly more likely to meet diagnostic criteria for depression.

There were also similarities between the undercontrolled and inhibited groups, suggesting that children with different behavior styles may be at general risk for similar adult outcomes. Both groups were significantly more likely to attempt suicide, and both groups of boys were more likely to report alcohol-related problems. The latter finding is consistent with causative accounts that posit 2 pathways to alcohol-related problems: one associated with under-

socialized behavior, the other with neurotic-depressive behavior.<sup>19</sup> That the relation between both behavior styles and alcohol-related problems was confined to boys is consistent with evidence that enduring, heritable behavior traits may play a more important role in alcohol-related problems among males than females.<sup>33</sup>

There was 1 unexpected finding and 1 negative finding in our study. The unexpected finding was that inhibited boys, like undercontrolled children, were more likely to have been convicted for a violent offense. However, they were not more likely to be recidivistic offenders; they appeared in court records only once. Nor did they meet the diagnostic criteria for antisocial personality disorder. This suggests that inhibited boys who had been convicted for violence may have committed a single offense that was uncharacteristic of their usual behavior. The negative finding was that inhibited children were not, as predicted, at increased risk for anxiety disorders. This finding is inconsistent with shorter-term studies linking behavioral inhibition to anxiety problems.<sup>34,35</sup> However, those studies relied on very small samples and found differences only for specific subsets of extremely inhibited children, for example, children who showed a stable pattern of inhibition at 4 assessment ages or children with a family history of psychiatric disorder. It is thus possible that inhibited childhood behavior is a risk factor for anxiety disorders among a specific segment of children who have a family history of anxiety or who experience chronic family stress.<sup>36</sup>

Although specific episodes of psychiatric disorders may be transient, documentation of a link between behavior styles in early childhood and psychopathologic abnormality in adulthood, paired with knowledge about the consistency of personality from childhood through adulthood,<sup>37</sup> suggests that, in the absence of significant characterological change, early-appearing behavioral differences may act as a persisting risk factor for some forms of psychiatric disorders.

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