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# Screening for Adolescent Panic Disorder in Pediatrics Settings

Alexander Harrison Queen

*University of Miami*, [aqueen@psy.miami.edu](mailto:aqueen@psy.miami.edu)

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UNIVERSITY OF MIAMI

SCREENING FOR ADOLESCENT PANIC DISORDER  
IN PEDIATRICS SETTINGS

By

Alexander Harrison Queen

A THESIS

Submitted to the Faculty  
of the University of Miami  
in partial fulfillment of the requirements for  
the degree of Master of Science

Coral Gables, Florida

December 2010

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IN PEDIATRICS SETTINGS

Alexander Harrison Queen

Approved:

---

Jill Ehrenreich May, Ph.D.  
Assistant Professor of Psychology

---

Terry A. Scandura, Ph.D.  
Dean of the Graduate School

---

Annette M. La Greca, Ph.D.  
Professor of Psychology and Pediatrics

---

Craig Marker, Ph.D.  
Clinical Assistant Professor of Psychology

---

Eugene R. Hershorin, M.D.  
Associate Professor of Clinical Pediatrics

QUEEN, ALEXANDER HARRISON

(M.S., Psychology)  
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Screening for Adolescent Panic Disorder  
in Pediatrics Settings

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Thesis supervised by Assistant Professor Jill Ehrenreich May  
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Although the prevalence rate of panic disorder (PD) among adolescents is relatively low, epidemiological research suggests that panic attacks and subclinical panic disorder symptoms occur in a substantial portion of the adolescent population. Retrospective and prospective studies also suggest that adolescence is a critical developmental period for the onset of PD symptoms. Given the negative academic, social, and emotional outcomes associated with undetected and untreated PD, effective prevention and intervention are warranted. Identifying adolescents with current PD or who may be at-risk for future PD is an important step in such treatment efforts. Among professionals working with youth, physicians and medical staff may be at a particularly advantageous position to screen for adolescent panic symptoms, given the high utilization of medical services among those experiencing such PD symptoms. Although limited time and resources within primary care settings frequently hinder effective mental health screening procedures, the use of time- and cost-effective screening instruments may aid professionals in detection efforts. With this in mind, the current study sought to validate a brief screening tool previously studied with adults for use with adolescents seen at pediatrics primary care practices. The screening instrument was evaluated both in terms of its ability to effectively detect adolescents with PD and in terms of the association

between positive screen status and cognitive, symptom, and broader impairment variables associated with PD.

Participants included 165 adolescents (57% male) ages 12 to 17 ( $M = 14.40$ ;  $SD = 1.77$ ) recruited from two general pediatrics clinics in Miami-Dade County, Florida. The sample was 42.3% White, Non-Hispanic, 41.1% Hispanic, 7.9% Black (African-American and Caribbean American), 1.2% Asian American, 7.4% mixed ethnicity or other, and 1.2% unknown. At Time 1, while in the waiting room of a pediatrics clinic, participants completed the *Autonomic Nervous System Questionnaire* (ANS; Stein et al., 1999), a five-item screening measure of panic symptoms. Of this larger sample, 45 participants (25 screening positive for potential panic disorder and 20 with negative screens, matched by age and gender to the positive screen group) completed telephone-administered follow-up measures at Time 2. Follow-up measures included a more comprehensive diagnostic assessment of PD and agoraphobia, as well as adolescent-report measures of anxiety sensitivity, interpretive biases, overall anxiety and depression, and functional impairment.

At Time 1, 65 participants (39.4%) screened positive on the ANS, as indicated by endorsing the first and/or second item on the measure. Of those screening positive, roughly one-third of participants (33.84% of positive screens) endorsed moderate to severe anticipatory anxiety about future panic attacks. The ANS displayed excellent sensitivity ( $Se = 1.00$ ), with two participants from the positive screen group meeting criteria for PD, and no control participants meeting criteria. However, as expected, specificity of the ANS was lower ( $Sp = .43$ ), indicating a high degree of false positives

(e.g., those screening positive but not meeting criteria for PD). In addition, as hypothesized, the ANS demonstrated good test-retest reliability ( $r = .74$ ).

Independent samples  $t$ -tests revealed that positive screen participants had significantly higher self-reported anxiety sensitivity, interpretive biases, anxious and depressive symptoms (including panic), and functional impairment than negative screen participants. This difference remained significant for overall symptom  $T$ -scores on the Revised Child Anxiety and Depression Scales (RCADS; Chorpita et al., 2000), even after controlling for group differences in anxiety sensitivity and interpretive biases. Finally, further analyses revealed that participants endorsing both starter items on the ANS ( $n = 7$ ) had higher elevations on self-reported anxiety sensitivity and panic symptoms, compared to those not endorsing either item or those endorsing the first item (e.g., “*In the past six months, did you ever have a spell or an attack when all of a sudden you felt frightened, anxious, or very uneasy?*”), but not higher than those endorsing only the second item (“*In the past six months, did you ever have a spell or attack when for no reason your heart suddenly began to race, you felt faint, or you couldn’t catch your breath?*”).

These findings offer preliminary validation for the ANS as a screening measure for PD in adolescence, given its high sensitivity and ability to adequately “catch” patients with PD (e.g., low false negative rate). Perhaps even more importantly, those screening positive on the ANS demonstrated higher scores on cognitive correlates of PD and elevated internalizing symptoms and functional impairment, compared to participants screening negative. Based on these analyses, current recommendations for physicians and medical staff are to monitor and follow-up with adolescents screening positive on the ANS for the development of anxiety and panic disorder symptoms, particularly among

those who endorse both starter items. However, given the relatively small sample size, replication of these findings in a larger sample is needed to further validate these recommendations. Finally, implications for prevention and intervention within pediatrics settings are discussed.



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## CHAPTER 1: INTRODUCTION

According to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (*DSM-IV-TR*; American Psychiatric Association, 2000), panic disorder (PD) is defined as recurrent panic attacks accompanied by at least one month of anticipatory worry of future panic attacks. Panic attacks are periods of acute anxiety, usually lasting less than 30 minutes, that involve physiological sensations (e.g., racing heart, dizziness), as well as emotional and cognitive symptoms (e.g., fears of going crazy or dying, feeling detached from one's body). Full symptom panic attacks, as specified in the *DSM-IV-TR*, are characterized by four or more symptoms (American Psychiatric Association, 2000). Panic attacks with fewer than four symptoms are termed limited symptom panic attacks (American Psychiatric Association, 2000).

Panic attacks may be *cued*, in which the attacks only occur within the context of anxiety-provoking situations, such as speaking in public or being separated from caregivers. In contrast, *uncued* panic attacks are perceived as occurring spontaneously or “out of the blue,” although they are typically a response to an internal stimulus (e.g., a physiological sensation). For a diagnosis of PD, the individual must experience repeated, uncued panic attacks (American Psychiatric Association, 2000). Over time, uncued attacks may become associated with certain locations (e.g., elevators, crowded places), leading to eventual avoidance of these stimuli. This avoidance behavior, in response to fears of having panic attacks in these places, characterizes the condition of agoraphobia (American Psychiatric Association, 2000).

While initially conceptualized exclusively as a disorder of adulthood, evidence suggests that PD does occur in adolescence, and that this is an important developmental

period in the onset of PD (Von Koff, Eaton, & Keyl, 1985). Retrospective reports of adults with PD indicate that approximately 40% of adult sufferers reported that their panic symptoms began in mid- to late-adolescence (Moreau & Follet, 1993). In addition, epidemiological and prospective studies suggest the modal age of PD onset is in mid-to late-adolescence, typically after the age of 14 (Kearney et al., 1997; Kessler et al., 2005, Van Oort, Greaves-Lord, Verhulst, Ormel, & Huizink, 2009).

In regards to age differences, PD appears to be quite rare before mid-adolescence (Ollendick, Mattis, & King, 1994). Although younger children are believed to be capable of experiencing panic symptoms, some (e.g., Nelles & Barlow, 1988) have theorized that the cognitive ability to anticipate future attacks does not develop until adolescence. In addition to age differences, gender differences in PD also begin during adolescence (Eaton, Kessler, Wittchen, & Magee, 1994). There are higher rates of PD observed among adolescent females as compared to males (Eaton, Dryman, & Weissman, 1991; Kearney et al., 1997; Thyer, Parrish, Curtis, Nesse, & Cameron, 1985; Wittchen, 1986). Epidemiological evidence suggests that PD is over twice as prevalent among adolescent females compared to males, and this gender difference increases throughout adulthood (Eaton et al., 1994).

Since adolescence appears to be a critical developmental period in the onset of PD, the current study sought to validate a brief screener for panic symptoms, previously tested with adults, for use with adolescents seeking treatment in a general pediatrics setting. In addition, broader symptoms of psychopathology and cognitive correlates of PD were compared between patients screening positive and screening negative. As a result, this study provides information regarding the ability to briefly yet accurately

detect PD symptoms in adolescence, as well as the broader symptom profiles of adolescents screening positive for panic symptoms in a pediatrics clinic setting.

### **Epidemiology and Comorbidity**

Although the prevalence rate of clinically significant PD among community samples of adolescents is low (e.g., ~1%; Lewinsohn, Hops, Roberts, Seeley, & Andrews, 1993; Reed & Wittchen, 1998), research suggests that limited symptom panic attacks are a more common experience during adolescence. In studies involving community samples of high school students, 36% to 63% of adolescents reported experiencing at least one limited symptom panic attack in their lifetime (King, Gullone, Tonge, & Ollendick, 1993; King, Ollendick, Mattis, Young, & Tonge, 1996; Macaulay & Kleinknecht, 1989). The prevalence rate of full symptom panic attacks is lower, although is still estimated to occur in 2% to 18% of adolescents (Essau, Conradt, & Petermann, 1999; Hayward et al., 1997, 2000).

As with other forms of childhood psychopathology (Costello, Egger, & Angold, 2004), cases of PD are frequently comorbid with other disorders. Approximately 90% of adolescents with PD possess comorbid anxiety disorders (Alessi & Magen, 1988; Biederman et al., 1997; Costello et al., 2004; Essau et al., 1999). Epidemiological studies have found that many children and adolescents with PD have comorbid separation anxiety disorder, in particular (Doerfler et al., 2007; Masi, Favilla, Mucci, & Millepiedi, 2000). Importantly, late onset of separation anxiety disorder (SAD) may be a particularly potent predictor of PD (Doerfler, Toscano, & Connor, 2008). In a comparison study of youth with SAD without PD and youth with comorbid SAD and PD, Doerfler and colleagues (2008) found that the latter youth had a later age of SAD onset, more severe

psychopathology, and greater functional impairment than youth with SAD that did not have concurrent PD.

In addition to other anxiety disorders, comorbidity with major depressive disorder (MDD) and substance abuse is also high (Birmaher & Ollendick, 2004; Strauss et al., 2000). Youth with PD also exhibit comorbidity with non-internalizing disorders, including attention-deficit/hyperactivity disorder, oppositional defiant disorder, and bipolar disorder (Biederman et al., 1997; Last & Strauss, 1989; Ollendick et al., 2004; Ollendick & Pincus, 2008).

In addition to comorbidity with other disorders, adolescent and adult sufferers of PD experience significant interference across family, peer, and school domains (Birmaher & Ollendick, 2004; Moreau & Weissman, 1992; Ollendick, Birmaher, & Mattis, 2004; Ollendick & Pincus, 2008). Adolescents with PD are at increased risk for substance abuse and suicide in adulthood, compared to those without PD (Birmaher & Ollendick, 2004; Strauss et al., 2000; Weissman, Klerman, Markowitz, & Queller, 1989). Importantly, adults with PD whose disorder began before the age of 17 are at greatest risk for these adverse outcomes (Weissman et al., 1997). Given these potentially negative trajectories, identification of panic symptoms and their associated correlates in adolescence is a crucial step in crafting effective treatment approaches and prevention efforts.

### **Screening of Youth Panic Symptoms In Pediatrics Settings**

While accurate detection of symptoms is crucial for prevention and intervention, unfortunately, the majority of adolescents with panic do not seek psychological assessment or treatment for their symptoms (Essau et al., 1999, 2000; King et al., 1993;

Ollendick, 1995, 1998). In fact, there is an average latency of 12 years from the onset of PD symptoms until help is sought (Moreau & Follet, 1993). Although fears of stigma may partially drive reluctance to receive treatment, many adolescents and adults also believe their panic symptoms have underlying medical causes, given the intense physiological sensations associated with panic attack symptoms (Katerndahl & Realini, 1995; Katon & Roy-Byrne, 1989). Despite their reluctance to seek psychological treatment, adolescents with panic and their families often turn to medical providers for initial assistance in identifying and treating their panic-related concerns (Katerndahl & Realini, 1995; Katon & Roy-Bryne, 1989).

More generally, primary care settings are seen as the “gateway” for treatment of youth psychopathology. Families of children with psychological distress have been found to utilize outpatient primary care services 25% more frequently than families of children without psychological distress (Navon, Nelson, Pagano, & Murphy, 2001). Furthermore, approximately 50% of families of youth with psychological disorders seek initial treatment within primary care settings (Albrecht & Naugle, 2002), and the vast majority of psychiatric services result from primary care physicians’ referrals (Costello et al., 1988). Primary care clinics may be especially salient screening sites for adolescents with panic, as youth with PD are higher health care users compared to both controls and other youth psychiatric populations (Katerndahl & Realini, 1997). In addition, detection and treatment of psychological disorders has been found to reduce health care utilization in 90% of patients, resulting in an average 20% overall decrease in medical costs (Chiles, Lambert, & Hatch, 1999). Given the tendency of youth mental health problems to worsen over time (Bennett & Offord, 2001), early detection and intervention may be



crucial in significantly reducing health care expenses incurred by previously unidentified patients (Costello et al., 1988; Chiles et al., 1999).

However, despite the numerous social and economic benefits of effective mental health screening within primary care settings, adolescent panic symptoms typically go under-detected by physicians (Roy-Byrne et al., 1999; Roy-Byrne, Wagner, & Scraunfnagel, 2005). Physicians report a lack of sufficient time and resources for effective screening of mental health problems (Sices, Feudtner, McLaughlin, Drotar, & Williams, 2003). Furthermore, translating well-validated but time-consuming assessments of PD symptoms, such as the Anxiety Disorders Interview Schedule for the DSM-IV, Child Version (ADIS-IV-C/P; Albano & Silverman, 1996) and the Structured Clinical Interview for Panic-Agoraphobia (PAS; Shear et al., 2001), into practical use within medical settings presents additional challenges.

Despite these difficulties, screening measures can greatly improve accuracy in detection (Pagano, Cassidy, Little, Murphy, & Jellinek, 2000), particularly when they are brief, easy to administer, and simple to both score and interpret (Jellinek et al., 1999; Murphy et al., 1996). Standard recommendations are to follow-up with patients screening positive for mental health concerns with further diagnostic evaluation (Jellinek, Little, Murphy, & Pagano, 1995), resulting in a more efficient allocation of time and resources. Therefore, the validation of time-effective, targeted assessments of adolescent panic symptoms is warranted for use in medical settings.

Given these needs, the present study sought to validate a potentially cost-and time-effective self-report screener for PD among adolescent pediatrics patients. The screener chosen for the study was the Autonomic Nervous System Questionnaire (ANS;

Stein et al., 1999). The ANS was selected for its brevity, as well as prior validation among adult patients in primary care settings, thereby making it an ideal candidate as a screener for adolescents in pediatric primary care clinics (Stein et al., 1999). For purposes of validation, the ANS was evaluated in its ability to accurately “catch” patients meeting criteria for PD upon follow-up diagnostic evaluation.

In addition to basic validation of the ANS, comorbid internalizing symptoms, functional impairment, and cognitive correlates of panic were examined to compare the broader symptom profile of adolescents initially screening positive on the ANS from those screening negative. The two panic-related cognitive correlates chosen for this study were anxiety sensitivity and interpretive biases towards threat. These correlates were selected due to the significant volume of evidence supporting their relations with panic symptoms. In addition, given that anxiety sensitivity and interpretive biases are targeted in interventions for adolescent PD (Pincus, Ehrenreich, & Mattis, 2008), measuring these constructs among patients screening positive for PD symptoms can aid in identifying the appropriateness of such treatment targets for adolescents with PD and youth at-risk for PD.

### **Cognitive Correlates of Panic Disorder**

#### *Anxiety Sensitivity*

Anxiety sensitivity (AS) is defined as a heightened awareness of and responsiveness to anxiety-related somatic sensations (e.g., rapid heartbeat, trembling, etc.) and their associated consequences (Reiss & McNally, 1985; Reiss, Peterson, Gursky, & McNally, 1986). AS has been distinguished from trait anxiety (e.g., a general tendency to experience anxiety) and is cross-sectionally associated with panic symptoms

in adults (Ehlers, 1995; Maller & Reiss, 1992; Schmidt, Lerew, & Jackson, 1997) and non-referred adolescents (Calamari et al., 2001; Ginsburg & Drake, 2002; Hayward, Killen, Kraemer, & Taylor, 2000; Lau, Calamari, & Waraczynski, 1996; Weems, Hayward, Killen, & Taylor, 2002). In addition, AS has been concurrently associated with panic symptoms among clinical youth. Children and adolescents with PD have reported higher AS compared to controls (Ollendick, 1995), as well as to youth with other anxiety disorders (Kearney, Albano, Eisen, Allan, & Barlow, 1997).

Anxiety sensitivity has also been found to prospectively predict panic symptoms among adolescents in community and laboratory settings, even after controlling for trait anxiety (Calamari et al., 2001; Schmidt et al., 2010). For example, in a Schmidt et al. (2010) study following a large community sample of adolescents ( $n = 277$ ) for one year, baseline AS scores significantly predicted future panic symptoms, after controlling for baseline anxiety and depression levels. Similarly, biological challenge studies have found AS to predict fearful responses to voluntary hyperventilation among non-clinical adolescents (Leen-Feldner, Feldner, Bernstein, McCormick, & Zvolensky, 2005).

In regards to gender differences, evidence suggests adolescent females report higher levels of AS than males (Silverman, Goedhart, Barrett, & Turner, 2003; Walsh, Stewart, McLaughlin, & Comeau, 2004). This gender difference appears to be particularly pronounced in regards to fear of physical sensations of anxiety (Zvolensky, McNeil, Porter, & Stewart, 2001). Given the strong association between AS and panic symptoms (Calamari et al., 2001), gender differences in levels of AS may partially explain the higher rate of PD observed among adolescent females than males (Kearney et al., 1997; Thyer et al., 1985).

### *Interpretive Biases*

Kendall's (1985) cognitive theory of anxiety in children and adolescents posits that schemas involving themes of vulnerability and danger become over-activated among youth with pathological anxiety (for a review, see Muris & Field, 2008). When confronted with potentially threatening internal or external events, these schemas direct cognitive resources and attention to threat-relevant information in the surrounding environment. Such an attentional bias is characteristic of high anxiety sensitivity (Reiss & McNally, 1985). In addition to attentional biases, anxious youth also display a tendency to interpret ambiguous stimuli as threatening (i.e., an interpretation bias), as well as quickly retrieve danger-laden memories (i.e., a memory bias; Muris & Field, 2008).

Specific to PD, Clark's (1986) cognitive model of panic posits that individuals at-risk for panic are prone to make automatic misinterpretations about bodily sensations. Therefore, in PD, interpretation biases are focused on internal cues, as opposed to external situations. For example, an adolescent at-risk for panic may experience a rapid heartbeat and think, "I must be having a heart attack" or "I'm going crazy." As a result, the adolescent may eventually become hypervigilant to internal sensations as attention is shifted to detect signals of potential danger or threat at an accelerated rate. This hypervigilance leads to a vicious cycle in which cognitions interact with physical sensations to elicit panic attacks (Clark et al., 1997).

Although some (e.g., Nelles & Barlow, 1988) initially argued that youth lacked the cognitive development necessary to display such interpretational biases in response to internal cues, others (Mattis & Ollendick, 1997a) have found support for this cognitive

process among youth, including younger children. Mattis and Ollendick (1997a) assessed attributions for somatic symptoms of panic among a sample of third, sixth, and ninth graders. Although the majority of children endorsed internal, non-catastrophic attributions for panic symptoms (e.g., “I’d think I was worried about something”), a minority of participants at all three grade levels endorsed internal, catastrophic attributions (e.g., “I’d think that I must be dying”).

In addition, while limited, there is evidence that anxiety sensitivity and interpretive biases are interrelated and uniquely predictive of anxiety symptoms in children and adolescents. For example, in the study by Mattis and Ollendick (1997a), higher anxiety sensitivity scores predicted the tendency to make internal, catastrophic attributions about panic symptoms. Weems, Costa, Watts, Taylor and Cannon (2007) found that anxiety sensitivity and interpretation biases were significantly correlated with one another, and were found to uniquely predict anxiety symptoms among youth between ages six and 17 in separate regression analyses. However, the Weems et al. (2007) study only examined general anxiety symptoms, as opposed to panic symptoms more specifically. Therefore, it remains to be tested if anxiety sensitivity and interpretive biases are separately associated with self-reported panic symptoms among adolescents.

### **Current Study**

As noted, the current study sought to validate a brief screener for panic attacks and PD among adolescents (ages 12 to 17) receiving services at pediatric primary care clinics. In line with current practice recommendations for screening procedures within medical settings (Jellinek et al., 1995), the study was conducted in two waves. The first wave involved administering the screening instrument to adolescent patients while at the

waiting room at the clinic. The second wave involved following-up with those screening positive, as well as matched controls screening negative, with more comprehensive diagnostic interviews and self-report measures. Specific aims and hypotheses for this investigation are as follows:

**Specific Aim 1:** To determine the percentage of self-reported positive screens for PD symptoms among the full sample of adolescent pediatrics patients.

*Specific Aim 1, Hypothesis 1:* It was anticipated that approximately 30%-40% of patients would screen positive on the ANS, a rate comparable to that of self-reported limited symptom panic attacks found in community studies of adolescents (King et al., 1993; King et al., 1996).

**Specific Aim 2:** To test the sensitivity, specificity, and stability of the ANS in validating the ANS as a screener for PD among adolescents.

*Specific Aim 2, Hypothesis 1:* The ANS was expected to demonstrate high sensitivity (e.g., proportion of true positive cases correctly identified), based upon previous validation studies among adult patients, in which the ANS displayed excellent sensitivity (Stein et al., 1999).

*Specific Aim 2, Hypothesis 2:* The ANS was expected to demonstrate adequate, but lower specificity (e.g., proportion of true negative cases correctly identified), compared to its sensitivity.

*Specific Aim 2, Hypothesis 3:* The ANS was expected to demonstrate good test-retest reliability, although test-retest reliability data among adult patients was not reported in previous validation studies (Stein et al., 1999). This hypothesis, then, was based on research demonstrating that other well-validated self-report measures of adolescent PD

symptoms have shown good reliability (e.g., Panic Disorder Severity Scale for Adolescents; Shear et al., 1997).

**Specific Aim 3:** To compare the broader symptom profile and levels of panic disorder correlates between adolescent patients screening positive on the ANS and patients screening negative, including anxiety sensitivity, interpretive biases, internalizing symptoms, and functional impairment.

*Specific Aim 3, Hypothesis 1:* Participants initially screening positive on the ANS were expected to demonstrate significantly higher scores on the Childhood Anxiety Sensitivity Index (CASI; Silverman, Fleisig, Rabian, & Peterson, 1991) compared to controls matched by age and gender initially screening negative.

*Specific Aim 3, Hypothesis 2:* It was hypothesized that participants initially screening positive on the ANS would display significantly higher scores on the Children's Automatic Thoughts Scales (CATS; Schniering & Rapee, 2002), a measure of interpretive biases towards various threat cues.

*Specific Aim 3, Hypothesis 3:* Adolescents initially screening positive on the ANS were expected to have significantly higher scores on the Revised Child Anxiety and Depression Scales (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000), compared to those screening negative. The RCADS was selected as a measure of broader internalizing symptoms, including panic symptoms.

*Specific Aim 3, Hypothesis 4:* Participants initially screening positive on the ANS were hypothesized to have significantly higher scores on the Lifetime Interference Measure (LIM; Lyneham, Abbott, & Rapee, 2003) of anxiety-related functional impairment, compared to those screening negative.

## CHAPTER 2: METHOD

### Participants

Participants were 165 adolescent patients between the ages of 12 and 17 ( $M = 14.40$ ,  $SD = 1.77$ ) who were recruited from two pediatric primary care clinics in Miami-Dade County. Participants were 57% male ( $n = 94$ ) and 43% female ( $n = 71$ ). Inclusion criteria included written parental consent, written adolescent assent, and patient status at the pediatric clinic. Participants were eligible for the study regardless of reason for appointment (e.g., whether for well or sick visit). The sample was 42.3% White, Non-Hispanic ( $n = 69$ ), 41.1% Hispanic ( $n = 67$ ), 7.9% Black (African-American and Caribbean American;  $n = 13$ ), 1.2% Asian American ( $n = 2$ ), 7.4% mixed ethnicity or other ( $n = 12$ ), and 1.2% with unreported ethnicity information ( $n = 2$ ). Distributions of family incomes among participants reporting income ( $n = 81$ ; 49.09% of sample) are presented in Table 1. Distributions for parent-reported lifetime prevalence of youth psychopathology and asthma among the overall sample, as well as among screen positive and screen negative participants, are presented in Table 2.

Of the 165 participants who participated at Time 1, 117 (70.9%) consented to follow-up at Time 2. Those consenting to Time 2 did not differ from remaining participants on age,  $t(163) = .47$ ,  $p = ns$ , screen status,  $\chi^2(1) = .001$ ,  $p = ns$ , gender,  $\chi^2(1) = .05$ ,  $p = ns$ , ethnicity,  $\chi^2(5) = 6.31$ ,  $p = ns$ , or income,  $\chi^2(6) = 8.85$ ,  $p = ns$ . Of those consenting to Time 2, 45 (27.27% of total sample) completed follow-up measures to compare screen positive ( $n = 25$ ) and screen negative ( $n = 20$ ) participants. The subsample was 47.7% White non-Hispanic ( $n = 21$ ), 34.1% Hispanic ( $n = 15$ ), 9.1% Black ( $n = 4$ ), 2.3% Asian-American ( $n = 1$ ), and 6.8% mixed ethnicity or other ( $n = 3$ ),



with 4.3% ( $n = 1$ ) with unreported ethnicity. The average follow-up time from Time 1 to Time 2 was 43.13 days ( $SD = 46.53$ ). See Figure 1 for a flowchart of participant involvement at each time point.

Those completing follow-up measures ( $n = 45$ ) did not significantly differ from the remaining participants ( $n = 120$ ) on age,  $t(163) = 1.09, p = ns$ , gender,  $\chi^2(1) = 1.65, p = ns$ , ethnicity,  $\chi^2(5) = 2.24, p = ns$ , or income,  $\chi^2(6) = 11.86, p = ns$ . Furthermore, the two groups did not differ by parent-reported history of anxiety,  $\chi^2(1) = .31, p = ns$ , ADHD,  $\chi^2(1) = 1.95, p = ns$ , or depression,  $\chi^2(1) = .12, p = ns$ . The two groups did differ by screen status,  $\chi^2(1) = 6.77, p < .01$ , with a higher percentage of screen positive participants (55.56%) in the follow-up sample compared to the remaining sample (33.33%). However, this was expected, given the need to have comparably sized groups of screen positive and screen negative participants for follow-up analyses.

### **Procedure**

First, approval for this investigation was obtained from the University of Miami's Institutional Review Board (IRB). In conjunction with IRB approval, the medical director at each of two participating pediatrics clinics gave permission to recruit participants in the waiting room. All relevant cover letters, parental consent forms, adolescent assent forms, the adolescent survey, and a supplemental parent questionnaire were distributed to the staff at the clinics. The physicians and staff were briefed about the purpose of the study and consented for patients to participate.

At Time 1, eligible participants and their parent were approached by an undergraduate research assistant in the waiting room of the pediatrics clinic. The purpose of the study was explained, including assurance that participation was voluntary and

information was kept confidential and separate from the clinic's medical records.

Participants were told that if they completed the survey while in the waiting room, they would be entered into a drawing for a \$100 gift card. If they consented to follow-up at a later date, they would be entered into a second drawing for a \$100 gift card.

Upon reading about the purpose and procedures of the study, parents were given the option to consent to their child's involvement in one or both of two phases: first, to complete the initial self-report measure, and second, to allow their adolescent to be contacted for a follow-up telephone assessment at a later date (e.g., within 1 month of initial screening) to complete additional measures. A similar procedure was used to obtain adolescent assent. If both parental consent and adolescent assent were obtained for the first wave of the study, adolescents completed the initial self-report measure, while parents completed a supplemental questionnaire described below. Upon completing all relevant forms, the participants placed all materials in the sealed envelope provided and returned the envelope to the front desk to be placed in a locked box for pick-up by study team members.

If both parental consent and adolescent assent were obtained for the second wave of the study, participants were eligible for follow-up telephone assessments at Time 2. Every attempt was made to contact eligible participants within one month of completion of the self-report measure at Time 1. During the telephone assessments, a subsample of participants screening positive for panic symptoms were administered diagnostic semi-structured interviews for PD and agoraphobia, as well as self-report measures of anxiety and mood disorder symptoms and evidenced correlates of panic. In addition, a subsample of adolescents screening negative for panic symptoms were administered the

same diagnostic interviews and measures, and were matched to screen positive participants based on age and gender. Given evidence for gender and developmental differences in panic symptom severity, this matching process attempted to control for potential confounding variables between groups (Thyer et al., 1985; Van Oort et al., 2009). Telephone assessments were conducted by either a doctoral student in clinical psychology or a trained, undergraduate research assistant. See Table 3 for a review of measures administered at Time 1 and at Time 2.

### Measures

**Autonomic Nervous System Questionnaire (ANS; Stein et al., 1999).** At both Time 1, the full sample ( $N = 165$ ), and at Time 2, the two subsamples of screen-positive ( $n = 25$ ) and screen-negative ( $n = 20$ ) participants completed the ANS. This is a brief, five-item self-report measure of panic symptoms within the previous six months. The ANS is frequently used among adults in primary care settings (for this and all additional measures, see Appendix A). Respondents are instructed to indicate either “Yes” or “No” to the first two prompts. The first prompt asks, *“In the past six months, did you ever have a spell or an attack when all of a sudden you felt frightened, anxious, or very uneasy?”* The second prompt asks, *“In the past six months, did you ever have a spell or an attack when for no reason your heart suddenly began to race, you felt faint, or you couldn’t catch your breath?”* If the respondent indicates “No” to both prompts, he or she is considered a negative screen and is instructed to stop. If the respondent answers “Yes” to either of the prompts, he or she is considered a positive screen and is instructed to answer the remaining three questions. The remaining items on the ANS assess the spontaneity of the panic attacks, the frequency of panic attacks in the past month, and anticipatory worry

about having a future panic attack (e.g., *not at all worried*, *somewhat worried*, or *very worried*). Given that the reading level of the measure appeared appropriate for adolescents, no changes were made to the questions.

Among a validation sample of adult patients in a primary care setting ( $N = 1476$ ), the ANS demonstrated excellent sensitivity (e.g., correctly detecting true-positive cases) but poorer specificity (e.g., correctly detecting true-negative cases; Stein et al., 1999). In this adult sample, the ANS displayed an average sensitivity (Se) value = .97 and average specificity (Sp) value = .36 (Stein et al., 1999). Sensitivity, specificity, and test-retest values for this adolescent sample are reported in the Results section.

**Supplemental Questionnaire.** At Time 1 only, parents completed a brief supplemental questionnaire assessing basic demographic information such as the adolescent's age, grade in school, and ethnicity, as well as the total family income. In addition, parents were asked if their child had ever received treatment for an anxiety disorder, and if their son or daughter had a current or past medical condition commonly associated with anxiety (e.g., asthma; Goodwin, Pine, & Hoven, 2003). Finally, parents were asked if their adolescent had ever been diagnosed or treated for a related psychological disorder, such as major depression, an eating disorder, or attention-deficit/hyperactivity disorder (ADHD). If so, parents were asked to indicate the relevant disorder and age of diagnosis.

**Anxiety Disorders Interview Schedule for DSM-IV-Child Report: Panic and Agoraphobia Modules** (ADIS-IV-C; Albano & Silverman, 1996). At Time 2 only, participants were administered the PD and Agoraphobia sections of the ADIS-IV-C. The ADIS-IV-C is a semi-structured diagnostic interview for children and adolescents ages

seven to 17 years that assesses all anxiety and mood disorders using criteria from the *DSM-IV*. This instrument is a downward extension of the Anxiety Disorders Interview Schedule for the DSM-IV (ADIS-IV; Brown, DiNardo, & Barlow, 1994), a well-established diagnostic interview used with adults. The PD module has an initial probe inquiring about lifetime prevalence of a spontaneous panic attack. If the respondent endorses this item, subsequent questions assess for spontaneity of the panic attack (e.g., ensuring attacks do not solely occur during anxiety-provoking stimuli), symptom prevalence and distress regarding panic attack symptoms (e.g., heart racing, beliefs of going crazy), as well as a one-month period of anticipatory worry of having future attacks. In line with *DSM-IV* criteria, the respondent must endorse four or more panic attack symptoms, report at least one-month period of anticipatory worry of future attacks, and indicate significant interference (e.g., a clinical severity rating of 4 or higher on a 0-8 scale) to receive a diagnosis of PD. The Agoraphobia module assesses if the adolescent currently avoids a range of places and situations (e.g., crowds, restaurants, movie theaters), as well as significant interference as a result of this avoidance. Although specific psychometrics for the PD module are unavailable, the ADIS-IV-C as a whole has demonstrated adequate test-retest reliability and has shown to be a reliable instrument of anxiety and mood diagnoses in children and adolescents (Silverman, Saavedra, & Pina, 2001). Self-report measures, treatment outcome data, and expert consensus have supported the construct, convergent, and predictive validities of the ADIS-IV-C (Silverman et al., 2001).

**Revised Child Anxiety and Depression Scales (RCADS;** Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000). At Time 2 only, adolescents were administered the

RCADS, a 47-item self-report measure adapted from the Spence Children's Anxiety Scale (SCAS; Spence, 1997, 1998), that has an additional 11-item depression scale, developed for children and adolescents ages eight to 18 years. The depression scale is modeled after well-validated self-report measures of depression (i.e., Children's Depression Inventory; Kovacs, 1985), and corresponds to *DSM-IV* criteria for major depressive disorder and dysthymic disorder for adolescents. The RCADS measures anxiety and depression on six distinct subscales: social phobia (SP), obsessive-compulsive disorder (OCD), panic disorder (PD), generalized anxiety disorder (GAD), separation anxiety disorder (SAD), and major depressive disorder (MDD). Each subscale has shown good internal consistency, with average Cronbach's  $\alpha = .77$  across subscales, with Cronbach's  $\alpha = .79$  for the PD subscale (Chorpita et al., 2000). The RCADS has demonstrated good reliability as well as sufficient construct, convergent, and divergent validity as a measure of adolescent anxiety and depressive symptomology (Chorpita et al., 2000).

**Children's Anxiety Sensitivity Index** (CASI; Silverman, Fleisig, Rabian, & Peterson, 1991). At Time 2 only, participants were administered the CASI, a downward extension of the Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986). The CASI is an 18-item self-report measure of anxiety sensitivity. Sample items include "It scares me when my heart beats fast" and "When I am afraid, I worry that I might be going crazy." Adolescents select the degree to which each statement corresponds to their experiences (*none, some, or a lot*). The CASI has demonstrated sufficient test-retest reliability ( $r = .79$ ), internal consistency (Cronbach's  $\alpha = .87$ ), and

validity, and it has shown to be a unique predictor of panic symptoms among adolescents, over and above trait anxiety (Chorpita, Albano, & Barlow, 1996; Silverman et al., 1991).

**Children's Automatic Thoughts Scales (CATS; Schniering & Rapee, 2002).** At Time 2 only, participants were administered the CATS, a 40-item self-report measure of children and adolescent's negative self-referent cognitions across internalizing and externalizing problems. Factor analyses have revealed loadings onto four main areas of cognitive content: physical threat, social threat, personal failure, and hostility. Sample items include "I'm going to have an accident," "Kids will think I'm stupid," and "It's my fault that things have gone wrong." Respondents are asked to indicate the frequency they have had each thought over the past week on a 5-point Likert scale from *not at all* to *all the time*. The CATS has demonstrated good internal consistency, with Cronbach's  $\alpha$  ranging from .82 to .92 across the four factors (Schniering & Rapee, 2002, 2004). The CATS has also demonstrated good discriminant validity in distinguishing between various childhood disorders. It is also considered to be more developmentally sensitive than other measures of cognitive biases in children and adolescents that are more or less downward extensions of adult measures (Schniering & Rapee, 2002).

**Lifetime Interference Measure (LIM; Lyneham, Abbott, & Rapee, 2003).** At Time 2 only, participants were administered the LIM. The LIM is a 31-item self-report measure assessing the frequency of various life interferences over the past month across a range of contexts (e.g., school, athletics, friends). Sample items include "I have missed or skipped school," "I have been left out of groups," and "I have stayed away from activities." Respondents indicate on a 5-point Likert scale the degree to which each

statement corresponds to them from *not at all* to *all the time*. Preliminary analyses suggest the LIM has high internal consistency ( $\alpha = .95$ ; Farrugia & Hudson, 2006).



## CHAPTER 3: RESULTS

Results from data from the full sample ( $N = 165$ ) were used to test the hypothesis from Specific Aim 1, while data collected from the follow-up sample ( $n = 45$ ) were used to test hypotheses related to Specific Aim 2 and Specific Aim 3. The percentage calculation of those screening positive on the ANS was used to test Specific Aim 1, while sensitivity, specificity, and test-retest reliability values were calculated to test hypotheses for Specific Aim 2. Independent samples  $t$ -tests were used to test hypotheses for Specific Aim 3. For Specific Aim 3, the average observed power across the dependent variables was 0.97, indicating high sensitivity to detect group effects.

### **Specific Aim 1: Determining the Frequency of Self-Reported Positive Screens for Panic Symptoms Among Adolescent Pediatrics Patients**

The percentage of those initially screening positive on the ANS was calculated to test Specific Aim 1, Hypothesis 1. At Time 1, 65 participants (39.4%) screened positive on the ANS, as indicated by a positive response to either of the first two items. This percentage was within the hypothesized range. Further analysis revealed that 34 participants (52.31% of positive screens) endorsed the first item only (e.g., “having a spell or attack when all of a sudden you felt frightened, anxious, or very uneasy”), 13 participants (20% of positive screens) endorsed the second item only (e.g., “having a spell or attack when for no reason your heart suddenly began to race, you felt faint, or you couldn’t catch your breath”), and 18 participants (27.69% of positive screens) endorsed both items. Of those screening positive, 46 participants (70.77% of positive screens) indicated that these attacks occurred outside of dangerous or embarrassing situations.

Among those screening positive, the majority of participants ( $n = 43$ ; 66.16% of positive screens) reported they were “not worried at all” about the recurrence of future panic attacks. However, a sub-sample of positive screens indicated moderate to severe anticipatory anxiety about future attacks: 18 participants (27.69% of positive screens) reported they were “somewhat worried” about the recurrence of these attacks in the past month, and a much smaller sub-sample ( $n = 4$ ; 6.15% of positive screens) reported they were “very worried” about the recurrence of these attacks.

An analysis among positive screens completing follow-up ( $n = 25$ ) revealed a similar breakdown of responses on the ANS: 10 (40% of follow-up positive screens) endorsed Item 1 only, 7 participants (28% of follow-up positive screens) endorsed Item 2 only, and 8 participants (32% of follow-up positive screens) endorsed both items. Additionally, 19 participants (76% of follow-up positive screens) reported they were “not worried at all” about the recurrence of attacks in the past month, while five participants (20% of follow-up positive screens) reported they were “somewhat worried” and one participant (4% of follow-up positive screens) indicated they were “very worried” about future attacks. The proportion of positive versus negative screens at Time 1, as well as a breakdown of positive screens, is represented in Figure 2.

### **Specific Aim 2: Determining the Sensitivity, Specificity, and Reliability of the ANS**

Specific Aim 2, Hypothesis 1 was that the ANS would evidence excellent sensitivity. Similar procedures to those carried out by Stein et al. (1999) were followed to determine the sensitivity (Se) and specificity (Sp) of the ANS in this sample. The sensitivity of the ANS was calculated by dividing the number of true positive cases (e.g., those screening positive at Time 1 and meeting criteria for PD at Time 2) by the number

of true positive and false negative cases (e.g., those screening negative and meeting criteria for PD). In this sample, two participants initially screening positive on the ANS at Time 1 met *DSM-IV-TR* criteria for PD at Time 2, one with and one without Agoraphobia ( $n = 2$ ; 1.21% of total sample). No participants initially screening negative on the ANS at Time 1 met diagnostic criteria for PD at Time 2. Therefore, as hypothesized, the ANS demonstrated high sensitivity among this adolescent sample ( $Se = 1.00$ ). The two participants meeting criteria for PD endorsed both starter items on the ANS, as well as indicated significant panic attack frequency (i.e., “2 to 3 times in the past month”) and worry (e.g., “somewhat or very worried”) on the fourth and fifth items of the ANS. In addition, both participants were 17 year-old females of White non-Hispanic ethnicity.

Specific Aim 2, Hypothesis 2 was that the ANS would demonstrate adequate but lower specificity, compared to the sensitivity. To test this hypothesis, the specificity ( $Sp$ ) of the ANS was calculated by dividing the number of true negative cases (e.g., those screening negative and not meeting criteria for PD;  $n = 20$ ) by the number of true negative and false positive cases (e.g., those screening positive who did not meet criteria for PD;  $n = 43$ ). Therefore, as hypothesized, the specificity of the ANS was lower than the sensitivity ( $Sp = .47$ ). However, only two of the false positive cases endorsed both high frequency and worry about future panic attacks on the ANS, with the remaining false positive cases reporting minimal frequency and anticipatory worry. Therefore, 50% ( $n = 2$ ) of those reporting both high frequency and worry about future attacks on the ANS met criteria for PD.

Finally, Specific Aim 2, Hypothesis 3 was tested by examining the test-retest reliability of the ANS. Reliability was calculated with the Pearson  $r$  correlation coefficient between participants' ANS score at Time 1 and ANS score at Time 2. As hypothesized, good test-retest reliability ( $r = .74$ ) was observed between ANS scores at Time 1 and those at Time 2.

### **Specific Aim 3: Examining Differences on Correlates of Panic Between Screen Positive and Screen Negative Participants**

All study variables at Time 2 were examined for normality and were found to be within acceptable limits (Skewness  $< 3$ , Kurtosis  $< 10$ ), and thus no transformations were made. There was no missing data for any study variables at Time 2. No significant gender differences in self-report were observed, although there was a trend towards significance concerning the Panic subscale of the RCADS, with girls reporting higher  $T$ -scores on this scale ( $M = 48.83$ ,  $SD = 13.62$ ) than boys ( $M = 43$ ;  $SD = 6.23$ ),  $t(31.42) = 1.85$ ,  $p = .07$ . No significant differences were found between those with differing ethnicities on any study variables at Time 2. Bivariate correlations among study variables are presented in Table 4.

Independent samples  $t$ -tests were conducted to determine group mean differences on CASI, CATS, LIM, and RCADS scores between participants initially screening positive on the ANS at Time 1 ( $n = 25$ ) and matched controls screening negative at Time 1 ( $n = 20$ ). Analyses revealed no significant age differences between screen positive ( $M = 14.76$ ,  $SD = 1.67$ ) and screen negative ( $M = 14.60$ ;  $SD = 2.01$ ) participants,  $t(43) = .29$ ,  $p = ns$ . There were also no significant differences between groups on gender,  $\chi^2(1) = .54$ ,  $p = ns$ , or ethnicity,  $\chi^2(4) = 5.54$ ,  $p = ns$ . Furthermore, there was no significant

difference in follow-up time from Time 1 to Time 2 between positive screen ( $M = 31.50$  days;  $SD = 40.89$ ) and negative screen ( $M = 46.58$  days;  $SD = 34.87$ ) participants,  $t(43) = 1.24, p = ns$ .

Specific Aim 3, Hypothesis 1 was that participants initially screening positive on the ANS would display higher mean CASI scores than participants screening negative. As hypothesized, those screening positive had significantly higher mean scores on the CASI than those screening negative,  $t(43) = 3.05, p < .01$ , with Cohen's  $d = .93$ , indicating a large effect.

Specific Aim 3, Hypothesis 2 was that participants screening positive on the ANS would display higher mean subscale scores on the CATS than participants screening negative. As hypothesized, those screening positive displayed higher mean scores on the Physical Threat subscale of the CATS,  $t(27.34) = 2.28, p < .05$ , Cohen's  $d = .65$  and on the Social Threat subscale of the CATS,  $t(30.38) = 2.77, p < .01$ , Cohen's  $d = .79$ .

Specific Aim 3, Hypothesis 3 was that screen positive participants would display higher mean  $T$ -scores on all RCADS subscales, compared to screen negative participants. To test this hypothesis, independent samples  $t$ -tests were conducted to examine differences between groups on each subscale of the RCADS. In line with the hypothesis, screen positive participants displayed higher mean  $T$ -scores on every anxiety disorder subscale of the RCADS, including the Separation Anxiety Disorder,  $t(33.19) = 3.02, p < .01$ , Cohen's  $d = .87$ , Generalized Anxiety Disorder,  $t(29.74) = 3.28, p < .01$ , Cohen's  $d = 1.23$ , Panic Disorder,  $t(27.22) = 4.72, p < .001$ , Cohen's  $d = 1.34$ , Social Phobia,  $t(34.51) = 3.88, p < .001$ , Cohen's  $d = 1.12$ , and Obsessive-Compulsive Disorder subscales,  $t(35.66) = 3.63, p = .001$ , Cohen's  $d = 1.05$ . Overall, screen positive

participants had higher RCADS Total Anxiety scores,  $t(30.40) = 4.46, p < .001$ , Cohen's  $d = 1.28$ . In addition to heightened anxiety scores, also as hypothesized, screen positive participants had higher mean Major Depressive Disorder  $T$ -scores,  $t(35.82) = 3.45, p = .001$ , Cohen's  $d = 1.00$ , as well as RCADS Total Scale scores,  $t(31.12) = 4.48, p < .001$ , Cohen's  $d = 1.29$ . The average effect size across RCADS subscales was Cohen's  $d = 1.15$ , indicating a large effect. However, it should be noted that all mean subscale  $T$ -scores, for both screen positive and screen negative participants, were below the suggested clinical cut-off score of 65 (Chorpita et al., 2000). Means, standard deviations, and  $t$ -test values between positive screens and negative screens are presented in Table 5.

In order to determine if differences in RCADS Total Scale  $T$ -scores were due to group differences on anxiety sensitivity and interpretive biases, a one-way analysis of covariance (ANCOVA) was conducted by entering CASI scores and scores from the Physical Threat and Social Threat subscales of the CATS as covariates. Analyses revealed a significant difference between groups on the Total Scale scores of the RCADS, after accounting for the effects of CASI and CATS-Physical Threat and CATS-Social Threat scores,  $F(1, 40) = 10.79, p < .01$ , partial  $\eta^2 = .21$ .

Finally, Specific Aim 3, Hypothesis 4 stated that participants screening positive would display higher mean LIM scores than participants screening negative. As hypothesized, participants in the positive screen group reported significantly higher levels of impairment, as evidenced by higher scores on the LIM, compared to negative screen participants,  $t(43) = 2.88, p < .01$ , with Cohen's  $d = .87$ , indicating a large effect.

After these preliminary analyses, further analyses were conducted to determine if there were significant differences in levels of internalizing symptoms and panic correlates

among participants endorsing both starter items on the ANS at Time 1 (e.g., Items 1 and 2), participants only endorsing Item 2, participants only endorsing Item 1, and participants endorsing neither starter item. Overall, there was a significant main effect on measures of internalizing symptoms, anxiety sensitivity, and interpretative biases.

Dunnett's *C* post-hoc analyses indicated that those who endorsed both items at Time 1 ( $n = 7$ ) had significantly higher scores on the CASI and the Panic, Total Anxiety, and Total Anxiety and Depression subscales of the RCADS than those who did not endorse either item at Time 1 ( $n = 20$ ) and those who only endorsed Item 1 ( $n = 9$ ), but did not significantly differ from those who only endorsed Item 2 ( $n = 9$ ). However, those who only endorsed Item 1 and those who only endorsed Item 2 did not significantly differ from one another on any variables. Strikingly, those who endorsed both starter items had mean Panic subscale scores ( $M = 64.57$ ;  $SD = 13.95$ ) near the clinical cut-off score of 65, whereas those only endorsing Item 2 ( $M = 46.78$ ;  $SD = 8.12$ ) and Item 1 ( $M = 45.22$ ;  $SD = 3.49$ ) had mean Panic subscale scores well below the clinical range.

## CHAPTER 4: DISCUSSION

The primary purpose of this study was to validate the ANS as a screening tool for panic symptoms among adolescents seen in pediatrics medical settings and to compare the symptom profiles of those screening positive and negative regarding common correlates of panic disorder. Results revealed that a significant portion of participants ( $n = 65$ ; 39.4% of total sample) initially screened positive on the ANS. However, few participants ( $n = 4$ ; 6.15% of positive screening) reported severe worry about the recurrence of attacks in the previous month. These results are consistent with hypotheses and with rates of limited symptom panic attacks found in larger community samples (King et al., 1993; King et al., 1996). Results indicated that the ANS has high sensitivity when used with adolescents in this medical setting, corresponding to a high proportion of true positives. As expected, the specificity of the ANS ( $Sp = 0.47$ ) was lower than the sensitivity ( $Se = 1.00$ ), demonstrating a simultaneously high proportion of false positives. Furthermore, as hypothesized, the test-retest reliability of the ANS was found to be good ( $r = .74$ ) in this sample.

Group differences on self-report measures of anxiety sensitivity, interpretive biases, functional impairment, and internalizing distress were also examined to evaluate the broader symptom profiles of positive and negative screen patients. In line with hypotheses, participants screening positive displayed significantly higher levels of anxiety sensitivity, interpretive biases regarding physical and social threat cues, functional impairment, and overall symptoms of anxiety and depression than participants screening negative. Importantly, the group effect on internalizing symptoms could not be accounted for by differences in anxiety sensitivity or interpretive biases, suggesting that elevations in internalizing symptoms in the screen positive group were not simply due to



higher levels of cognitive biases alone. Finally, further analyses revealed that those endorsing both starter items on the ANS possessed higher levels of self-reported panic symptoms and anxiety sensitivity than those only endorsing the first starter item on this questionnaire.

These results provide preliminary support for the ANS as a useful screening tool for panic symptoms with an adolescent population. The high sensitivity of the ANS indicates that adolescents with such panic symptoms are likely to screen positive using this measure. In other words, the ANS appears to adequately “catch” adolescents who currently have heightened panic symptoms, and the chance of false negatives (e.g., those who have PD screening negative) appears quite low. The sensitivity and specificity evidenced by the ANS in this adolescent sample closely matches values seen with adult patients (Stein et al., 1999). Moreover, these findings fit with the low overall prevalence rate of PD among adolescents (Lewinsohn et al., 1993), as well as the high rate of false positives noted with self-reports of panic attacks (Ollendick, 1998).

As noted by Stein and colleagues (1999), the cost of high sensitivity is often lowered specificity, as observed in using the ANS with this sample. In other words, while the ANS appears to correctly identify adolescents with PD, the high sensitivity comes with the “trade-off” of a high false positive rate (e.g., many of those screening positive do not have PD). However, this may not necessarily be a drawback within medical settings, particularly if the goal is to “flag” as many patients as possible that may be experiencing elevated levels of panic and other internalizing symptoms upon follow-up evaluation. This use of the ANS is supported by findings that patients screening positive on the ANS demonstrated an elevated symptom profile across multiple indices in

this study, as compared to those screening negative. Even among patients screening positive but not meeting criteria for PD (e.g., a false positive), a positive screen on the ANS may still warrant attention, given the observation of elevated scores across measures of panic correlates, other internalizing symptoms, and functional impairment. Therefore, despite the high false positive rate, physicians and other clinicians may still find the ANS to be a useful screener, both in terms of potentially elevated panic symptoms and other anxiety-related symptom profiles. The appeal of the ANS to physicians and other clinicians may be even greater when also considering its low cost and time of administration, given that lack of time and resources is a frequent physician-reported reason for insufficient mental health screening in primary care settings (Sices et al., 2003).

### **Limitations and Future Directions**

Although the current study advances the literature in several ways, it also has limitations. Upon initial examination, the relatively small sample size of participants in the follow-up analyses ( $n = 45$ ) seems a major limitation. The small sample size limited abilities to test moderation effects as well as estimate specificity calculations. However, despite the small sample size, the observed power was quite high (Power = 0.97), likely a result of the large effect sizes. Given these effect sizes, replication with larger samples may yield similar results, although this bears empirical testing. Furthermore, the use of a larger sample would allow for formal tests of moderation (e.g., gender, age, ethnicity).

An additional limitation is the sole use of adolescent self-report measures for panic symptoms and panic correlates in this investigation. The use of parent reports may have lowered the rate of false positives observed (Ollendick, 1998). Furthermore, it

would have been beneficial to corroborate the diagnosis of PD for the two participants with parent report. Additionally, it would be interesting to further examine the concordance between parent and child reports at the diagnostic level and symptom levels for PD, which has shown to be generally poor for other anxiety disorders (Comer & Kendall, 2004; Canavera, Wilkins, Pincus, & Ehrenreich-May, 2009; Grills & Ollendick, 2002).

Third, although other internalizing symptoms were assessed with the RCADS, due to time limitations, this study did not include interview-based diagnostic assessment of other internalizing and externalizing disorders beyond PD and Agoraphobia. Therefore, it was unclear if PD was the primary diagnosis for those meeting criteria, or if those not meeting criteria for PD or screening negative for panic met criteria for other disorders. However, given the strong validity properties of the RCADS (Chorpita et al., 2000), it is unlikely that those with low *T*-scores on the RCADS would meet criteria for the corresponding disorder. Nevertheless, future research could benefit by including a full diagnostic interview with youth and parents (e.g., ADIS-IV-C/P) to assess for other disorders beyond PD.

Finally, although the supplemental parent questionnaire assessed for past and current medical conditions possibly affecting anxiety, including asthma, reasons for the current visit to the clinic were not assessed. It is possible that adolescents frequently visiting the clinic for reasons consistent with symptoms of panic attacks (e.g., recent asthma attack, fears of having a heart attack) may be more likely to screen positive for panic and benefit from prevention efforts than those visiting for other reasons (e.g., vaccination, routine check-up). Furthermore, these parent-reported medical and

psychological histories were not corroborated with physicians' report. Future research could expound upon this study by examining if reason for clinic visit moderates the prevalence rate of self-reported panic attacks, as well as motivation for prevention or treatment.

Given these limitations, the following are preliminary recommendations to physicians and clinicians, and studies with larger samples should be conducted to confirm such recommendations. First, physicians should “flag” adolescents who endorse both starter items on the ANS, as these adolescents were found to have significantly higher anxiety sensitivity and panic symptom scores, compared to those only endorsing one starter item or none. Second, physicians may want to pay particular attention to adolescents screening positive who endorse moderate to severe frequency (i.e., Item 4) and significant anticipatory anxiety regarding future attacks (i.e., Item 5), given that the two participants screening positive and meeting criteria for PD endorsed both of these latter items on the ANS.

Although most individuals screening positive on the ANS did not meet criteria for PD, those screening positive may benefit from efforts geared toward prevention of future anxiety disorders. Indeed, emerging findings indicate primary care clinics may be viable settings for intervention and prevention efforts. For example, Weersing, Gonzalez, Campo and Lucas (2008) found preliminary efficacy for an eight-session, individual brief behavioral therapy (IBBT) administered in the pediatrics primary care context. This pilot study was conducted at a primary care clinic with 54 youth, ages seven to 17 years, exhibiting primary anxiety and depressive disorders. In addition to providing initial

efficacy data, Weersing et al. (2008) found positive attitudes towards conducting treatment within this primary care setting among parents, youth, and medical staff.

Although promising, none of the youth in the Weersing et al. (2008) study had PD, and thus future work is needed to generalize findings to youth with clinical and sub-threshold levels of PD. In terms of prevention, youth at-risk for PD may benefit from a condensed form of treatment drawing upon principles shown to be effective in Panic Control Treatment for Adolescents (PCT-A; Pincus et al., 2008). Such principles include psychoeducation about panic attacks, cognitive restructuring, and interoceptive exposures to allow adolescents to experience and accept the physical sensations of panic without catastrophizing or exacerbating the consequences of such experiences. Since those screening positive evidenced higher levels of risk factors targeted in these interventions, these principles may prove effective within the context of a prevention effort. Future research should investigate the efficacy and feasibility of implementing such prevention programming for PD within primary care settings.

### **Conclusions**

This study offers preliminary validation and support for the use of a time-effective screening measure for PD. Although the ANS has demonstrated high sensitivity and moderate specificity in adult samples (Stein et al., 1999), this was the first known study to test its utility during adolescence, which is a developmentally sensitive period for the onset of panic symptoms (Kearney et al., 1997; Moreau & Follet, 1993; Von Koff et al., 1985). Consistent with findings from adult samples (Stein et al., 1999), this study found high sensitivity and moderate specificity of the ANS when used with adolescents. Furthermore, the ANS demonstrated adequate test-retest reliability in this sample.

Therefore, physicians and clinicians seeking time-and cost-effective measures for adolescent PD should consider the ANS as a convenient yet valid and reliable screener.

Extending beyond basic validation of the ANS as a screener for PD, this study found that the ANS may detect those with heightened levels of common panic disorder correlates, as well as increased levels of other anxiety and depressive symptoms. This finding may broaden the applicability and appeal of the ANS to physicians and other clinicians, as preliminary evidence suggests those screening positive may exhibit anxiety symptoms that are more prevalent in adolescence than PD (e.g., social anxiety, generalized worry; American Psychiatric Association, 2000). In this vein, the ANS may function best as a “marker” for possible increased risk for panic and other internalizing symptoms, and physicians and clinicians may find it most useful for purposes of such monitoring and related prevention. Although replication with larger samples is recommended, this study offers exciting preliminary support for the use of the ANS in the detection and possible prevention of youth panic symptoms.

Table 1. Distributions of Family Incomes Among Participants Reporting Incomes ( $n = 81$ )

Annual Family Income	<i>N</i>	% Sample Reporting Income
\$100,000 or greater	28	34.57%
\$75,000 - \$99,999	11	13.58%
\$50,000 - \$74,999	16	19.75%
\$35,000 - \$49,999	11	13.58%
\$25,000 - \$34,999	7	8.64%
\$15,000 - \$24,999	3	3.70%
\$10,000 - \$14,999	2	2.47%
Below \$10,000	3	3.70%

Table 2. Distributions of Parent-Reported Lifetime Prevalence of Youth Psychopathology and Asthma

<b>Parent-Reported Psychopathology/Asthma</b>	<b>Overall Sample (<i>N</i> = 165)</b>	<b>Positive Screens (<i>n</i> = 65)</b>	<b>Negative Screens (<i>n</i> = 100)</b>
Anxiety Disorder	15 (9.1%)	10 (15.4%)	5 (5%)
Depression	9 (5.5%)	6 (9.2%)	3 (3%)
ADHD	26 (15.8%)	10 (15.4%)	16 (16%)
Learning Disorder	5 (3%)	2 (3.1%)	3 (3%)
Asthma	30 (18.2%)	14 (21.5%)	16 (16%)

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Table 3. Measures Administered at Time 1 and Time 2

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Time 1	Time 2
Autonomic Nervous System Questionnaire (ANS)	Autonomic Nervous System Questionnaire (ANS)
Parental Informed Consent Form	ADIS-IV-C: Panic Disorder/Agoraphobia
Adolescent Informed Assent Form	Revised Child Anxiety and Depression
Supplemental Parent Questionnaire	Scales (RCADS)
Index (CASI)	Children's Anxiety Sensitivity
	Children's Automatic Thoughts Scales (CATS)
	Lifetime Interference Measure (LIM)

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Table 4. Bivariate Correlations Among Key Study Variables at Time 2 ( $n = 45$ )

	CASI	Physical Threat	Social Threat	Personal Failure	Hostility	SAD	GAD	PD	SP	OCD	MDD	LIM
CASI	-	.75**	.62**	.72**	.51**	.80**	.73**	.83**	.66**	.76**	.62**	.72**
PhysTh	-	-	.82**	.82**	.58**	.86**	.76**	.77**	.68**	.76**	.69**	.74**
SocTh	-	-	-	.91**	.63**	.75**	.66**	.61**	.84**	.66**	.67**	.74**
PerFail	-	-	-	-	.60**	.80**	.72**	.65**	.80**	.71**	.69**	.80**
Hostility	-	-	-	-	-	.55**	.38*	.52**	.52**	.47**	.54**	.74**
SAD	-	-	-	-	-	-	.81**	.81**	.72**	.76**	.64**	.72**
GAD	-	-	-	-	-	-	-	.70**	.70**	.73**	.67**	.68**
PD	-	-	-	-	-	-	-	-	.64**	.69**	.68**	.71**
SP	-	-	-	-	-	-	-	-	-	.59**	.72**	.68**
OCD	-	-	-	-	-	-	-	-	-	-	.52**	.73**
MDD	-	-	-	-	-	-	-	-	-	-	-	.74**

Note. \* $p < .05$ , \*\* $p < .001$ ; PhysTh = Physical Threat; SocTh = Social Threat; PerFail = Personal Failure; SAD = Separation Anxiety Disorder; GAD = Generalized Anxiety Disorder; PD = Panic Disorder; SP = Social Phobia; OCD = Obsessive Compulsive Disorder; MDD = Major Depressive Disorder; LIM = Lifetime Interference Measure

Table 5. Means (Standard Deviations) and *T*-Tests (two-tailed) by Screen Status for Key Study Variables at Time 2 (*n* = 45)

	<i>t</i>	Positive Screen ( <i>n</i> = 25)	Negative Screen ( <i>n</i> = 20)
Children's Anxiety Sensitivity Index	3.05*	11.12 (6.89)	5.55 (4.89)
Physical Threat Subscale – CATS	2.28*	5.24 (8.66)	1.15 (2.06)
Social Threat Subscale – CATS	2.77*	8.24 (9.46)	2.65 (3.15)
Personal Failure Subscale - CATS	2.43*	5.28 (6.91)	1.55 (2.98)
Hostility Subscale – CATS	1.96	10.24 (6.56)	6.65 (5.46)
Separation Anxiety Disorder – RCADS	3.02*	53.60 (15.28)	43.45 (6.23)
Generalized Anxiety Disorder – RCADS	3.28*	42.48 (13.19)	33.30 (4.16)
Panic Disorder – RCADS	4.72**	51.20 (12.15)	39.35 (2.83)
Social Phobia – RCADS	3.88**	47.40 (14.67)	34.70 (6.47)
Obsessive Compulsive Disorder – RCADS	3.63*	48.28 (12.36)	38.15 (5.82)
Major Depressive Disorder – RCADS	3.45*	49.24 (14.41)	38.00 (6.84)
Lifetime Interference Measure	2.88*	28.48 (18.19)	13.95 (14.87)

*Note.* \**p*<.05, \*\**p*<.001; CATS = Children's Automatic Thoughts Scale; RCADS = Revised Child Anxiety and Depression Scales

FIGURE 1

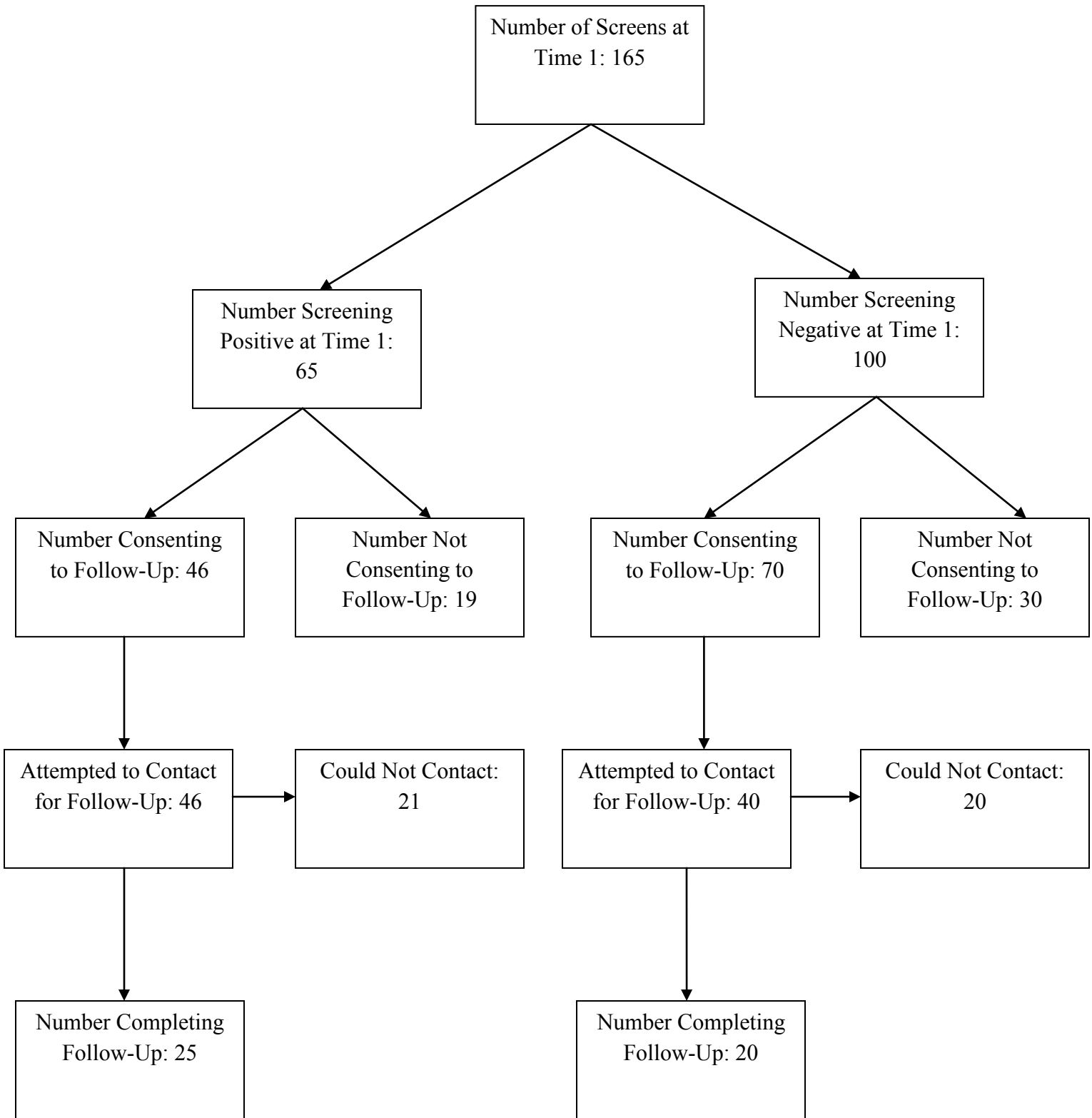
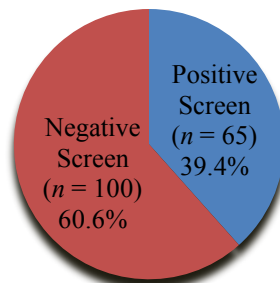
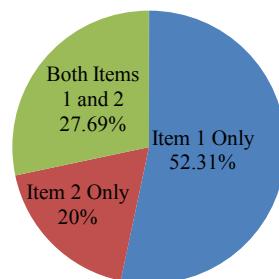
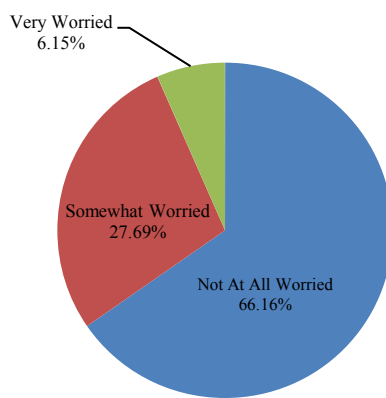


FIGURE 2

**Total Screens ( $N = 165$ )****Positive Screens****"In the past month, how worried have you been that spells or attacks might happen again?"**

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Appendix A

Autonomic Nervous System Questionnaire

1. In the past 6 months, did you ever have a spell or an attack when all of a sudden you felt frightened, anxious or very uneasy?

Yes\_\_\_

No\_\_\_

2. In the past 6 months, did you ever have a spell or attack when for no reason your heart suddenly began to race, you felt faint, or you couldn't catch your breath?

Yes\_\_\_

No\_\_\_\_\_

IF YOU ANSWERED YES TO QUESTION #1 OR TO QUESTION #2, THEN CONTINUE WITH THE QUESTIONNAIRE, OTHERWISE, STOP.

3. Did any of these spells or attacks ever happen in a situation when you were not in danger or not the center of attention?

Yes\_\_\_

No\_\_\_

4. How many times have you had a spell or attacks in the past month? (Check one.)

Hasn't happened at all in the past month\_\_\_\_\_

Once\_\_\_\_\_

2 to 3 times\_\_\_\_\_

4 to 10 times\_\_\_\_\_

More than 10 times\_\_\_\_\_



5. In the past month, how worried have you been that spells or attacks might happen again?

(Check one.)

Not at all worried \_\_\_\_\_

Somewhat worried \_\_\_\_\_

Very worried \_\_\_\_\_

## Supplemental Parent Questionnaire

- (1) Has your son/daughter ever received psychological treatment for anxiety? Yes/No

If yes, at what age did they receive treatment? \_\_\_\_\_

For how long were they in treatment? \_\_\_\_\_

- (2) Does your son/daughter currently have any medical conditions that may affect their anxiety level? Yes/No

If yes, please describe: \_\_\_\_\_

- (3) Has your son/daughter ever had a medical condition which affected their anxiety level? Yes/No

- (4) Has your son/daughter ever been diagnosed or treated for another “emotional” disorder besides anxiety (e.g., depression, eating disorder, etc.)? Yes/No

If yes, please describe what they were diagnosed with and when:

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- (5) Has your son/daughter ever suffered from asthma or another chronic respiratory illness (i.e., chronic allergies such as rhinitis or sinusitis), either in the past or currently? Yes/No

If yes, please describe, to the best of your ability, what they suffered from and when:

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- (6) What age is your son/daughter? \_\_\_\_\_

- (7) What grade in school is your son/daughter in? \_\_\_\_\_

- (8) What is your son/daughter’s ethnicity? (please circle one)

- (A) White/Caucasian
- (B) African-American (not Hispanic)
- (C) Caribbean-American (e.g., Haitian, Jamaican)
- (D) Hispanic or Latino (e.g., Cuban, Columbian, Puerto Rican, Mexican)
- (E) Asian

(9) What is your current *total* household income, which includes court-ordered custody pay, if applicable? (please circle one)

- (A) Less than \$10,000
- (B) \$10,000 to \$14,999
- (C) \$15,000 to \$24,999
- (D) \$25,000 to \$34,999
- (E) \$35,000 to \$49,999
- (F) \$50,000 to \$74,999
- (G) \$75,000 to \$99,999
- (H) \$100,000 and over

## RCADS

Respond “Never,” “Sometimes,” “Often,” or “Always” to each question.

1. I worry about things.
2. I feel sad or empty.
3. When I have a problem, I get a funny feeling in my stomach.
4. I worry when I think I have done poorly at something.
5. I would feel afraid of being on my own at home.
6. Nothing is much fun anymore.
7. I feel scared when I have to take a test.
8. I feel worried when I think someone is angry with me.
9. I worry about being away from my parents.
10. I get bothered by bad or silly thoughts or pictures in my mind.
11. I have trouble sleeping.
12. I worry that I will do badly at my school work.
13. I worry that something awful will happen to someone in my family.
14. I suddenly feel as if I can't breathe when there is no reason for this.
15. I have problems with my appetite.
16. I have to keep checking that I have done things right (like the switch is off, or the door is locked)
17. I feel scared if I have to sleep on my own.
18. I have trouble going to school in the mornings because I feel nervous or afraid.
19. I have no energy for things.
20. I worry I might look foolish.

21. I am tired a lot.
22. I worry that bad things will happen to me.
23. I can't seem to get bad or silly thoughts out of my head.
24. When I have a problem, my heart beats really fast.
25. I cannot think clearly.
26. I suddenly start to tremble or shake when there is no reason for this.
27. I worry that something bad will happen to me.
28. When I have a problem, I feel shaky.
29. I feel worthless.
30. I worry about making mistakes.
31. I have to think of special thoughts (like numbers or words) to stop bad things from happening.
32. I worry what other people think of me.
33. I am afraid of being in crowded places (like shopping centers, the movies, buses, busy playgrounds)
34. All of a sudden I feel really scared for no reason at all.
35. I worry about what is going to happen.
36. I suddenly become dizzy or faint when there is no reason for this.
37. I think about death.
38. I feel afraid if I have to talk in front of my class.
39. My heart suddenly starts to beat too quickly for no reason.
40. I feel like I don't want to move.
41. I worry that I will suddenly get a scared feeling when there is nothing to be afraid of

42. I have to do some things over and over again (like washing my hands, cleaning or putting things in a certain order)
43. I feel afraid that I will make a fool of myself in front of people.
44. I have to do some things in just the right way to stop bad things from happening.
45. I worry when I go to bed at night.
46. I would feel scared if I had to stay away from home overnight.
47. I feel restless.

## CASI

1. I don't want other people to know when I'm afraid. None    Some    A lot
2. When I cannot keep my mind on my schoolwork I worry that I might be going crazy. None    Some    A lot
3. It scares me when I feel 'shaky.' None    Some    A lot
4. It scares me when I feel like I am going to faint. None    Some    A lot
5. It is important for me to stay in control of my feelings. None    Some    A lot
6. It scares me when my heart beats fast. None    Some    A lot
7. It embarrasses me when my stomach growls (makes noise). None    Some    A lot
8. It scares me when I feel like I am going to throw up. None    Some    A lot
9. When I notice that my heart is beating fast, I worry that there might be wrong with me. None    Some    A lot
10. It scares me when I have trouble getting my breath. None    Some    A lot
11. When my stomach hurts, I worry that I might be really sick. None    Some    A lot
12. It scares me when I can't keep my mind on my schoolwork. None    Some    A lot
13. Other kids can tell when I feel shaky. None    Some    A lot
14. Unusual feelings in my body scare me. None    Some    A lot
15. When I am afraid, I worry that I might be crazy. None    Some    A lot
16. It scares me when I feel nervous. None    Some    A lot
17. I don't like to let my feelings show. None    Some    A lot
18. Funny feelings in my body scare me. None    Some    A lot

## CATS

Instructions: Listed below are some thoughts that children and adolescents have said pop into their heads. Please read each thought carefully and decide how often, if at all, each thought popped into your head over the past week.

0 = Not at all true; 1 = Sometimes; 2 = Fairly Often; 3 = Often; 4 = All the time

1. Kids will think I'm stupid.
2. I have the right to take revenge on people if they deserve it.
3. I can't do anything right.
4. I'm going to have an accident.
5. Other kids are stupid.
6. I'm worried that I'm going to get teased.
7. I'm going crazy.
8. Kids are going to laugh at me.
9. I'm going to die.
10. Most people are against me.
11. I am worthless.
12. My mom or dad is going to get hurt.
13. Nothing ever works out for me anymore.



14. I'm going to look silly.
15. I won't let anyone get away with picking on me.
16. I'm scared of losing control.
17. It's my fault that things have gone wrong.
18. People are thinking bad things about me.
19. If someone hurts me, I have the right to hurt them back.
20. I'm going to get hurt.
21. I'm afraid of what other kids will think of me.
22. Some people deserve what they get.
23. I've made such a mess of my life.
24. Something awful is going to happen.
25. I look like an idiot.
26. I'll never be as good as other people are.
27. I always get blamed for things that are not my fault.
28. I am a failure.
29. Other kids are making fun of me.
30. Life is not worth living.

31. Everyone is staring at me.
32. I'm afraid I will make a fool of myself.
33. I'm scared that somebody might die.
34. I will never overcome my problems.
35. People always try to get me into trouble.
36. There is something very wrong with me.
37. Some people are bad.
38. I hate myself.
39. Something will happen to someone I care about.
40. Bad people deserve to get punished.

## LIM

Respond “Not at all,” “Sometimes,” “Fairly Often,” “Often,” or “All the time” to each question.

Over the past month...

1. I have missed or skipped school.
2. I have argued or fought with my parents.
3. I have been teased by other kids.
4. I have been to the doctor.
5. I have had arguments/fights with other kids.
6. I have withdrawn from the world.
7. I have felt sick.
8. My enjoyment in life has been limited.
9. I have done poor quality work.
10. I have avoided going on dates.
11. I have not done well in sport.
12. I have argued/fought with my brothers/sisters
13. I have been left out of groups.
14. I have been in trouble with teachers or employers.
15. I have found it hard to sleep.
16. I have not been able to get a job.
17. I have avoided new challenges.
18. I have had aches or pains.
19. I have struggled to do my work.

20. I have missed out on friendships.
21. I have stayed away from activities.
22. I have skipped doing fun things with my family.
23. My work has been slowed down.
24. I have done or said things I later regretted.
25. I have skipped doing fun things with my friends.
26. My opportunities in life have been limited.
27. I have had problems with other kids.
28. I have done badly in tests or exams.
29. I have been left out of fun activities.
30. I have put on weight.
31. I have been disorganized.