

Adolescent Social Anxiety as an Outcome of Inhibited Temperament in Childhood

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ABSTRACT

Objective: Chess and Thomas suggested that temperament might make a contribution to social phobia and other forms of extreme social anxiety. This study provides the first investigation of the outcomes in adolescents who had been inhibited (subdued to and avoidant of novelty) or uninhibited (approaching novelty) in the second year of life, utilizing both direct interview and direct observation. **Method:** Seventy-nine subjects, aged 13 years, who had been classified as inhibited or uninhibited in the second year were assessed with both standardized interview and direct observation. **Results:** There was a significant association between earlier classification of a child as inhibited and generalized social anxiety at adolescence, but no association with specific fears, separation anxiety, or performance anxiety. The adolescents who were classified as socially anxious made fewer spontaneous comments than those without social anxiety; no relation was seen between any other type of fear and the number of spontaneous comments. Adolescent girls who had been inhibited as toddlers were more likely to be impaired by generalized social anxiety than boys. **Conclusions:** The interview and observational data indicate that important aspects of an inhibited temperament are preserved from the second year of life to early adolescence, which predispose an adolescent to social anxiety. *J. Am. Acad. Child Adolesc. Psychiatry*, 1999, 38(8):1008–1015. **Key Words:** social anxiety, social phobia, temperament, adolescence, developmental psychopathology.

While the etiology of social phobia and other extreme forms of social anxiety is likely multifactorial (Rosenbaum et al., 1994; Stein, 1995), ever since Chess and Thomas, psychiatrists have been receptive to the notion that temperament might make a contribution to later anxious symptoms. This is the first prospective study that used behavioral observations early in life to classify children into temperamental groups and follow them up at adolescence with both direct interviews and observation.

The term *temperament* refers to the variety of stable moods and behavioral profiles observed in early child-

hood that are controlled, in part, by the individual's biology. The sense meaning of a temperamental construct is a coherence of physiological and psychological processes that emerges early in development. The contemporary referential meaning is neither a set of genes nor behaviors but a psychological profile that is the result of environments acting on young children who inherited a particular physiology.

Although the concept of temperament is more than 2,000 years old—the idea dates back to the ancient Greeks—the bold writings of Stella Chess and Alexander Thomas (Chess et al., 1960), 40 years ago, sparked a resurgence of interest in children's temperaments. Two of the most extensively studied temperamental constructs are related to the Chess and Thomas dimension of approach/withdrawal. This dimension describes typical responses to unfamiliar people, objects, and situations and is usually referred to with terms such as shyness versus sociability, caution versus boldness, or withdrawal versus approach. Kagan (1994) calls these 2 categories of children behaviorally inhibited and uninhibited, respectively.

Inhibited children in the second year typically interrupt ongoing behavior, cease vocalizing, seek comfort from a familiar person, or withdraw in response to unfamiliar

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people or situations. Uninhibited children approach unfamiliar persons or objects and are outgoing and typically talkative.

Investigators have reported modest preservation of these profiles from early childhood to later childhood (Asendorpf, 1990; Kerr et al., 1994). Caspi and Silva (1995) have reported modest preservation of these profiles from early childhood to adolescence. It is of interest that these 2 behavioral styles show evidence of heritability in children (Matheny, 1983, 1990). However, the degree of stability of temperamental types from early childhood to adolescence is an open question. Longitudinal studies that cover such a long interval are expensive, difficult, and, hence, rare.

Kagan and colleagues, who have followed 2 cohorts of inhibited and uninhibited children through the eighth year (Kagan et al., 1988), found that many inhibited children continued to show withdrawal, subdued affect, and/or avoidance of unfamiliar people, places, and situations. By contrast, many of the uninhibited children showed the complementary characteristics. Inhibited and uninhibited children also differed in sympathetic reactivity, with the inhibited children showing larger cardiac accelerations and larger pupillary dilations to selected cognitive challenges. However, these children had not been assessed directly after age 7½ years.

Previous studies have linked behavioral inhibition to anxiety problems in earlier childhood (Biederman et al., 1990; Hirshfeld et al., 1992). However, those studies have relied on small samples, did not assess the child directly, used lay interviewers, and did not span the era from the second year to adolescence. By contrast, Caspi et al. (1996), who studied a longer interval, did not find that inhibited children were at increased risk for anxiety disorders at 21 years. Caspi and Silva (1995) did find that subjects who had been inhibited at age 3 were lacking in social potency at age 18.

We evaluated the developmental trajectory of inhibited and uninhibited children through early adolescence with 2 different types of evidence: interview and observation of behavior. We studied 79 adolescents who had been categorized 12 years earlier as inhibited or uninhibited on the basis of their behavior with unfamiliar people, procedures, and objects in a laboratory setting. As 2-year-olds, uninhibited children often approached unfamiliar persons or objects while vocalizing and smiling, whereas inhibited toddlers withdrew from unfamiliar incentives. The primary questions were whether the 2

temperamental groups continued to differ in their behavior and in current fears. We hypothesized that social anxiety would be particularly prevalent among adolescents who had been categorized in the second year of life as inhibited. We also hypothesized that adolescents who had been inhibited would smile and vocalize less when interacting with an unfamiliar adult.

METHOD

Subjects

The 79 subjects who were assessed at age 13 years (mean = 13.0, SD = 0.5) represented 71% of the 2 original cohorts of 112 children (55 inhibited, 57 uninhibited). Forty-four (56%) of these subjects were originally classified as inhibited (20 males, 24 females) and 35 (44%) as uninhibited (16 males, 19 females). The sample was homogeneously middle-class and white.

Initial Selection of Subjects

The subjects came from 2 different cohorts.

Cohort 1. Cohort 1 subjects (Coll et al., 1984) were observed at 21 months, with their mothers present, while they interacted with unfamiliar women and objects in unfamiliar laboratory rooms. The initial group consisted of 305 volunteer families. Prescreening interviews were used to identify 160 potential subjects, of which 117 actually came to the laboratory for observation. The session consisted of 6 episodes during which the infant's reactions to a range of events judged to be moderately unfamiliar to 2-year-olds were coded by 2 observers. One served as an experimenter; the other videotaped the behavior through a one-way mirror. The 6 episodes were administered in the following order: (1) The experimenter greeted the mother and infant, explained the purpose of the study, obtained background information, and recorded the infant's weight and height. (2) The infant, parent, and experimenter moved to a playroom, where a set of toys, including realistic representations of people, utensils, beds, foods, and animals, was arranged on the floor. The mother was instructed not to encourage her child to play with any particular toy and to interact only if the child initiated such interaction. (3) After 5 minutes of free play, the experimenter and mother joined the child on the floor, and the experimenter modeled 3 acts varying in complexity: a doll talking on a toy telephone, a doll cooking toy food in a pan and serving dinner on plates for 2 other dolls, and 3 animals walking together through a rainstorm simulated by hand motions and then hiding under a cloth. No special verbal instructions were given to the child after the 3 acts were modeled. Five additional minutes of free play were recorded. (4) The experimenter left the room, and an unfamiliar woman entered, sat on a chair, and did not initiate any interaction with the child or the parent for 30 seconds. The woman then called the child by name and asked the child to come to the floor and perform 3 age-appropriate items of the Bayley Scale: pink puzzle board, follow directions, and the yellow pegs. The unfamiliar adult then left the room. (5) The experimenter then opened a set of curtains in one corner of the room, revealing a robot 60 cm tall. The robot was constructed of tin cans and springs with Christmas-tree lights on its head. The infant was encouraged to explore the robot, and after touching it, the experimenter showed the child how to turn on and off the lights located on the robot's head. After the child was engaged in the manipulation of lights, the exper-

imenter pressed a hidden foot pedal that operated a tape recorder. A male voice spoke to the infant through a speaker in the robot's mouth for 20 seconds, after which the experimenter encouraged the infant to explore the robot. (6) After the child resumed playing with the toys, the experimenter signaled the mother, in a subtle manner, to leave the room. The mother left and returned after 3 minutes, or immediately if the infant started to cry.

The responses indicative of behavioral inhibition were apprehension, withdrawal, long latencies to approach the unfamiliar person or object, clinging to the mother, crying, sobbing or fretting, facial expressions and vocalizations of distress, and cessation of play. On the basis of the presence or absence of inhibited behaviors during each of these 6 situations, each child was classified into 1 of 3 groups: inhibited (a total of 9 or more inhibited response behaviors); uninhibited (2 or fewer inhibited behaviors); or neither (3 to 8 behaviors). These criteria were determined a priori from pilot data. Twenty-eight subjects were classified as inhibited and 30 subjects as uninhibited in cohort 1. The remaining subjects classified as neither inhibited nor uninhibited were excluded from further follow-up.

Cohort 2. Cohort 2 subjects (Snidman, 1989) were observed at 31 months. Each child played with an unfamiliar child of the same sex and age in a laboratory playroom with both mothers present. The play session, which occurred in a room containing a variety of age-appropriate toys, had a one-way mirror permitting observation from an adjoining room. The children first met outside the entrance of the playroom. The mothers were given written instructions that described the session and instructed them to remain seated on a couch and to limit interactions with the child, but to intercede if a problem developed.

The 40-minute play session was divided into 2 segments. The children were free to play with each other and the toys during the first 35 minutes. Coders standing behind the mirror recorded latencies to touch the first toy, to vocalize, to enter a cloth tunnel, and to approach the other child and total time spent in proximity to the mother. During the last 5 minutes, 2 unexpected events occurred. First, an unfamiliar woman wearing a plastic bag that covered her trunk and arms from neck to waist entered, sat on the floor in the middle of the room, but did not speak. Several minutes later, after the first woman left the room, a second unfamiliar woman entered and uncovered the robot made of tin cans and Christmas tree lights (see description for cohort 1). The woman invited the child to approach and to play with the robot's lights. If the child approached and played with the light switches, the robot "spoke" through a speaker in the robot's mouth, inviting the child to play.

The behavioral criteria used for classification of inhibited or uninhibited were time spent proximal to the mother (greater than 9 minutes for inhibited or less than 1 minute for uninhibited), latency to touch the first toy (greater than 2 minutes or less than 35 seconds), latency to approach the other child for the first time (greater than 13 minutes or less than 9 minutes), not entering or entering the toy cloth tunnel, not approaching or approaching the first unfamiliar woman, and latency to approach the robot (greater than 2 minutes or less than 1 minute). A child had to meet 1 of the 2 criteria for time spent proximal to the mother and, in addition, meet any 2 of the other 5 criteria in order to be classified as either inhibited or uninhibited. This complex criterion protected the investigator from classifying a child as inhibited simply because he or she played alone. Rubin (1993) has made an important distinction between this type of child, who can be autonomous, and one who is isolated and seeks contact with an available parent because of uncertainty or anxiety. Twenty-seven subjects were classified as inhibited and 27 subjects as uninhibited in cohort 2. The remaining subjects were excluded from further follow-up.

The work of Calkins et al. (1996) and Rubin (1993) suggests that the dependent variables used in cohorts 1 and 2 are valid indices of inhibition. No subjects were psychiatrically ill at original selection.

Adolescent Assessment

Direct observational data were gathered on 77 of 79 subjects. Two girls—one inhibited and one uninhibited—declined to participate in the assessment during which direct observational data were gathered. The number of spontaneous comments made by one subject during the battery could not be coded from the videotape because of a technical failure. Thus the data on this variable are based on 76 subjects. The frequency of spontaneous smiles and comments made during the 1-hour psychophysiology battery was coded from videotapes by a coder who was also blind to the child's temperamental type and early behavior. A spontaneous comment was a remark that was not in response to the examiner's questions or explanations. The interrater reliability for coding of spontaneous smiles was 0.90; for spontaneous comments it was 0.89.

The laboratory battery consisted of the following procedures. The subject was greeted by a female examiner (the same for all subjects). The battery was explained to the subject, who was then asked to empty his/her bladder in a rest room in preparation for a urine collection at the end of the battery. The subject was then instructed in the placement of electrodes for recording of heart rate. Baseline heart rate and blood pressure measurements were made, both sitting and standing. The subject then completed a timed pencil-and-paper task in which the subject connects sequentially numbered circles and letters, followed by a standardized testing of fine motor coordination (hand steadiness), a modified Stroop Interference task (Schwartz et al., 1996), a test of word recall, another standardized test of fine motor coordination (grooved pegboard), repeated measurements of heart rate and blood pressure sitting and standing, reading of words from the prior Stroop task, a handwriting sample, and completion of a questionnaire.

Interview

Seventy-four subjects were interviewed directly. Thus, 5 subjects (3 inhibited and 2 uninhibited) who completed the battery during which the direct observational data were gathered—the first of the 2 assessment sessions—did not participate in the interview. Of these 5 subjects, 2 inhibited subjects and 1 uninhibited subject refused the interview; 1 moved out of state and 1 could not be contacted. As noted earlier, each adolescent subject was interviewed by the senior author using modules from a semistructured lifetime psychiatric interview (Kentgen et al., 1997; Klein et al., 1991) adapted from the Diagnostic Interview Schedule for Children (Shaffer et al., 1989), designed to assess 4 domains of past and current anxiety symptoms: specific fears, separation anxiety, performance anxiety, and generalized social anxiety. Interrater reliability was computed using κ : specific fears, $\kappa = 1.0$; separation anxiety, $\kappa = 0.71$; performance anxiety, $\kappa = 0.75$; generalized social anxiety, $\kappa = 0.80$. The interviewer was blind to the child's original temperamental classification in the second year as well as all earlier behaviors.

The specific fears included heights or high places; thunderstorms; water; bugs; animals; darkness; tunnels, bridges, or highways; crowded places; cars, buses, trains, or planes; elevators; doctors; dentists; or small, closed spaces. Separation anxiety includes persistent and unrealistic worry about possible harm befalling major attachment figures or fear that they will leave and not return; unrealistic and persistent worry that an untoward calamitous event will separate the child from a major attachment figure; reluctance or refusal to go

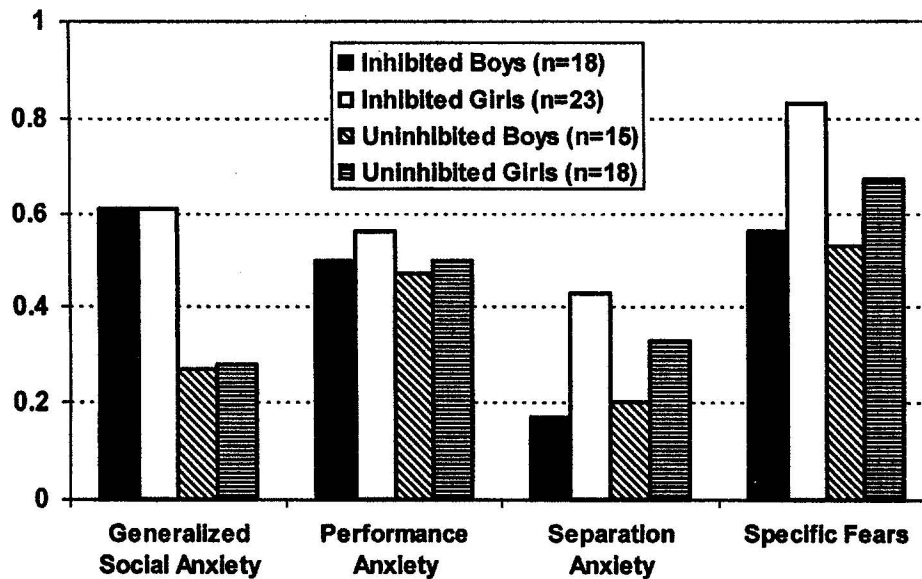


Fig. 1 Proportion of adolescent subjects with current anxiety by temperament and sex at age 2 years.

to sleep without being near an attachment figure or to sleep away from home; persistent avoidance of being alone, including "clinging" and "shadowing" major attachment figures; repeated nightmares involving the theme of separation; recurrent signs or complaints of excessive distress in anticipation of separation from home or major attachment figures; or recurrent signs or complaints of excessive distress when separated from home or major attachment figures. Performance anxiety includes worries and fears about speaking or performing in front of others, especially in school settings. Generalized social anxiety refers to extreme shyness, feeling nervous and uncomfortable around unfamiliar people, feeling apprehensive when being looked at or noticed, being worried about meeting new people, watching rather than participating in activities with others, experiencing difficulty in making new friends, being reluctant to ask directions or help from others, and being nervous about going to social gatherings, such as birthday parties.

Statistical Analyses

Contingency tables were used to examine the relation between temperamental classification in the second year of life and current fears and impairment. The χ^2 and Fisher exact tests were used where appropriate because of small cell size.

Unless indicated, all results are reported as significant when $p < .05$ (2-tailed). Analysis of variance (ANOVA) was used to examine the relation between the original temperamental categories, on the one hand, and the number of spontaneous comments and smiles, on the other. The relation between current fears and spontaneous comments and smiles was examined using contingency tables. Subjects were divided by gender into those with smile and comment scores above or below the median.

RESULTS

Psychiatric Interview

Figure 1 reveals that the adolescents formerly classified as inhibited or uninhibited did not differ with respect to

the presence of current specific fears (boys, $\chi^2_1 = 0.02$; girls, $\chi^2_1 = 1.4$), separation anxiety (boys, $\chi^2_1 = 0.06$; girls, $\chi^2_1 = 0.4$), or performance anxiety (boys, $\chi^2_1 = 0.04$; girls, $\chi^2_1 = 0.17$).

However, the 2 temperamental groups did differ in the frequency of social anxiety. More inhibited than uninhibited adolescents had current generalized social anxiety (boys, $\chi^2_1 = 3.9$, $p = .05$; girls, $\chi^2_1 = 4.4$, $p = .04$) (Fig. 1). The pattern of the results in both cohorts was similar.

Sixty-one percent of the adolescents who had been inhibited as toddlers had current social anxiety, compared with 27% of the subjects who had been uninhibited, a greater than 2-fold increase. Only 20% of those who had been inhibited reported *never* having generalized social anxiety, compared with 48% of the uninhibited adolescents. When the threshold is raised to require definite impairment in the subject's normal routine, academic functioning, or social activities, 44% (10/23) of female adolescents who were inhibited as toddlers were impaired to a major degree by generalized social anxiety, compared with only 6% (1/18) of females who had been uninhibited (Fisher exact test, $p = .01$). Twenty-two percent (4/18) of males who were inhibited as toddlers were impaired by generalized social anxiety, compared with 13% (2/15) of males who had been uninhibited in the second year of life (Fisher exact test, not significant).

More adolescent girls than boys had current separation fears, regardless of their original temperament ($\chi^2_1 = 3.8$, $p = .05$). A similar trend was seen for current

specific fears ($\chi^2_1 = 3.6, p = .06$), but no sex differences occurred for social or performance anxiety.

Many adolescents who reported social anxiety also reported other fears. Among the 34 adolescent subjects with current generalized social anxiety, 22 (65%) also had performance anxiety, 15 (44%) had current separation fears, and 24 (71%) had current specific fears. Because of this co-occurrence between social anxiety and the 3 other types of fears, we sought to test the specificity of the observed association between an inhibited temperament in the second year and social anxiety at adolescence. We created an aggregate index for the 3 other fears; a subject received a score of 1 or 0 depending on whether the subject had or did not have each type currently. The sum of these scores was computed for each subject. Thus the aggregate index ranged from 0 if the subject had neither separation anxiety, specific fears, nor performance anxiety, to a value of 3 if the subject currently had all 3 types of fears. An ANOVA revealed no relation between the aggregate index and temperamental group, supporting the specificity of the observed association between temperament and social anxiety.

Direct Observation of Behavior: Spontaneous Smiles and Comments

The adolescents who had been categorized as inhibited in the second year smiled fewer times when interacting with the examiner than those who had been uninhibited ($F_{1,76} = 3.84, p = .05$) (Table 1). Furthermore, girls, both inhibited and uninhibited, smiled more than boys ($F_{1,76} = 16.1, p < .001$), but there was no significant temperament group by sex interaction. There was no main effect for temperament, sex, or any temperament by sex interaction for spontaneous comments (Table 1). However, a one-tailed t test did support our strong prior hypothesis, based on observation of these subjects at age 2, that adolescents who had been inhibited made fewer spontaneous

comments than those who had been categorized as uninhibited ($t = 1.65, p = .05$). This effect was mediated primarily by the girls.

Relation Between Interview and Direct Observation

The confidence in an association between an inhibited temperament during childhood and social anxiety at adolescence is supported by the positive relation between current social fears ascertained by interview and the frequency of spontaneous comments. Adolescents of both sexes who had generalized social anxiety made fewer spontaneous comments to the examiner than those without current generalized social anxiety (boys, $\chi^2_1 = 8.9, p = .003$; girls, $\chi^2_1 = 5.2, p = .02$). This relation also occurred in adolescent girls with performance anxiety ($\chi^2_1 = 5.2, p = .02$). There was no relation between any other type of fear and the number of spontaneous comments.

We examined those cases in which the child's early temperament did not predict the expected adolescent profile. Four boys who had current generalized social anxiety had been uninhibited in the second year. Three of these 4 boys displayed infrequent spontaneous comments and smiles, a pattern typically observed in inhibited adolescents and consistent with social anxiety. Two of these 4 boys did not smile *once* during the entire laboratory battery (the mean number of smiles for uninhibited boys was 14.3). These 2 boys made only 3 and 6 spontaneous comments, respectively, compared with a mean of 26.3 for all uninhibited boys. Similarly, 4 of the 5 girls who had been uninhibited as children but had current social anxiety also displayed infrequent smiles and comments. Thus the classification according to the interview was in accord with the subject's actual behavior in the laboratory.

DISCUSSION

The interview *and* behavioral data indicate that important aspects of the original inhibited temperamental profile were preserved over a 12-year interval, from the second year to early adolescence. The information from the interview suggests specificity in the association between an inhibited temperament during the toddler period and later social anxiety. Possession of an inhibited temperament in the second year predisposed the adolescent to developing social anxiety, whereas an uninhibited temperament seemed to protect the adolescent from

TABLE 1
Spontaneous Smiles and Comments Made During Laboratory Battery

	Smiles		Comments	
	Mean	SD	Mean	SD
Inhibited girls	26.0	17.6	16.6	15.1
Inhibited boys	12.7	10.1	23.9	26.2
Uninhibited girls	43.1	37.9	30.9	29.9
Uninhibited boys	14.3	11.1	26.3	18.0

social anxiety. The association was significant only for generalized social anxiety and not for specific fears, separation anxiety, or performance anxiety. Furthermore, adolescents who had been inhibited as children smiled less and made fewer spontaneous comments than those who had been uninhibited, as was true in the second year of life. In addition, adolescents with current social anxiety made fewer spontaneous comments to the examiner than those without current social anxiety, supporting the validity of the interview findings. It is unusual for longitudinal studies to incorporate behavioral data from direct observation together with interview data, and we encourage others to explore these paradigms.

That inhibition was a better predictor of generalized social anxiety than of specific fears is in accord with recent research on fear in animals. Evidence suggests that the neural circuits that mediate a fear reaction to a specific conditioned stimulus that had been associated with electric shock are different from those circuits that mediate a fear reaction to the context in which the shock was delivered (Davis et al., 1995; Phillips and LeDoux, 1992). Generalized social anxiety might be thought of as reflecting a fear of an unfamiliar context rather than fear of a specific person or object. In addition, the most recent review of anxiety disorders suggests that psychologists and psychiatrists are arriving at a consensus that the various categories of anxiety are genetically heterogeneous (Mineka et al., 1998).

Our results are consistent with those of previous studies that have linked behavioral inhibition to anxiety problems in earlier childhood (Biederman et al., 1990; Hirshfeld et al., 1992). Our findings stand in contrast to those of Caspi et al. (1996), who did not find that inhibited children were at increased risk for anxiety disorders at 21 years, but they are in accord with those of Caspi and Silva (1995), who found that subjects who had been inhibited at age 3 were lacking in social potency at age 18. However, Caspi's inhibited subjects were classified at 36 months rather than at 21 or 31 months, as in the present study. In addition, Caspi's study treated the temperamental classification of inhibition as a continuum and may have included children who were less extreme in inhibition. Such a strategy may have included some children who were shy for reasons not related to temperament. It is also possible that the developmental outcome of an inhibited temperament may be quite different at early adolescence and early adulthood. Further follow-

up of the subjects in the present study will help clarify these questions.

The findings in our study should be viewed in light of their methodological limitations. Because more uninhibited than inhibited subjects were lost to follow-up over the 11-year period, our results may be biased in some unknown way. Inasmuch as our sample size is relatively small, we present these results uncorrected for multiple comparisons. These results should be replicated, although it will be difficult to do so because of the labor-intensive nature of direct behavioral observation necessary for the original temperamental categorization and the long period of follow-up. We recognize that these results, restricted as they are to middle-class white subjects, may not be generalizable to other populations and encourage investigators to explore these factors in other ethnic and socioeconomic groups.

Clinical and Research Implications

These data suggest that adolescent girls who were inhibited in the second year are more vulnerable to developing a major impairment of their functioning due to generalized social anxiety than adolescent boys with a similar temperament. This sex difference in outcome might have a biological component, or it might be due to differential socialization of boys and girls. Inhibited boys may receive more direct and subliminal help and pressure to overcome early inhibition than do girls.

These data probe the borders of temperament, personality, and psychopathology and raise important questions for future research. Thirty-four percent of adolescents, boys and girls, who were originally classified as inhibited were definitely impaired by generalized social anxiety as adolescents, as contrasted with 9% of those classified as uninhibited, suggesting that temperament is indeed an important risk factor. Sixty-six percent of inhibited toddlers, however, did not develop severe social anxiety, indicating that environmental and nongenetic familial factors play a major role in risk and resilience. It is hoped that better characterization of these factors will allow for earlier preventive interventions. Interestingly, the only twin study of social phobia in adults (Kendler et al., 1992) indicates that environmental factors accounted for twice the liability for the disorder as did genetic factors.

In this study, we chose to analyze separately the relationship between an inhibited temperament in childhood and performance anxiety on the one hand, and

generalized social anxiety on the other. In *DSM-IV* both types of fears are subsumed under the rubric of *social phobia*, also referred to as *social anxiety disorder*. The subtyping of social phobia has been controversial and remains an unsettled clinical and nosological issue. Performance-oriented situations (e.g., public speaking) involve behavior or activities that are subject to observation or scrutiny by others; the individual can comfortably perform these activities alone but experiences anxiety if others are present (Stein, 1995). Generalized social anxiety involves interactional social situations (e.g., meeting new people) or anticipation of the same. To further complicate matters, avoidant disorder of childhood in *DSM-III-R* involves excessive and persistent shrinking from contact with unfamiliar people. Beidel (1991) and Francis et al. (1992) found children with avoidant disorder and social phobia were not distinguishable in terms of measures of fear and anxiety and suggested that avoidant disorder be viewed as a type of social phobia. In *DSM-IV* avoidant disorder of childhood is nowhere to be found and has been implicitly absorbed into social phobia.

A factor analysis of anxiety in a population sample of children and adolescents (March et al., 1997) found that humiliation/rejection fears and performance anxiety comprise separate elements of the broader construct of social anxiety and that both factors were dimensionally distributed in the population. Epidemiological studies have suggested that anxiety about public speaking is much more prevalent than other types of social anxiety (Stein et al., 1994).

On the basis of this review of the clinical and research literature, we thought it reasonable that generalized social anxiety and performance anxiety might be distinct entities with distinct developmental determinants, and a priori decided to analyze separately the relationship between early inhibited temperament and these 2 outcomes; we found a significant relationship for the former but not for the latter. Furthermore, a post hoc analysis that combined performance anxiety and generalized social anxiety revealed no significant relationship between the combined anxiety category and early temperament. Thus, our study provides additional evidence for regarding generalized social anxiety and performance anxiety as distinct psychological entities and may support a nosological distinction between the two in future diagnostic schema. Future high-risk, intervention, and

treatment studies for social anxiety should take care to distinguish between these subtypes.

In summary, these data provide evidence for a psychological predisposition for uncertainty to unfamiliar social events, rooted in early childhood and persisting into adolescence.

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Dose-Response Effect of Fetal Cocaine Exposure on Newborn Neurologic Function. Claudia A. Chiriboga, MD, MPH, John C.M. Brust, MD, David Bateman, MD, W. Allen Hauser, MD

Background: Studies of fetal cocaine exposure and newborn neurologic function have obtained conflicting results. Although some studies identify abnormalities, others find no differences between cocaine-exposed and cocaine-unexposed infants. To determine the effects of prenatal cocaine exposure on intrauterine growth and neurologic function in infants, we prospectively evaluated 253 infants shortly after birth. **Methods:** Women who delivered a live singleton >36 weeks by dates were eligible for enrollment. Maternal exclusionary criteria were known parenteral drug use, alcoholism, and acquired immunodeficiency syndrome; infant exclusionary criteria were Apgar scores ≤ 4 at 5 minutes, obvious congenital malformations, seizures, or strokes. A total of 98% of infants were evaluated between 1 to 7 days of age. Newborns were assessed with the *Neurological Examination for Children* (NEC) by a pediatric neurologist (C.A.C.) who was blinded to exposure status. Gestational age was determined by Ballard's examination. Cocaine exposure was determined for the last trimester by radioimmunoassay of maternal hair (RIAH). Exposure values ranged from 2 to 4457 ng/10 mg hair. Infants were excluded if a maternal hair sample was missing ($N = 13$). The sample comprises 240 woman and infant pairs—104 cocaine-exposed and 136 cocaine-unexposed. **Results:** Compared with unexposed controls, cocaine-exposed infants exhibited higher rates of intrauterine growth retardation (24% vs 8%), small head circumference ([HC] <10th% percentile) (20% vs 5%) and neurologic abnormalities: global hypertonia (32% vs 11%), coarse tremor (40% vs 15%), and extensor leg posture (20% vs 4%). We found increasing odds (odds ratio) of growth and neurologic impairment with increasing level of cocaine exposure in stratified analyses. The odds ratio associated with three levels of cocaine exposure (no exposure, low exposure = RIAH 2-66 ng/mg; and high exposure = RIAH 81-4457 ng/mg) respectively are: 1.0, 3.3, and 6.1 for small head size (χ^2 for trend); 1.0, 3.3, and 4.3 for global hypertonia (χ^2 for trend); 1.0, 3.4, and 7.4 for extensor leg posturing (χ^2 for trend); and 1.0, 3.8, and 3.8 for coarse tremor (χ^2 for trend). Significant associations between cocaine exposure and neurologic signs were found in logistic regression equations that controlled for 20 or more variables. **Conclusion:** We conclude that adverse neonatal effects associated with fetal cocaine exposure follow a dose-response relationship: newborns with higher levels of prenatal cocaine exposure show higher rates of impairments in fetal head growth and abnormalities of muscle tone, movements, and posture. Significant relationships between cocaine exposure and these outcomes remain in controlled analyses. *Pediatrics* 1999;103:79-85. Reproduced by permission of *Pediatrics*, copyright 1999.