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The Effects of Stimulant Medication on Anxiety Behaviors as Observed in Children with Attention Deficit Hyperactivity Disorder

Kelly J. Kromer

Effects of Stimulants

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The Effects of Stimulant Medication on Anxiety Behaviors as Observed in Children with Attention Deficit Hyperactivity Disorder

Kelly Kromer

Louisiana State University

Abstract

We observed 3 children, ages 4-6 when they did and did not receive medication for the simultaneous occurrence of both Attention Deficit Hyperactivity Disorder (ADHD) and anxiety related behaviors. ADHD related behaviors were measured using a 10-second interval scale. Anxiety behaviors were recorded using three frequency checklists. Each child had a previous diagnosis of ADHD. Children received either a placebo or 10 mg dosage of Adderall each day. Direct observations were conducted for both anxiety and ADHD behaviors. A single-subject, multi-element design was used to evaluate results. Medication status was alternated in a multi-element design using double blind placebo controls. Of primary interest were the within-child relationships between ADHD and anxiety behaviors during previously prescribed stimulant medication or placebo condition. Adderall was found to increase certain anxiety related behaviors such as gratuitous hand movements, crying and whining, and skin picking while improving off task behavior and total disruptive behaviors associated with ADHD.

Attention Deficit Hyperactivity Disorder (ADHD)

ADHD Definition

Attention Deficit Hyperactivity Disorder(ADHD) was first presented by George Still in 1902 as a biological disorder consisting of severe hyperactivity (Barkley, 1988). Currently, the disorder is of interest to parents and clinicians alike. Children with a diagnosis of ADHD tend to show impairments in all aspects of attention, including maintenance, investment and organization thereof. Children also seem to have a strong tendency to seek immediate reinforcement. These impairments are usually seen with the presence of hyperactivity as well, so much so that the category of children diagnosed with Attention Deficit Disorder without hyperactivity is a small minority. Children with ADHD also have a low ability to function well in situations which require a delay of gratification and find it more difficult to adhere to commands which require them to conform behavior to a social norm (Barkley,1988).

The DSM-IV cites that 3-5% of children have ADHD and that the disorder is more prevalent in males. ADHD is three times more likely in males than in females (APA, 1994, p. 82). Symptoms of ADHD behavior can be seen in children as early as three-years of age or even younger and these symptoms are classified in two separate categories; inattention and hyperactivity or impulsivity. Symptoms of inattention include failing to give close attention to details or making careless mistakes in schoolwork, having difficulty sustaining attention, not listening when spoken to directly, not following through on instructions and failing to finish schoolwork, having difficulty organizing tasks and activities, avoidance of tasks which require sustained mental effort, losing

things necessary to complete tasks, being easily distracted by extraneous stimuli, and being forgetful in daily activities. Symptoms of hyperactivity include fidgeting with hands or feet and squirming while seated, leaving classrooms or other situations where staying seated is expected, running or climbing excessively in situations where it is not appropriate, having difficulty playing or engaging in leisure activities quietly, acting as if "driven by a motor", and talking excessively.

Impulsivity is characterized by blurting out answers to questions before the question has been completed, having difficulty awaiting one's turn, and interrupting and intruding on others such as during conversations or games. ADHD behaviors must be initially exhibited in early childhood and have impaired activity before the age of seven for the diagnosis to be reached. Symptoms of inattention, hyperactivity and impulsivity also must be present in two or more settings and these impairments must be causing true difficulty in social, academic or occupational functioning (APA, 1994). The etiologies of ADHD are unknown; researchers cite etiologies from neurological factors to food additives to toxins to genetic and social causes (Barkley, 1988).

ADHD Assessment

In order to assess ADHD within school settings, information about the child's behavior must be obtained from parents and teachers as well as from first-hand observations about the child. Assessment procedures include interviews with the parent and child, questionnaires that are completed by teachers and parents in addition to observations across multiple settings. Medical evaluation should include a complete medical history as well as a physical examination. Individual testing plays a minimal role in the testing for ADHD because these measures have not been found to be reliable or

accurate for the purpose of diagnosis. Children with ADHD often display appropriate levels of attention and self-control when placed in a restricted setting of a highly structured nature such as during most standardized tests (DuPaul, 1992). Screening for ADHD can be done through the use of an ADHD rating scale. Once screened, the DSM-IV criteria of ADHD are reviewed with the teacher. School records are examined and parent-teacher ratings are made using a scale such as the child behavior checklist. Direct observation of behaviors is an integral part of the assessment process and once observed, these results must be interpreted carefully. ADHD observation protocols (Barkley, 1988) typically include inappropriate vocalizations, playing with objects, being out of seat, being off task, and fidgeting. Not so much is the importance placed on the actual activity but its situational appropriateness (AACAP, 1997).

ADHD Treatment

There are various forms of treatment for children diagnosed with ADHD, however stimulant medication is by far the most common. The decision to medicate children with ADHD is usually based on a diagnosis of the disorder and symptoms that are severe enough to cause functional impairment at school as well as at home. Medication should not be used as a substitute for well-targeted educational materials or competent and engaging teachers in the classroom; rather it should be used to aid those children who do not respond to well-designed educational environments. The effects of medication may be assessed using brief math or reading probes because these tools are similar to the tasks which the child is expected to complete at home (AACAP, 1997). Direct observations in the classroom and the use of blind placebo controls are also recommended.

The most widely used form of medication for children with ADHD is stimulants. Specifically, Ritalin (trade name) or methylphenidate (generic) is commonly used. Adderall is a stimulant that has been increasingly common in use in recent years. Having a longer half-life than Ritalin, Adderall's effects last longer and thus its use is becoming more widespread. Stimulants are the most studied and most children with the disorder seem to respond positively to them. The effects of the medications, although positive, still vary widely for different children and each child's reaction to such drugs should be observed carefully. Stimulants produce motor, social, and cognitive effects (AACAP, 1997). According to "Practice parameters for the assessment and treatment of children, adolescents, and adults with attention deficit hyperactivity disorder" (AACAP, 1997), motor effects include a reduction of activity level and excessive disruptive talking as well as improved handwriting and fine motor control. Social effects of stimulants are reduced off-task behavior in the classroom, an improved ability to work and play independently, reduction of anger, bossiness, verbal and physical aggression, an improved (but not normalized) peer social status. Stimulants also produce reduction in non-compliance as well as improved mother-child and family relations and parents and teachers becoming more positive. Cognitive effects of stimulants include improved sustained attention, reduced distractibility, improved short-term memory, a reduction in impulsivity, and an increased amount of academic work completed (AACAP, 1997). The particular stimulants Dextroamphetamine and possibly Adderall, often have a longer duration of action as compared to Methylphenidate (AACAP, 1997). These slight differences in types of stimulants serve to show that if one kind is not effective, another should be tried before moving on to another classification of medication. The short half-life of stimulants

makes this type of trial and error procedure possible in that each type does not stay in the system long and does not need to build up high plasma levels in the bloodstream in order to be effective. Stimulant medication is rapidly acting, producing effects on behavior within 30-45 minutes and a peak within 2-4 hours and for Adderall 4-6 hours. Because of their fast-acting quality, stimulants are not effective after 3-7 hours depending on the child. Side effects seem to be mild, including insomnia, appetite reduction, irritability in some children, and apparent sadness later in the afternoon, however there is again great variability in individual responses and some children may have significant adverse effects.

Other types of medications used to treat ADHD symptoms exist but have not been so widely and systematically studied. Buproprion has been found to decrease hyperactivity and aggression while improving the cognitive performance of children with ADHD yet it also brings the seizure threshold down and may exacerbate tics (AACAP, 1997). Tricyclic antidepressants also have been found to be helpful in the treatment of symptoms (AACAP, 1997). They are longer acting but sometimes produce sluggish reactions in focusing the optic lens. They also pose the risk of serious cardiac side effects and there is the danger of overdose. Tricyclic antidepressants also have been found to produce troublesome sedating side effects and have been seen to decline in efficiency over time. Other antidepressants have also been considered for use in medication; these include selective serotonin reuptake inhibitors, SSRI's, monoamine oxidase inhibitors and alpha adrenergic agonists (AACAP, 1997). The SSRI's are preferred because of significantly fewer side effects.

As well as the use of medication for the treatment of ADHD, other forms of

intervention have been found to produce positive results. Psychosocial interventions such as behavior modification have been used. In these interventions, token economies have been used successfully by parents, teachers, and clinicians. Although behavior modification has been proven to be effective, alone it seems to be less advantageous than medication and most helpful when paired with medication (AACAP, 1997). Parent training, family therapy, academic skills training, individual psychotherapy, cognitive behavior modification, therapeutic recreation, multimodal treatment and dietary interventions have also been explored as treatment options.

Social skills training has also been used as an adjustive treatment (Barkley, 1988), as many children with ADHD also have significant social problems. In this mode of treatment, teaching ADHD children additional skills is not so much the focus as is assisting them in learning when the performance of such skills would be useful in social situations.

Parent training has proved helpful in the management of ADHD symptoms as well. Parents review the information on ADHD, develop and enhance parent attention, attend to the child's independent play, and are instructed as to how to establish a token economy and time-out for noncompliance. Parents are also instructed how to manage their child's non-compliance in public places and how to manage future misconduct. Combined treatments include a combination of parent training in child behavior management, classroom implementation of behavior modification techniques, social skills training, and stimulant medication. In "A 14 Month Randomized Clinical Trial of Treatment Strategies for Attention Deficit/ Hyperactivity Disorder" (MTA Cooperative Group, 1999), researchers found that treatment using medication management yielded the

same results as a combined medication and behavioral management plan but that the latter required lower medication doses (MTA Cooperative Group, 1999). Using studies such as this one, perhaps some children may be able to be tapered off medication for ADHD symptoms. However, these results were only for the "core" diagnosis of attention deficit and hyperactivity. Combined treatments were not effective for related problem areas such as social skills and academic performance. Finally, in "A Brief Assessment of Methylphenidate Effects in the classroom" (Northup, Gulley, Fusilier, Swanon, & Dunamay, 1999) three children were studied individually in order to find the effects of the stimulant medication. The first child, Jerry, was reported as having high levels of anxiety as well as ADHD according to the DSM-IV and the child behavior checklist. He frequently refused to leave his parents and was initially withdrawn. Jerry acted the same regardless of stimulant medication and a few studies have suggested that children exhibiting anxiety related behaviors may not respond to medication. In another study by Northup, Gulley, Edwards, & Fountain, the "common and potentially large individual differences in children's response to MPH" was noted (in press). Also in this study there was a clear "negative and linear-dose response effect for social engagement (i.e. increasing social withdrawal with increasing dosages) that occurred for two of the three participants" (in press). Clearly, individual differences must be taken into consideration when a treatment method for ADHD children is being formulated.

Anxiety Definition

The study of childhood anxiety has not been as popular or as extensive as that of ADHD. However, the prevalence and importance of anxiety in children has been increasingly recognized in recent years and anxious children are the focus of many

clinicians' interest. Anxiety is defined by the DSM-IV as "apprehension, tension, or uneasiness that stems from the anticipation of danger" (American Psychiatric Association, 1994). Anxiety responses may be internal or external. They may be focused on a specific object or activity or unfocused. Focused anxiety is termed as a phobia while unfocused anxiety may be classified as free floating or general anxiety. There are three specific diagnoses for anxiety. They are separation anxiety, avoidant disorder, and overanxious disorder. Anxiety responses may be cognitive, physiological, and behavioral. As with ADHD, anxiety is diagnosed when symptoms are very severe to the point of being disabling, persistent, age appropriate, unusual or bizarre, and if those symptoms differ greatly from familial or societal norms. Behavioral manifestations of anxiety include motor restlessness, hyperactivity, being hyper-alert, excessive shyness, and inattention (American Psychiatric Association, 1994).

There are twelve classifications of anxiety according to the APA, each of which is linked to a discrete stimulus situation or differs in the degree of anxiety attached to certain stimuli. Separation anxiety, agoraphobia without history of panic disorder, social phobia, specific phobia, panic disorder with agoraphobia, panic disorder without agoraphobia, obsessive compulsive disorder, post traumatic stress syndrome, acute stress disorder, generalized anxiety disorder, substance-induced anxiety disorder, and anxiety disorder not otherwise specified are these classifications (American Psychiatric Association, 1994).

Children tend to suffer from three specific anxiety disorders, these being separation anxiety disorder, avoidant disorder, and overanxious disorder (Harper, 1990). Separation anxiety is excessive anxiety concerning the separation from major attachment

figures. There are nine specific symptoms indicative of SAD. Cognitive symptoms include persistent worry that an attachment figure will not return, that an event will separate the child, reluctance to go to school or sleep or be alone for fear of not being near an attachment figure, and nightmares about separation. Physical symptoms include headaches, stomachaches, nausea, and even vomiting when forced to leave an attachment figure and recurrent excessive distress when separated. Avoidant disorder is a form of anxiety where the anxiety is focused on contact with unfamiliar people. This anxiety results in a shrinking away from adults and peers. Diagnostic criteria for avoidant disorder are a persistent shrinking away from strangers, a strong desire for acceptance by family members, and avoidant behavior that interferes with peer relationships. These symptoms must be present at least six months. Excessive worry and forgetful behavior mark overanxious disorder that is nonspecific to situations. These symptoms include excessive worry about future events, appropriateness of past behavior, and their own competence. Overanxious disorder sometimes produces headaches or stomachaches; sufferers are self-conscious, need constant reassurance, and feel tense and unable to relax. Risk factors for these types of anxiety may be familial, stressful life events, developmental, or one's own temperament. Although anxiety is less intense than fear, still sufferers exhibit motor, physiological and subjective responses such as performance impairment and phenomenological distress respectively (Barrios & O'Dell, 1988).

Anxiety must be separated from normal fears of developing children. Typically, one to three-year-olds fear strangers, loud noises, and separation. Preschoolers and first graders fear animals, darkness and monsters while older children express distress over natural phenomena, school, health, and home-related events. Generally, as children grow

older the amount of fears they possess decreases, yet in females especially when they get older, anxiety symptoms increase (Barrios & O'Dell, 1988).

Intervention techniques using cognitive behaviorism revolve around a child's cognitions and behavior as well as the child's internal and external environment. Cognitive behaviorism has been used in the treatment of nighttime fears, medical procedures, evaluation anxiety, and many clinical cases. Although this method has proven effective, there is a need for improved assessment of children's cognitive distortions and a greater understanding of the development of normal coping skills (Kendall, Howard, & Epps, 1988).

Anxiety Assessment

Assessment of anxiety is multimodal; personality tests, anxiety scales, parent scales, structured diagnostic interviews, behavioral observations, and physiological measures all contribute to the diagnosis of anxiety. Several semi-structured interviews exist for evaluating anxiety.

The Diagnostic Interview Schedule for Children (DIS-C) relies on DSM-IV criteria and utilizes an interviewer-observer format. Interrater reliability was found to be high for parent and child interviews as well as test/retest (March & Allen, 1988). The Children's Anxiety Evaluation Form (CAEF) assesses anxiety in nonpsychotic children of normal intelligence (March & Allen, 1988). This interview explores the history of anxiety, parent's subjective assessment and observations during interview. The CAEF is less documented in its psychometric properties. The Schedule for Affective Disorders and Schizophrenia in School-aged Children (K-SADS) is based on clinical judgments while the Child Assessment Schedule is based on algorithms. The Child and Adolescent

Psychiatric Assessment (CAPA) incorporates these two scales. Structured interviews for anxiety exist as well. The Diagnostic Interview for Children and Adolescents (DICA) consists of a child and corresponding parent interview. It covers both internalizing and externalizing psychopathology for all areas. The DICA has the lowest agreement rating for the anxiety portion of the interview. The Diagnostic Interview Schedule for Children (DISC) also assesses anxiety.

Other methods of assessment include parent and teacher ratings. Most common are the Conners Parent Rating Scale (CPRS) and the Conners Teacher Rating Scale (CTRS). The Child Behavior Checklist (CBCL) assesses competencies and problems of children ages four to six. The CBCL includes a teacher version and explores both internalizing and externalizing symptoms. The lack of anxiety specific factors limits its use for assessment however (March & Allen, 1988). Self-report measures provide a good way for the child to express hidden experiences of anxiety (March & Allen, 1988). The Revised Children's Manifest Anxiety Scale, the most common self-report measure, consists of three factors; physiological manifestations of anxiety, worry and oversensitivity, and fear. The State-Trait Anxiety Inventory for Children (STAIC) uses two independent 20-item inventories. The first part measures the child's present state while the other part inquires about traits that occur across various situations. The Fear Survey Schedule for Children (FSS-FC) uses an 80-item inventory measured using a four-point scale to explore school, home, social, physical, animal, travel, classical, and miscellaneous phobias. The revised version of this scale uses a three-point scale in an attempt to adapt to mentally disabled children.

Behavioral observation for the assessment of anxiety in young children is an

underdeveloped area. The Preschool Observation Scale of Anxiety (POSA) is one of the few available measures. Using this measure, raters note the presence of certain behavioral symptoms of anxiety such as crying, nail-biting, physical complaints, and verbal expressions of fear or worry. According to Glennon and Weisz (1978), who developed this scale, other "methods assume both the ability and the willingness of subjects to correctly describe their feelings. The first assumption is clearly tenuous with young children. And with regard to the second assumption, there is evidence that many children give inaccurate reports about their anxiety due to defensiveness or social pressure"(p. 1247). The measure has been proven to be both reliable and valid (March &Allen, 1988). In addition to the POSA, Behavioral Avoidance Tasks (BAT) have also been used to assess anxiety by placing the patient in anxiety-provoking situations.

Anxiety treatment

Treatment of anxiety in children is just as complicated and as underdeveloped as assessment. Behavioral methods such as systematic desensitization, relaxation techniques and biofeedback, flooding and implosive therapy, modeling and cognitive behavioral therapy have been employed. Psychopharmacological methods using Ideral and Valium or Librium have also been used (Harper, 1990). Kane and Kendall (1989) evaluated behavior therapy for the treatment of anxious children. These treatments were justified by the fact that generalized anxiety had been previously treated successfully in adults using various forms of behavior therapy and that an individual's cognitions have been suggested to be very important in the construct of anxiety. Using the Anxiety Disorders Interview Schedule for Children, the STAIC for both children and parents, CBCL, and the Hamilton Anxiety Rating Scale, children were assessed for anxiety. Using a treatment

of four components, target complaints for each child improved. Treatment consisted of recognition of anxious feeling and somatic responses, clarification of cognitions in anxiety provoking situations, development of a plan to help cope with the situation, and evaluating the success of those coping strategies.

Other behavioral methods for dealing with anxiety have been used. Systematic desensitization has been used in dealing with children's fear of small animals (Barrios & O'Dell, 1988). Desensitization consists of training in deep muscle relaxation, ranking of distressful situations by the child, imagining those situations in a relaxed state called "emotive imagery" and finally facing the actual feared stimuli in a state called "in vivo", that is, in a real session (Barrios & O'Dell, 1988). Obsessions and compulsions have been treated effectively using prolonged exposure. Exposure techniques use immediate and intense exposure to stimuli by imaginal flooding, "in vivo" flooding, implosion, or reinforced practice. Stressful medical procedures also produce a great amount of anxiety in children. This stress has been treated with the use of modeling. During modeling, an observer watches another experience the feared stimuli, either live or using a videotape. The observer then tries to do the same as the other or imagine doing so. School and social events have been shown to produce anxiety as well in children. Contingency management as well as self-management has been proven helpful in this area of anxiety. Contingency management rewards the child for reacting to the stimulus or punishment if the child refuses to interact. Self-management seems to be less successful in the treatment of defensive children. Self-management uses adaptive ways to view behavior and relaxation techniques. These behavioral techniques may be used by themselves or in combination with each other in order to treat anxiety (Barrios & O'Dell, 1988).

In selecting a form of these behavioral treatments, ethical and technical considerations must be weighed. Systematic desensitization is applicable when fear is symbolic or when "in vivo" exposure is accessible and approachable in stages. Prolonged exposure poses obvious ethical problems while modeling seems relatively problem-free, ethically speaking. In using contingency management, some have argued that the punishment is a problem, as well as the fact that contingencies increase cost of treatments. Psychological costs for the child, parent, and clinician as well as financial costs to the parents must be considered as well. Once treated, treatment itself must be evaluated. Treatment may be evaluated using child self-report, parent report, teacher report, cognitive and behavior assessments (Barrios & O'Dell, 1988; Laurent & Potter, 1998).

Comorbidity Between Anxiety and ADHD

Children with one disorder sometimes display symptoms of other disorders as well. This overlap of symptoms and diagnoses is referred to as comorbidity. In an article published by the MTA cooperative group (1999), researchers reported that "for 34% of sample with Diagnostic Interview Schedule for Children defined anxiety disorders, behavioral treatment showed an enhanced response for parent-reported ADHD and internalizing symptoms" (p. 1094). Among children with ADHD, comorbid disorders of learning disabilities, oppositional defiant disorder, conduct disorder, and anxiety have been reported. Assessment of ADHD must include assessment of other disorders as well in order to find a true picture of an individual child. There is a large overlap of hyperactivity and learning disabilities. According to one researcher, 47% of children with hyperactivity showed symptoms of anxiety (Harper, 1990). There is also a strong rate of

comorbidity between ADHD and conduct disorder. ADHD and conduct disorder may be further compounded with anxiety, yielding a child with multiple diagnoses. Youths who seem to exhibit signs of conduct disorder as well as anxiety engage in less serious antisocial behavior as opposed to youths without anxiety. In fact, findings suggest that there may be an inhibition of serious antisocial behavior when anxiety is high (Walker, et al., 1991). Conduct disorder is associated with an increased risk of panic, phobia, obsessive compulsive disorder, and depression as well as adult antisocial disorder. Conduct disorder does indeed seem to be closely related to ADHD. There are many correlations between symptoms, yet conduct disorder is of an aggressive nature while ADHD is cognitive and academic. Oppositional Defiant Disorder may be a subgroup between ADHD and ADHD with CD.

Anxiety may also be comorbid with ADHD. Higher rates of ADHD have been found in kids with anxious parents. The risk of anxiety disorders among families of patients with ADHD is higher as well. The comorbid association between ADHD and anxiety disorders has been found to be 25% according to Biederman, Newcorn, and Sprich (1991). Clearly, the presence of comorbid disorders should be examined when choosing a method of treatment. Anxiety disorders or unrealistic fear, depression, or substance abuse have been shown to affect ADHD. Comorbidity of ADHD has been documented as 20-25% for anxiety disorders (AACAP, 1997). Some studies have found that children with anxiety do not respond as well as children with ADHD to stimulant medication (Northup et al.,1999).

Stimulant medication and anxiety

Although most children diagnosed with ADHD do benefit from stimulant

medication, the success of such medication is highly individualized. Stimulant medication affects children's attentional, academic, behavioral, and social domains (AACAP, 1997). Because of its many effects, each child should be observed independently in order to assess the results of stimulant medication. In a study conducted by Northup, Edwards, Gulley, Fusilier, Swanson, & Dunaway (1999), three children were observed in order to explore the effects of Methylphenidate. One of these children, Jerry, was also reported as having high anxiety according to the child behavior checklist and the DSM-IV. Jerry was reported as being initially withdrawn at the beginning of the study; refusing to enter the classroom or leave his parents. Jerry's ADHD-related behaviors did not improve with stimulant medication (1999).

Another study headed by Northup illustrated the "common and potentially large" individual differences in children's response to MPH and went on further to say that a "clear negative and linear dose response effect" was found for social engagement. That is, in two of the three children studied, higher social withdrawal was correlated with higher dosages of medication (Northup, Gulley, Edwards, Fountain, in press). This finding seems to be tenuous; in other studies a diagnosis of comorbid anxiety was not associated with a negative dose response (MTA Cooperative Group, 1999). These contradictory studies make further studies in this vein necessary. Is stimulant medication correlated with a negative response in anxious children? Does stimulant medication, regardless of its effect on ADHD behaviors, affect anxiety behaviors positively or negatively?

Method

Participants and Setting

Participants were three children, Allison, Nathan, and Kevin, ages 4-6, enrolled in Louisiana State University's (LSU) Summer Treatment and Research program (STAR) for children with Attention Deficit Hyperactivity Disorder (ADHD). Enrollment in the program required a previous diagnosis of ADHD. Either a parent or teacher had expressed concern of anxiety as well. Diagnoses were made by a consulting psychiatrist and based on a parent interview, and scores at least two standard deviations above the mean for attention problems on either the Connor's Rating Scale or the Child Behavior Checklist. All participants were in the average or above average range of intellectual functioning. The STAR program was held each weekday from 8:00 until 11:30. The program took place in an experimental classroom at the Department of Psychology at LSU. All staff at the program were graduate or undergraduate students from LSU psychology under the direction of LSU psychology faculty.

Procedures

Response Definitions

ADHD behaviors. ADHD operational definitions were based on the ADHD Behavior Coding System (Barkley, 1991). ADHD behaviors include inappropriate vocalizations, playing with objects, being out of seat, being off-task and fidgeting. Teacher attention and peer attention were also recorded as consequences. Inappropriate vocalizations were defined as any vocal noise or verbalization made by the child that was not preceded by raising a hand or acknowledgment by an adult. Playing with objects was defined as touching any object that was not at the student's desk or associated with the

assigned task. Out of seat was defined as the child's full body weight not being supported by the chair, and/or the child's buttocks removed from the chair for greater than three seconds. Off-task was defined as the child looking away from instructional materials for greater than three seconds. A repetitive unnecessary movement of any part of the body (i.e. rocking back and forth, tapping a pencil on a desk) was defined as fidgeting. Teacher attention was defined as any verbal or physical redirection or reprimand given to the child by the teacher. Peer attention was defined as any verbal statements or physical contact given to the target child by a peer. Inappropriate vocalizations, playing with objects, and being out of seat were combined and referred to as disruptive behavior.

Anxiety-related behaviors. Operational definitions for anxiety-related behaviors were adapted from the Preschool Observational Scale of Anxiety (POSA) (Glennon and Weisz, 1978). Based on prior informal observations, the following behaviors were determined most likely to occur: crying, whining or whimpering, touching of fingers to the mouth, nail-biting, lip-licking, skin-picking, gratuitous hand movement, a complaint about being afraid or worried about something, desire to leave, and leaving the social situation. Crying was defined as tears being present during the 10-second interval. A whine or whimper was a vocal noise of distressful nature. Fingers touching the mouth area was defined as the child's fingers touching the mouth area for more than three seconds and was not counted if the child bit the fingernails. Nail biting was the child actually biting his or her nails during the 10-second interval. Lip licking was defined as the tongue being visible on lips in a repetitive manner. Skin picking was defined as picking, pulling and wringing of skin not around the child's mouth. Gratuitous hand movement was unnecessary movement of the hand for more than three seconds. A

complaint about being afraid or worried about something must have used the word "afraid", "scared", "worried", or a synonym. Desire to leave was defined as the child saying that he or she wants to leave the situation or making excuses about why they must leave. Leaving the social situation was the child removing themselves from all other children (producing a distance of more than five feet) for more than three seconds. Crying, whining or whimpering, fingers touching the mouth, nail-biting, lip-licking, skin-picking, gratuitous hand movement, desire to leave, and actually leaving were combined and referred to as anxiety-related behavior. Specific anxiety-related behaviors also were examined separately in order to evaluate more individualized anxiety-related behaviors.

Data Collection

ADHD and comorbid anxiety behaviors were observed informally for the first two days in order to identify specific target behaviors for each child. Subsequent direct observations of children were conducted for both anxiety and ADHD-related behavior at least twice daily. Direct observations of ADHD were recorded before transitions using 10-second partial interval recording procedures. Transitions were defined as the period of time when children were leaving the classroom on their way to a non-academic activity. The period before transitions was thought to be most closely related to the periods of anxiety related behavior observations. Data were collected on a laptop computer using an observational software program developed at Johns Hopkins Hospital. Direct observations of anxiety-related behaviors were taken using three separate frequency checklists as described below.

ADHD data collection. ADHD behaviors were assessed in the classroom during independent academic work. Five-minute observations were conducted to correspond

with the peak medication times; that is 1-3 hrs following oral administration. Children were seated at desks in the classroom and given an instructional level academic task and told to remain in their seats and work quietly as described above. Observers recorded all ADHD behaviors using a computer program. After five minutes, the children were told to put down their work and move on to the next class activity. ADHD observations taken before recess were used to compare medication effects to anxiety behaviors. These pre-recess observations were believed to be most representative of typical classroom behaviors.

Anxiety data collection. Children were observed informally for the first two days of the summer program to identify the most prevalent times for observing individual anxiety-related behaviors. Specific behaviors exhibited by each child were recorded during this time. Assessment during the first two days determined when anxiety-related behaviors were to be measured. It was found that anxiety-related behaviors were most prevalent during sports camp, recess, and transitions for each of the three participants.

Informal observations of anxiety yielded three checklists of anxiety-related behaviors observed to occur during each of the three corresponding time periods. One checklist was completed by observers during transitions, one was completed during sports camp, and one during recess (Appendix A-C). Frequency data were collected daily on each checklist for each time period for each child. Observation times ranged from five to ten minutes.

Interrater Agreement. Interrater reliability was obtained through a second observer who simultaneously but independently recorded the same behaviors. Most observers had previous experience with the method of data collection used for ADHD.

All observers also completed a training period prior to the summer program and had previously demonstrated at least 80% agreement. When a disagreement did occur, the primary observer's data was used.

Medication Status

A consulting psychiatrist prescribed a medication course alternating between placebo and a 10mg dose of Adderall. Mg/kg was approximately 1 for each of these children. This is typically considered a high dose. Placebos were prepared according to standard pharmacy procedures. All medication was color-coded for later identification. Parents were provided written instructions for the morning administration of medicine. The program director confirmed the child's daily medication status and only he or a designate was aware of the child's status.

Design

A single-subject multi-element design was used to evaluate results. Medication status (i.e. Adderall or placebo) was alternated in a multi-element design using double-blind controls. ADHD and anxiety-related behaviors were recorded as described above. Each child was observed at least three times for both ADHD and anxiety-related behaviors at each medication status for each time period for a minimum of five days.

Results

ADHD Related Behaviors

Classroom observations conducted during five-minute interval before recess indicated that a 10mg dose of Adderall was associated with a substantial decrease in ADHD related behaviors for two of the three participants. Figures A, B, and C show the results of classroom observations for Nathan, Alison, and Kevin, respectively.

Nathan showed a substantial difference in ADHD behaviors when he did and did not receive medication. When receiving medication, ADHD behaviors also had a greater variability (0-54.8%) in contrast to when he did not receive medication (12.9-26-7%). Nathan's ADHD related behaviors averaged 22.58 percent when he did receive medication and 20.73 when he did not.

Alison displayed few or no ADHD related behaviors in the classroom regardless of whether she received medication.

Kevin (figure C) showed a substantial difference when he did and did not receive medication. ADHD related behaviors averaged at 12.86 when he did not receive medication and 0 when he did. When he did receive medication, his behavior was clear and stable at 0. ADHD behaviors were variable when he did not receive medication (0-41.9%).

Anxiety Related Behaviors

Observations taken during transition periods showed a clear and substantial distinction between anxiety related behavior when they did and did not receive medication for all participants. Nathan also showed an increase in anxiety related behavior during recess when he did receive medication. Kevin showed an increase in

anxiety related behaviors during sports. Alison showed an increase in anxiety related behaviors during sports and recess. Figures D-Q show these results. There were no other substantial differences in anxiety related behaviors when participants did and did not receive medication for any other behaviors or during any other observation period.

Placebo. Nathan displayed quite low frequencies of crying and whining during transitions with a mean of 2.25 (range, 0-9) and during recess with a mean of 1.5 (range, 1-5). When Alison received a placebo, she displayed moderate levels of skin picking during sports with a mean of 9.2 (3-18) and low but variable frequencies of gratuitous hand movement during recess with a mean of 1.4 (0-6) and transitions with a mean of 5.25 (3-7). Kevin displayed mild levels of skin picking during sports with a mean of 9.25 (4-16) and gratuitous hand movement during transitions with a mean of 4.16 (0-11). There were no other substantial differences when participants did not receive medication in anxiety related behaviors or during any other observation period.

Medication. In contrast to the placebo condition, Nathan displayed an increase of crying and whining behavior when receiving medication during transitions with a mean of 8.5 (4-17) and recess with a mean of 10.67 (1-16). Alison displayed an increase in skin picking during sports shown with a mean of 22.0 (10-31) and gratuitous hand movement during recess with a mean of 3.3 (0-6) and during transitions with a mean of 16.3 (5-23) when receiving medication as well. Finally, Kevin displayed an increased frequency of skin picking during sports with a mean of 16.4 (4-31) and an increase in gratuitous hand movement during transitions with a mean of 18.6 (11-35).

Figure A

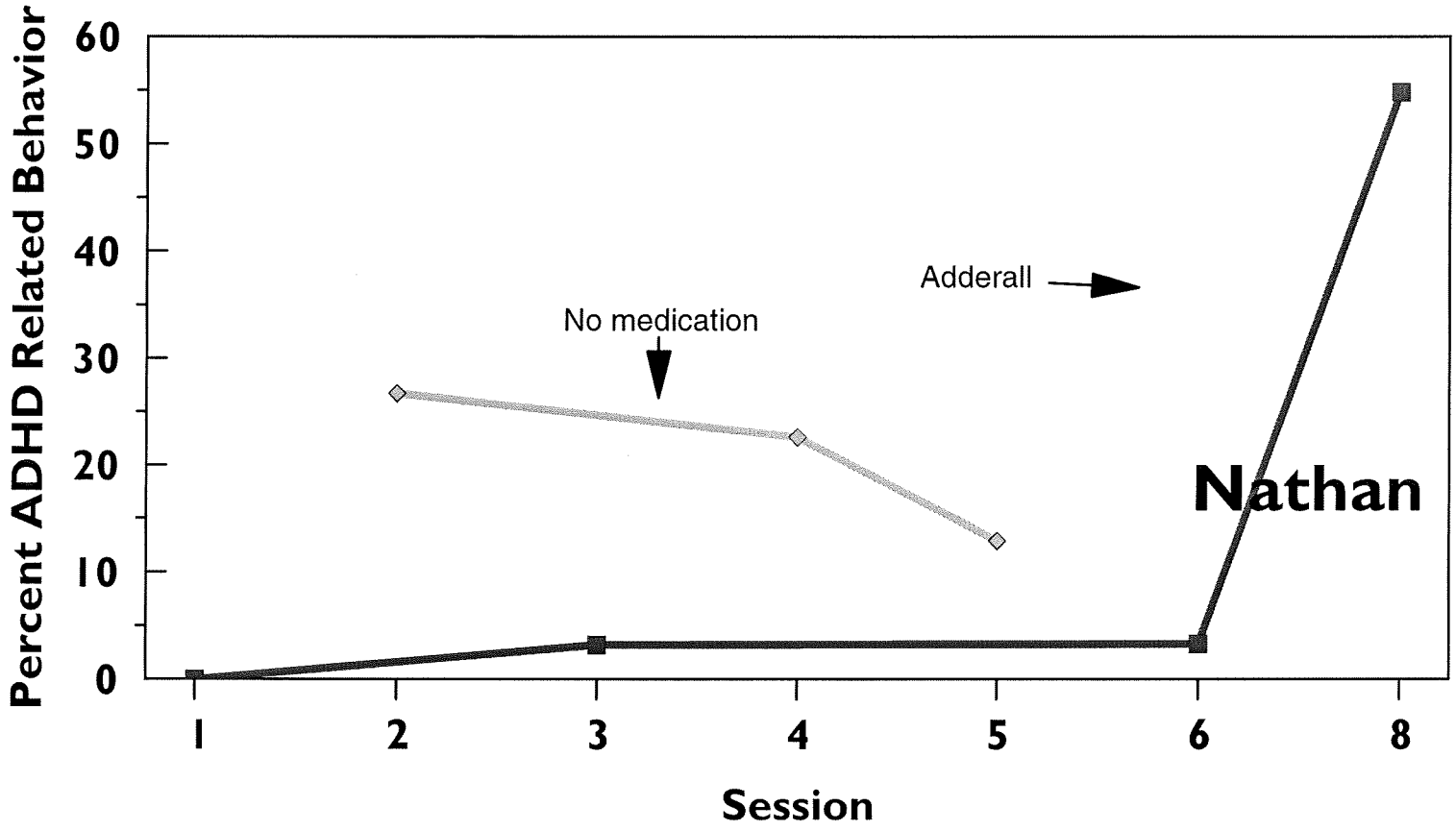

Percent ADHD Related Behavior
60
50
40
30
20
10
0
No medication
Adderall
Nathan
1
2
3
4
5
6
8
Session

Figure B

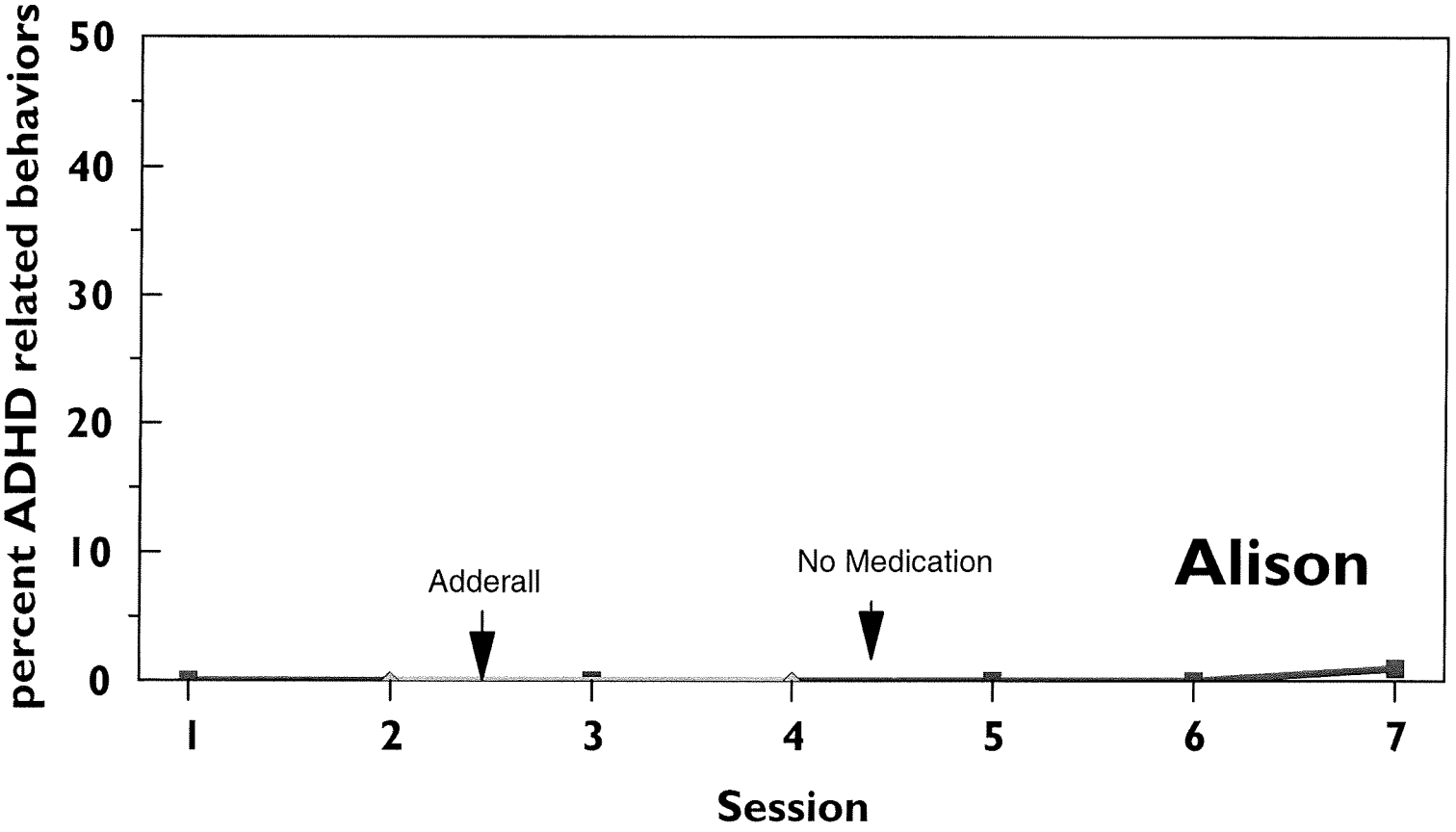

percent ADHD related behaviors
50
40
30
20
10
0
Adderall
No Medication
Alison
1
2
3
4
5
6
7
Session

Figure C

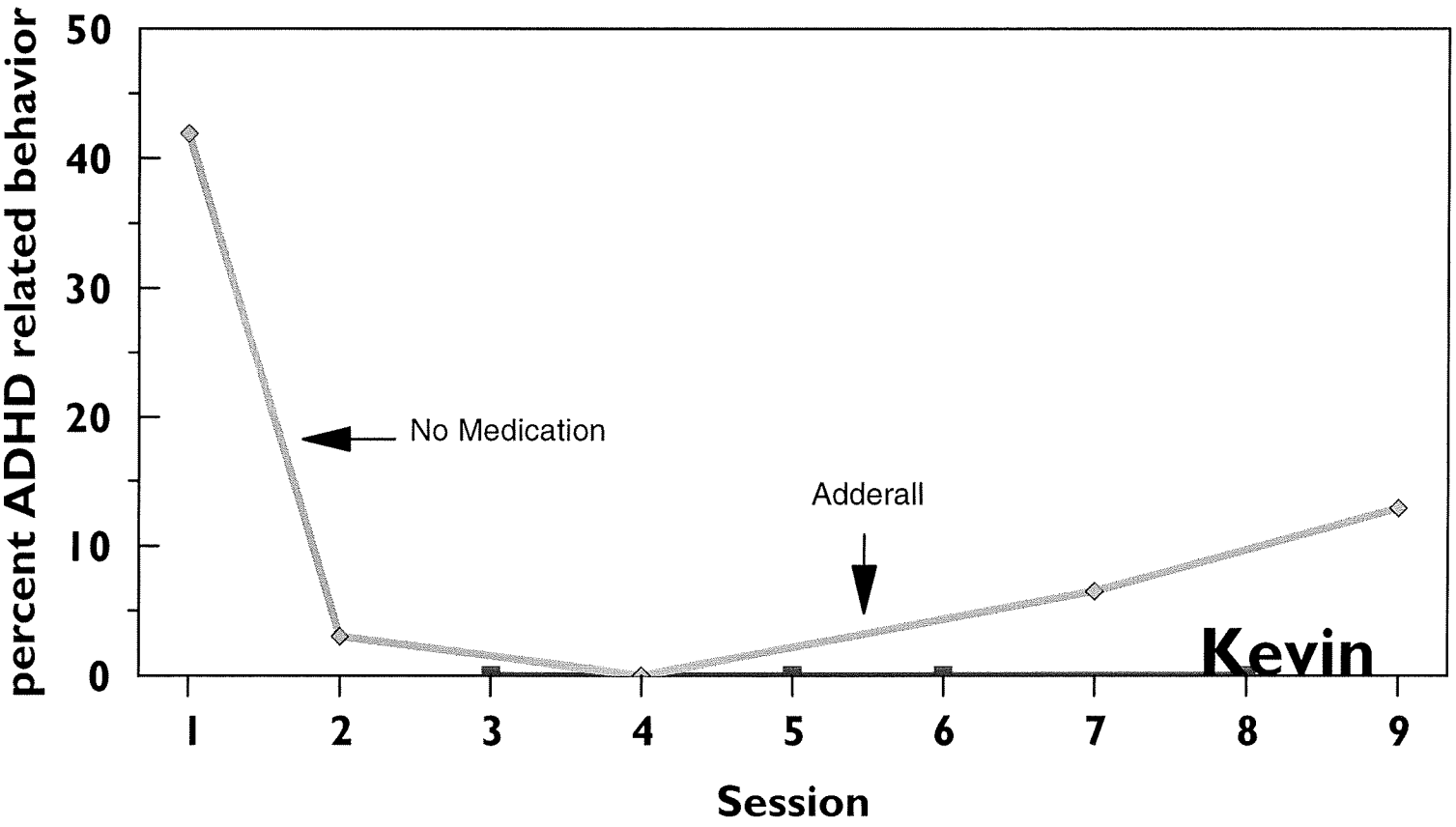

percent ADHD related behavior
50
40
30
20
10
0
No Medication
Adderall
Kevin
1
2
3
4
5
6
7
8
9
Session

Figure D

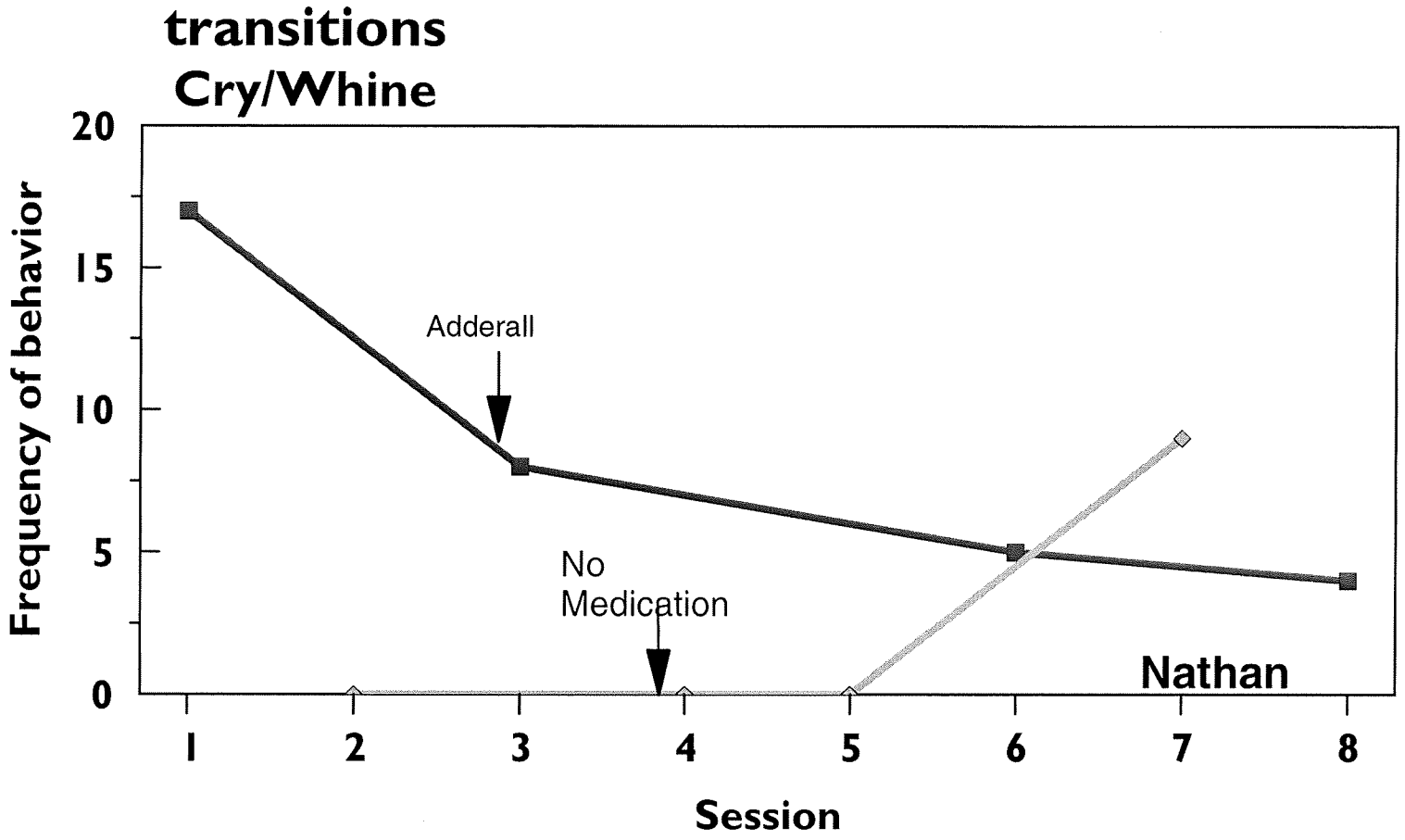

transitions
Cry/Whine
Frequency of behavior
20
15
10
5
0
Adderall
No
Medication
Nathan
1
2
3
4
5
6
7
8
Session

Figure E

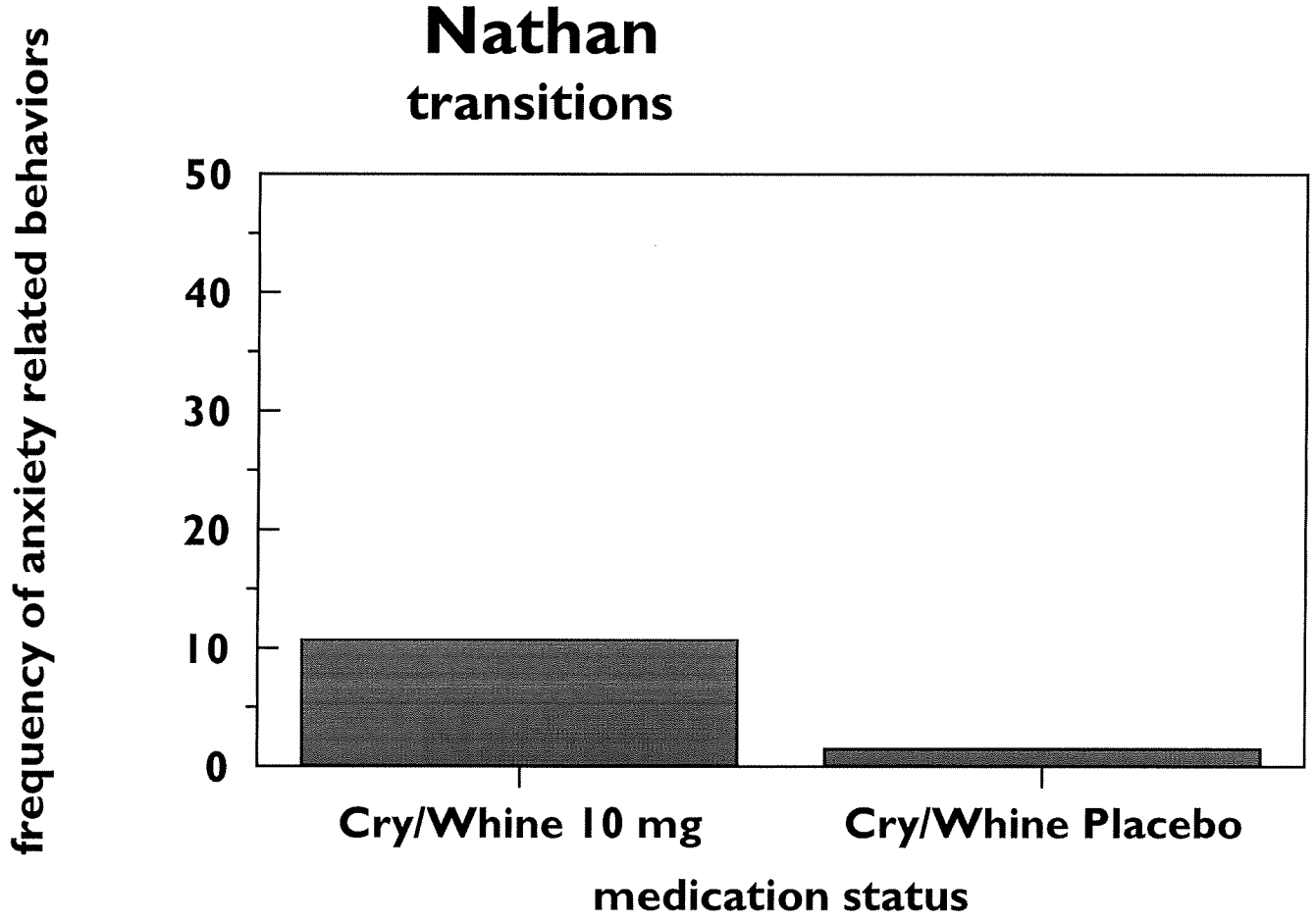

Nathan
transitions
frequency of anxiety related behaviors
50
40
30
20
10
0
Cry/Whine 10 mg
Cry/Whine Placebo
medication status

Figure F

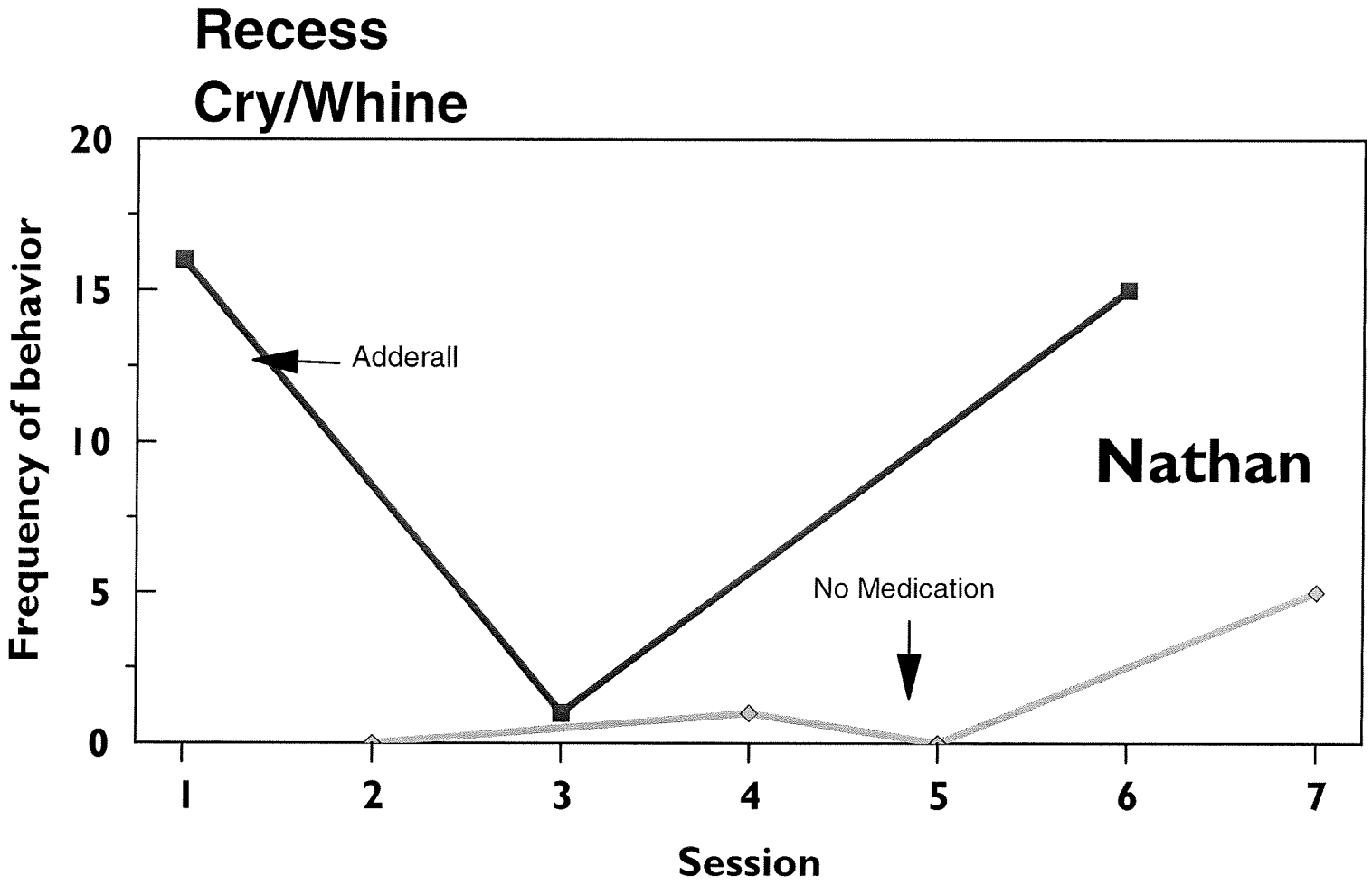

Recess
Cry/Whine
20
15
10
5
0
Frequency of behavior
Adderall
No Medication
Nathan
1
2
3
4
5
6
7
Session

Figure G

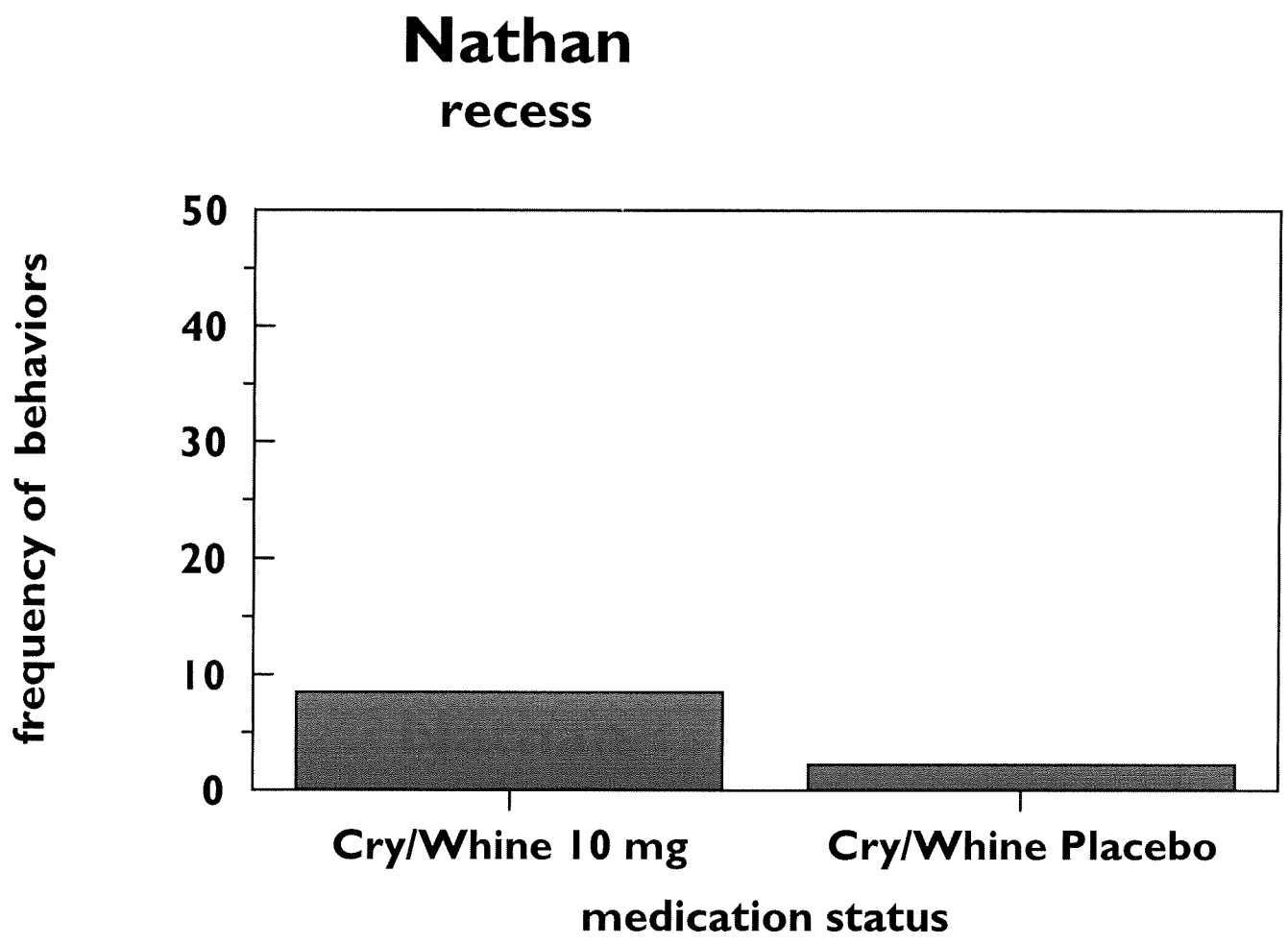

Nathan
recess
frequency of behaviors
50
40
30
20
10
0
Cry/Whine 10 mg
Cry/Whine Placebo
medication status

Figure H

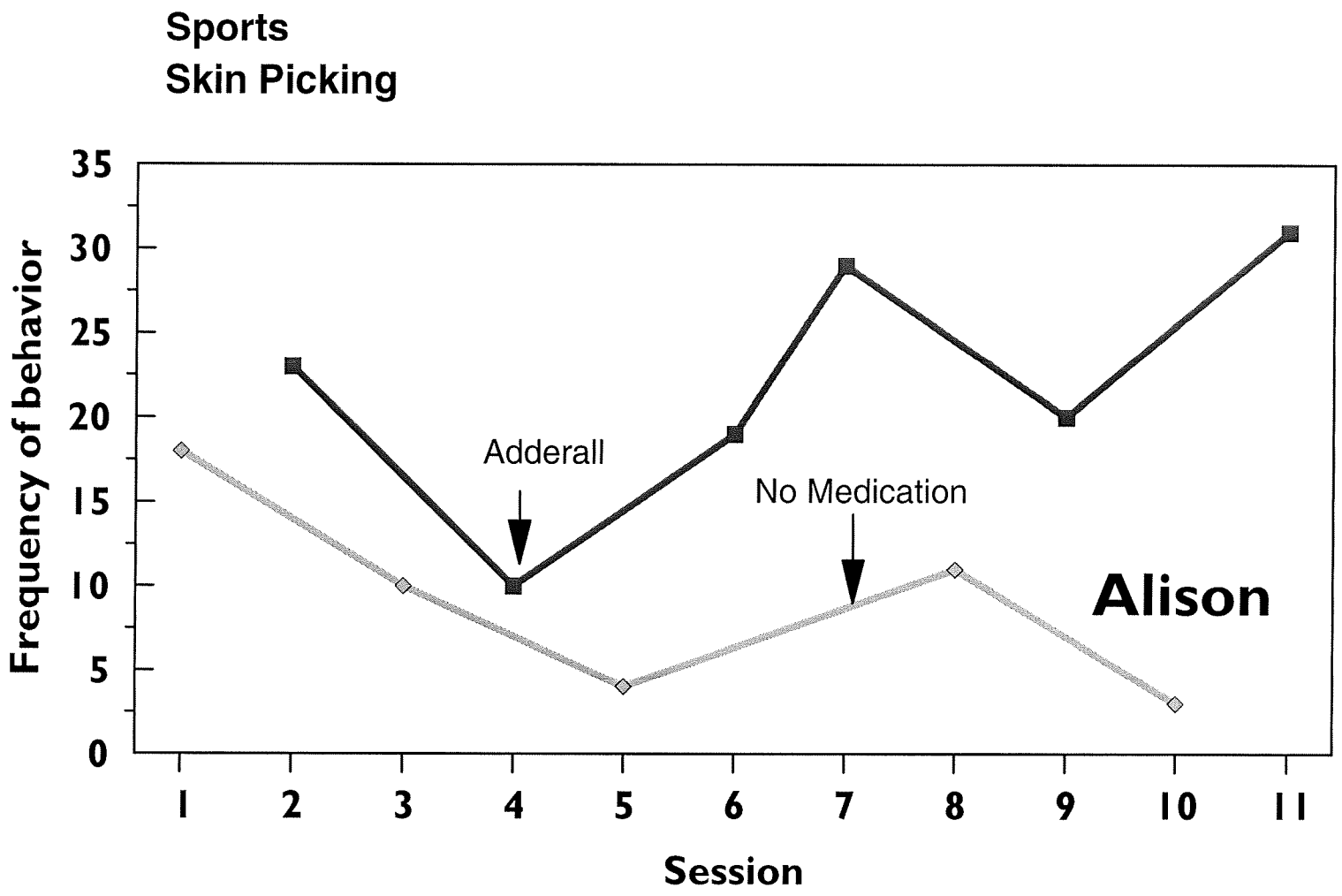

Sports
Skin Picking
Frequency of behavior
35
30
25
20
15
10
5
0
Adderall
No Medication
Alison
1
2
3
4
5
6
7
8
9
10
11
Session

Figure I

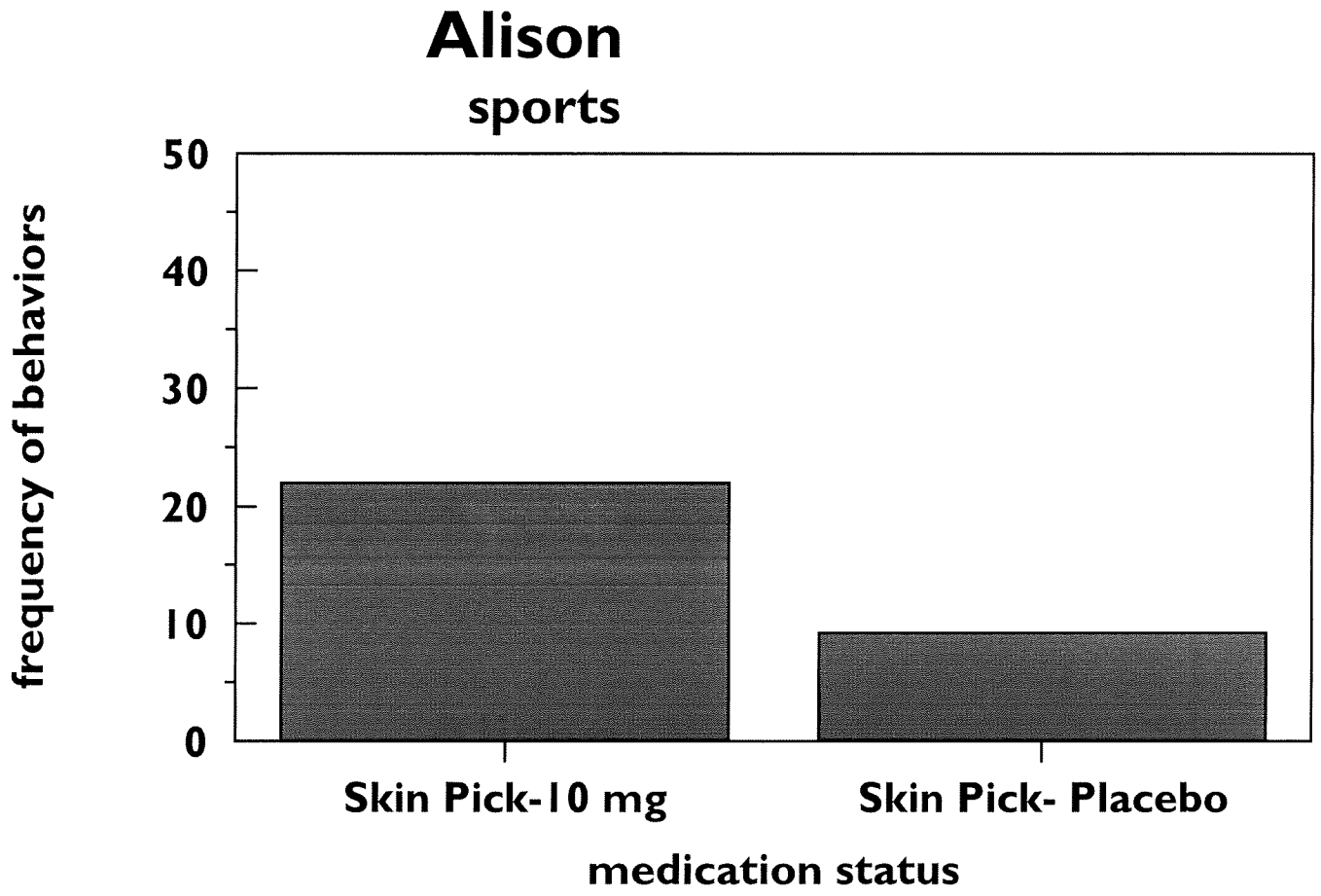

Alison
sports
frequency of behaviors
50
40
30
20
10
0
Skin Pick-10 mg
Skin Pick- Placebo
medication status

Figure J

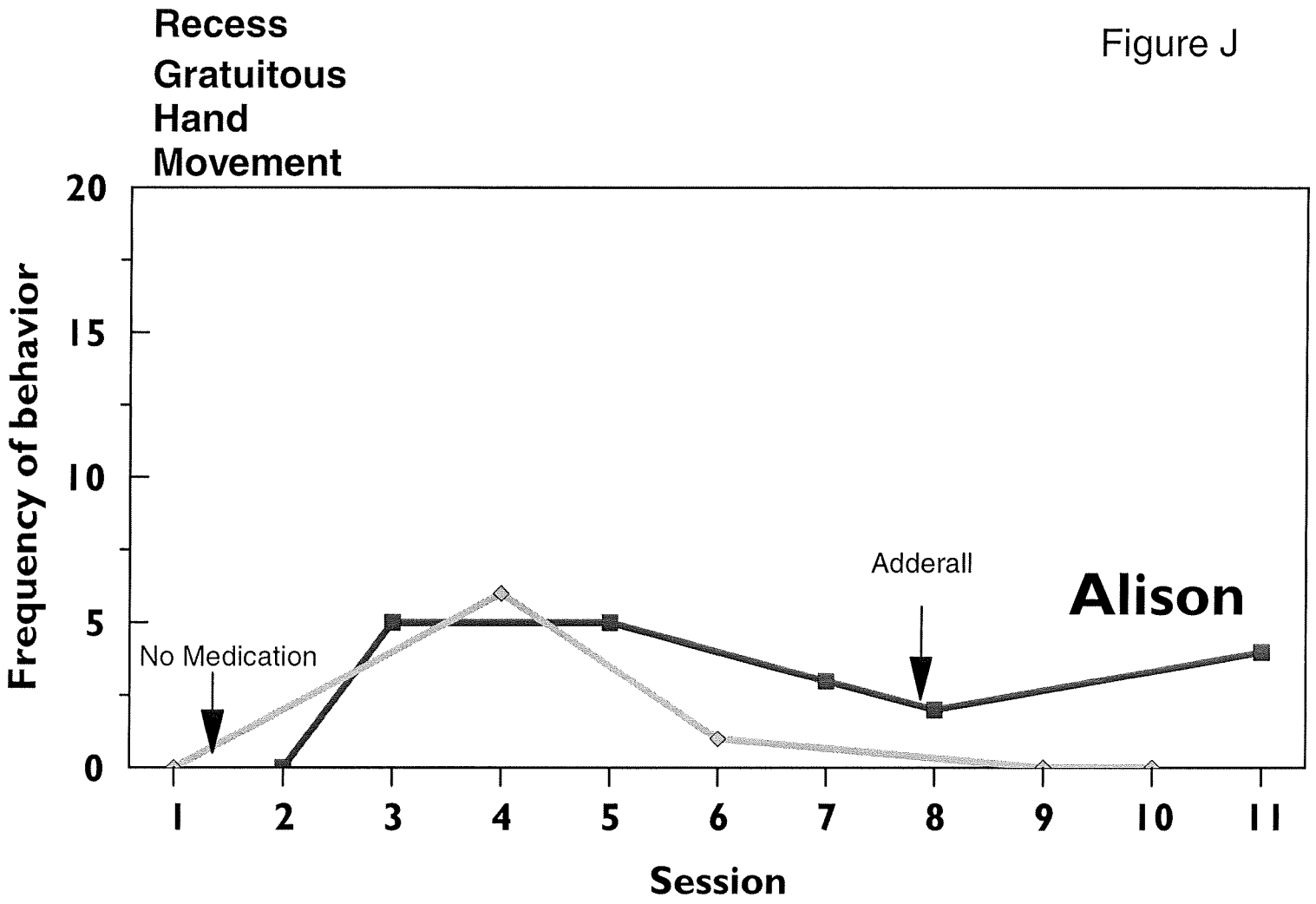
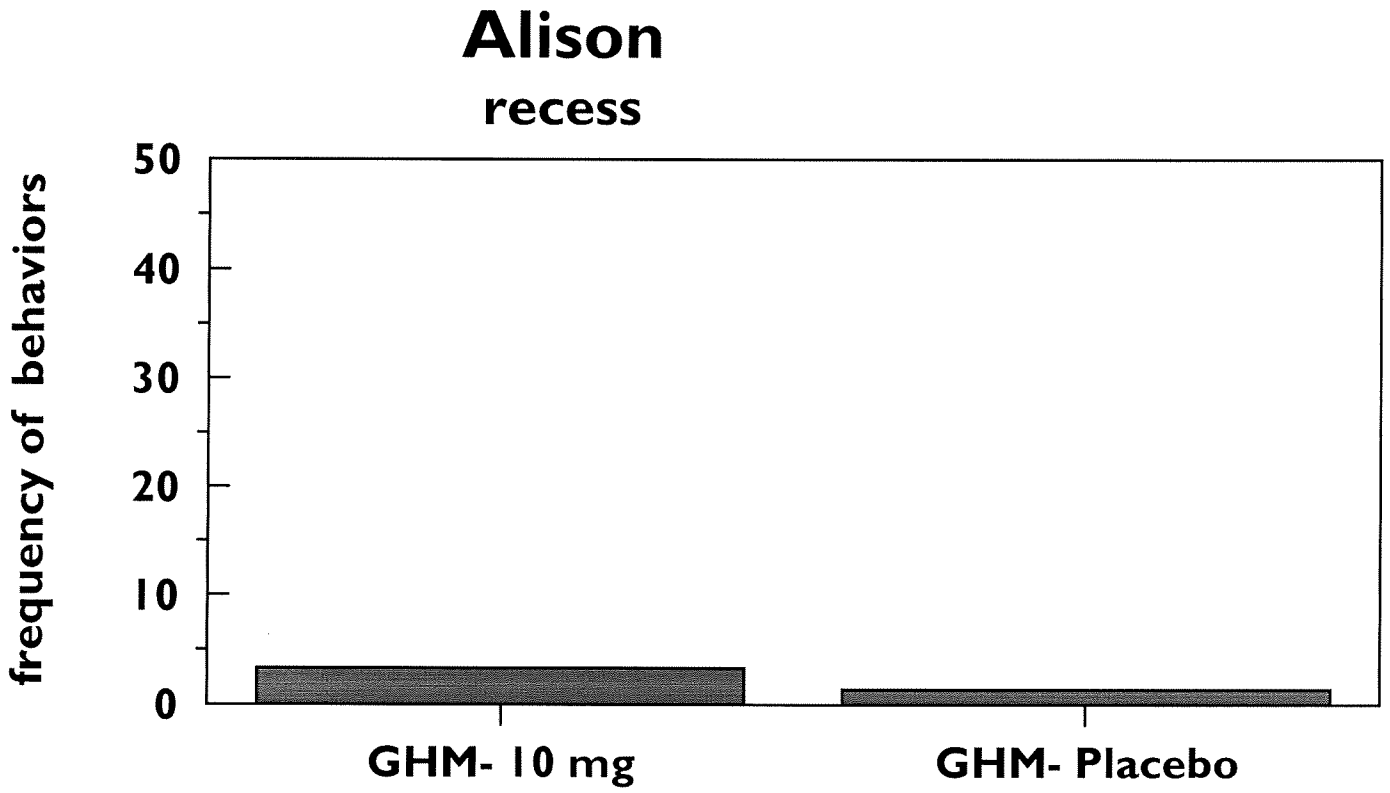

Recess
Gratuitous
Hand
Movement
Frequency of behavior
20
15
10
5
0
No Medication
Adderall
Alison
1
2
3
4
5
6
7
8
9
10
11
Session

Figure K



GHM= Gratuitous Hand Movement

Figure L

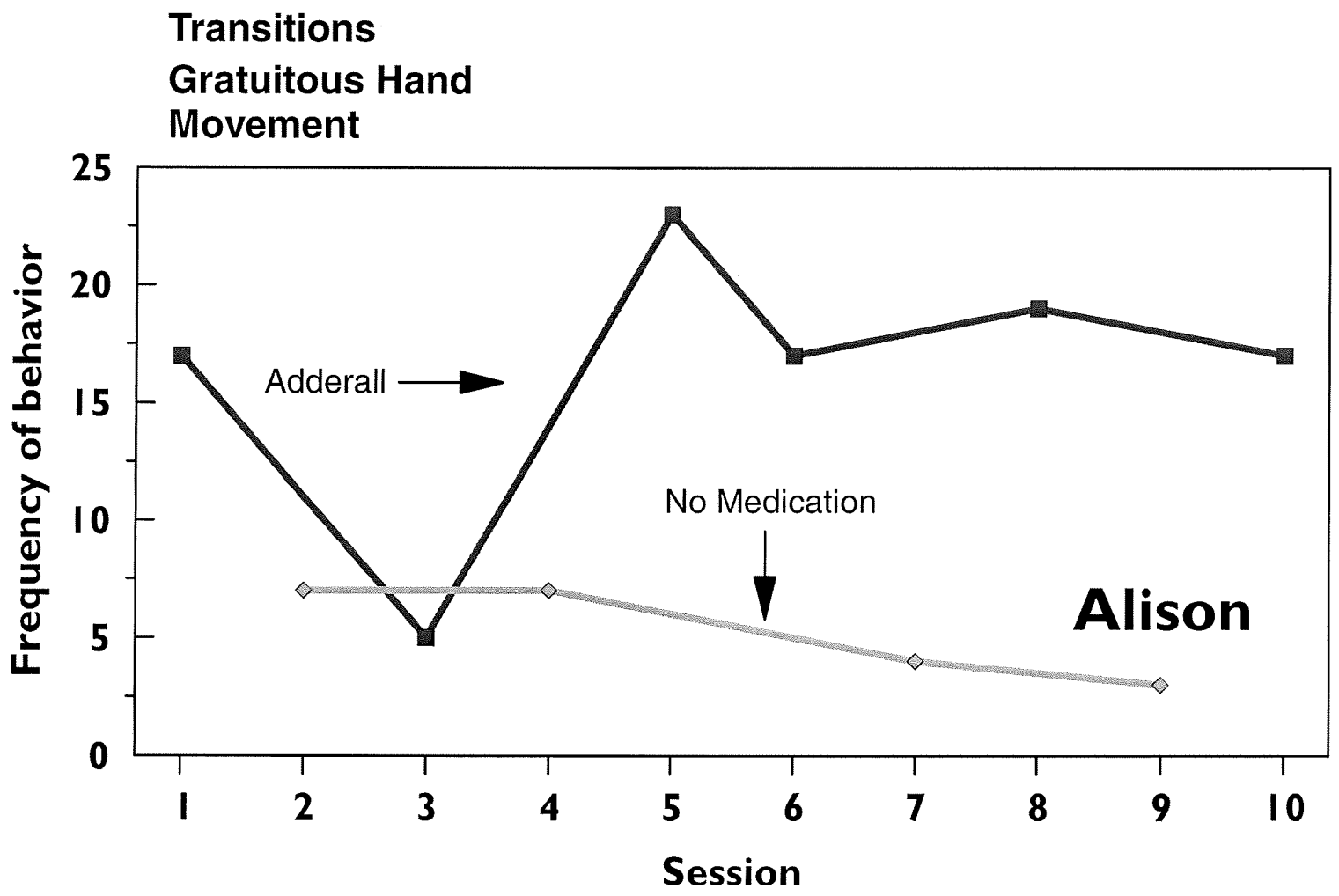
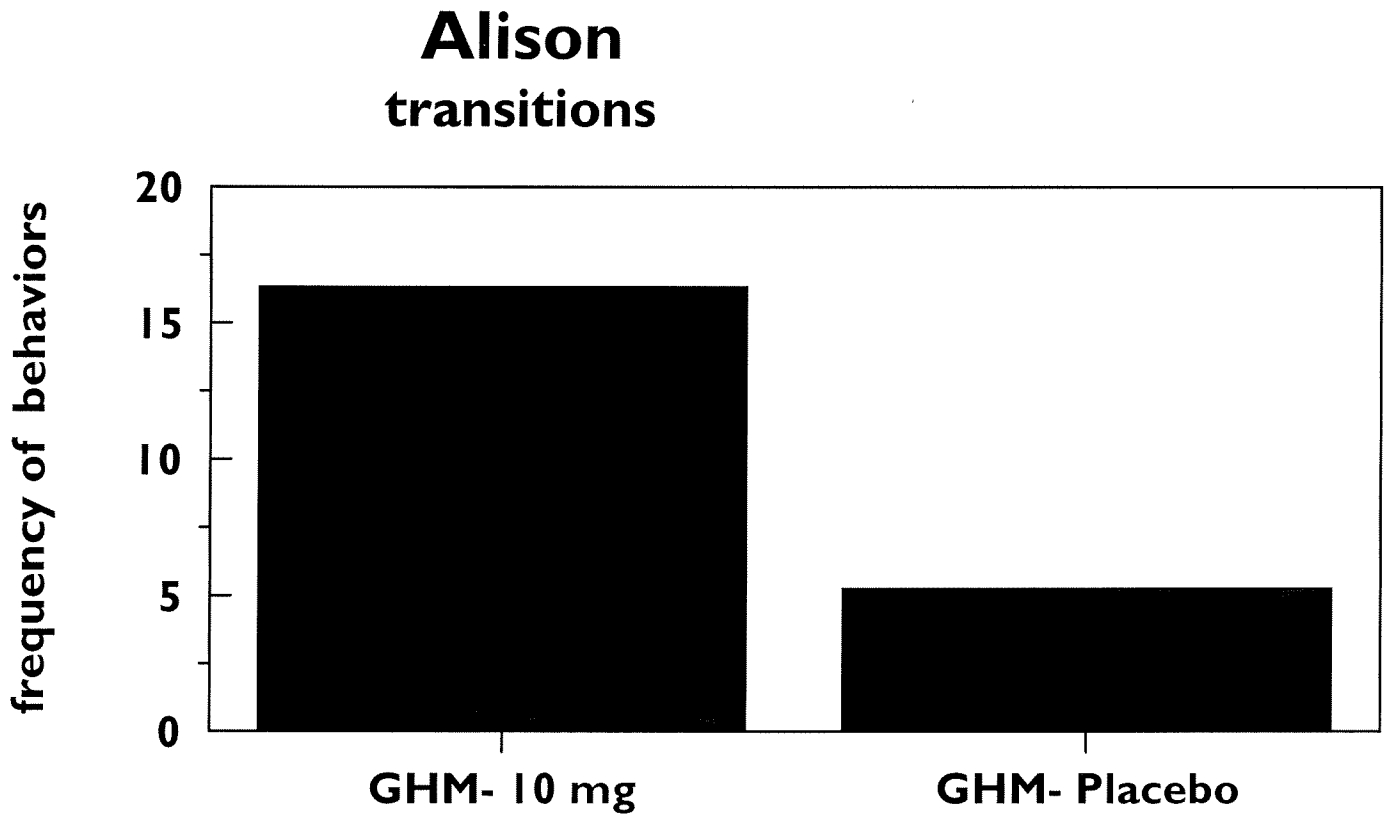

Transitions
Gratuitous Hand
Movement
Frequency of behavior
25
20
15
10
5
0
Adderall
No Medication
Alison
1
2
3
4
5
6
7
8
9
10
Session

Figure M



GHM= Gratuitous Hand Movement

Figure N

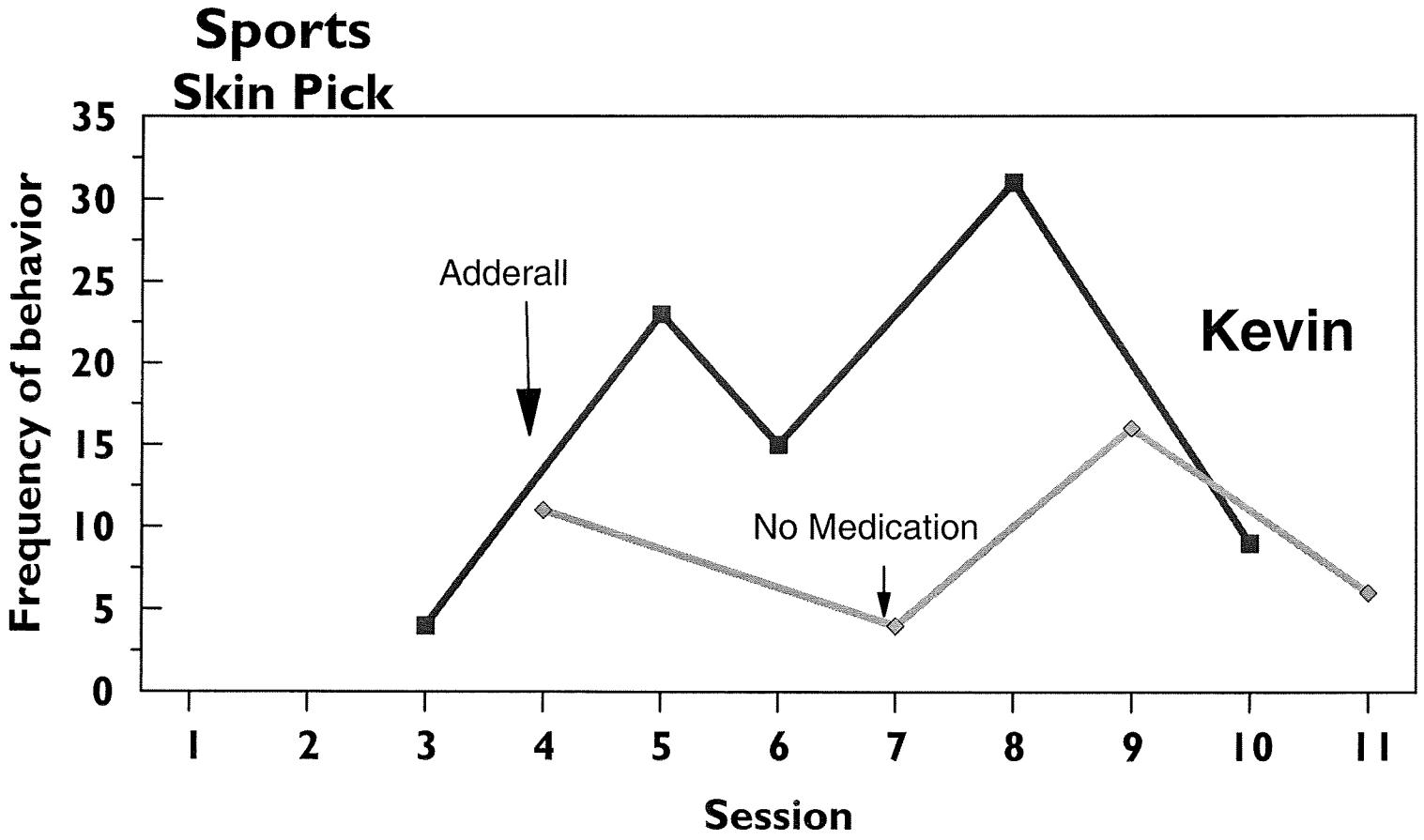

Sports
Skin Pick
Frequency of behavior
35
30
25
20
15
10
5
0
Adderall
No Medication
Kevin
1
2
3
4
5
6
7
8
9
10
11
Session

Figure O

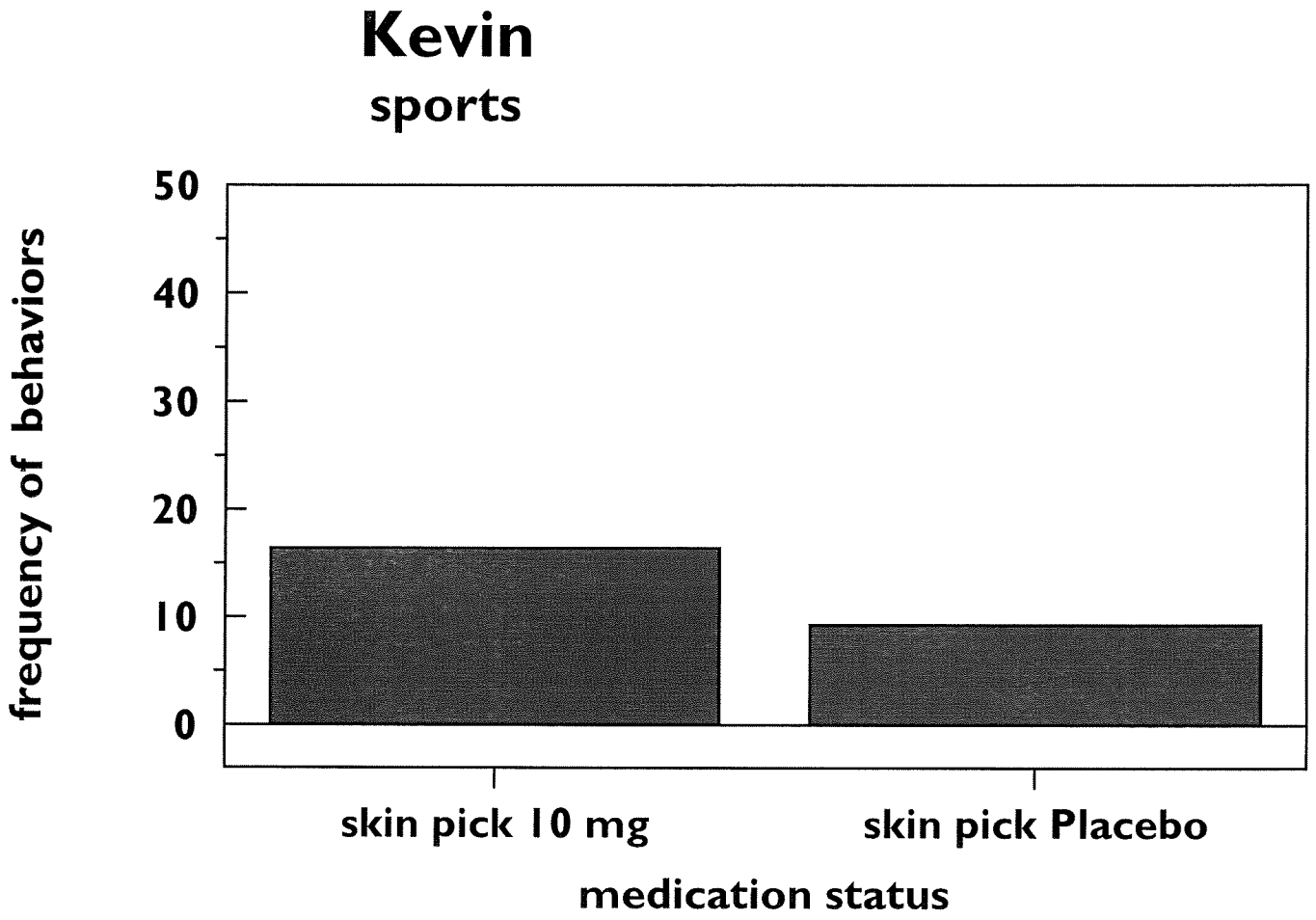

Kevin
sports
frequency of behaviors
50
40
30
20
10
0
skin pick 10 mg
skin pick Placebo
medication status

Figure P

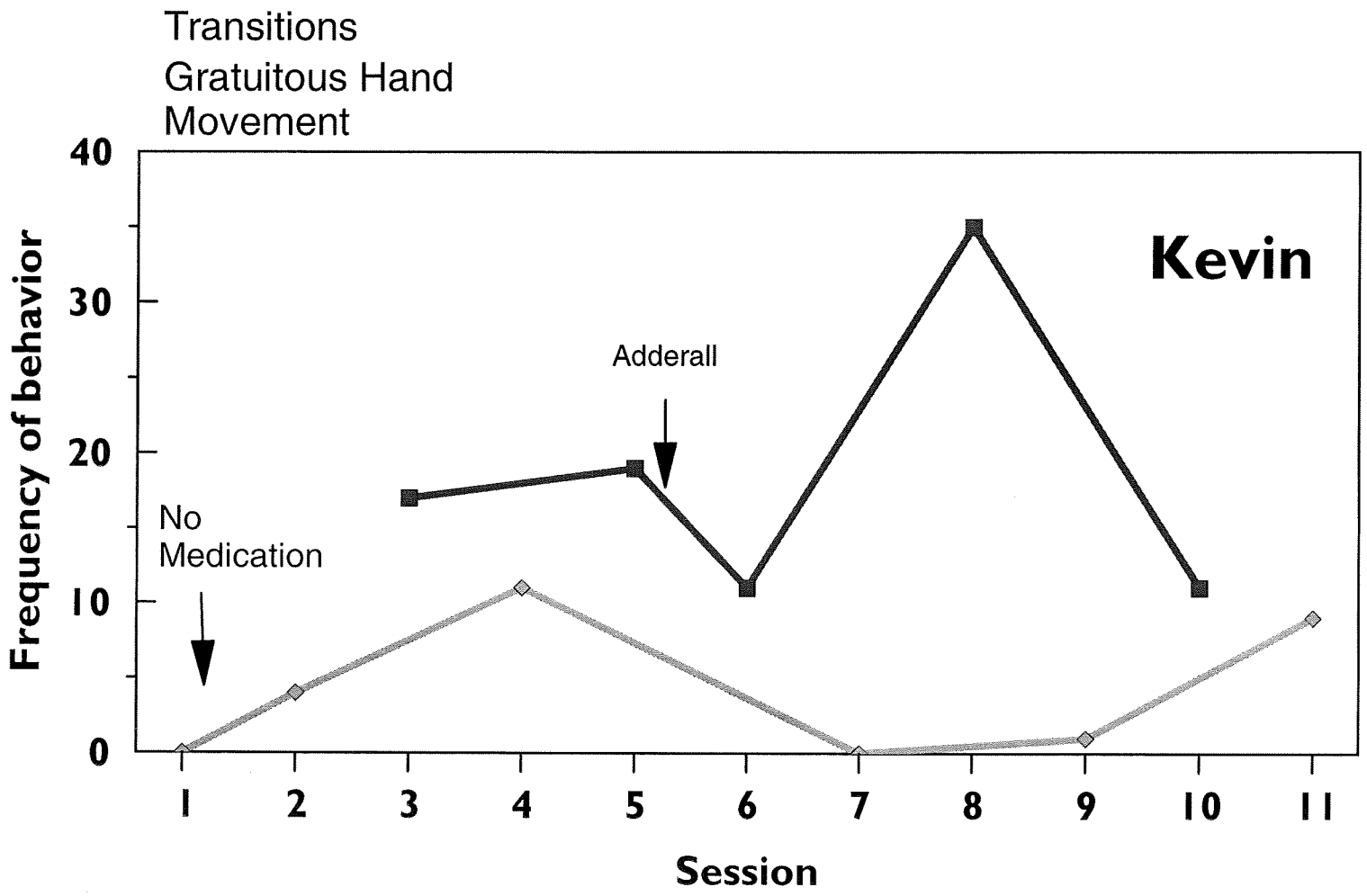
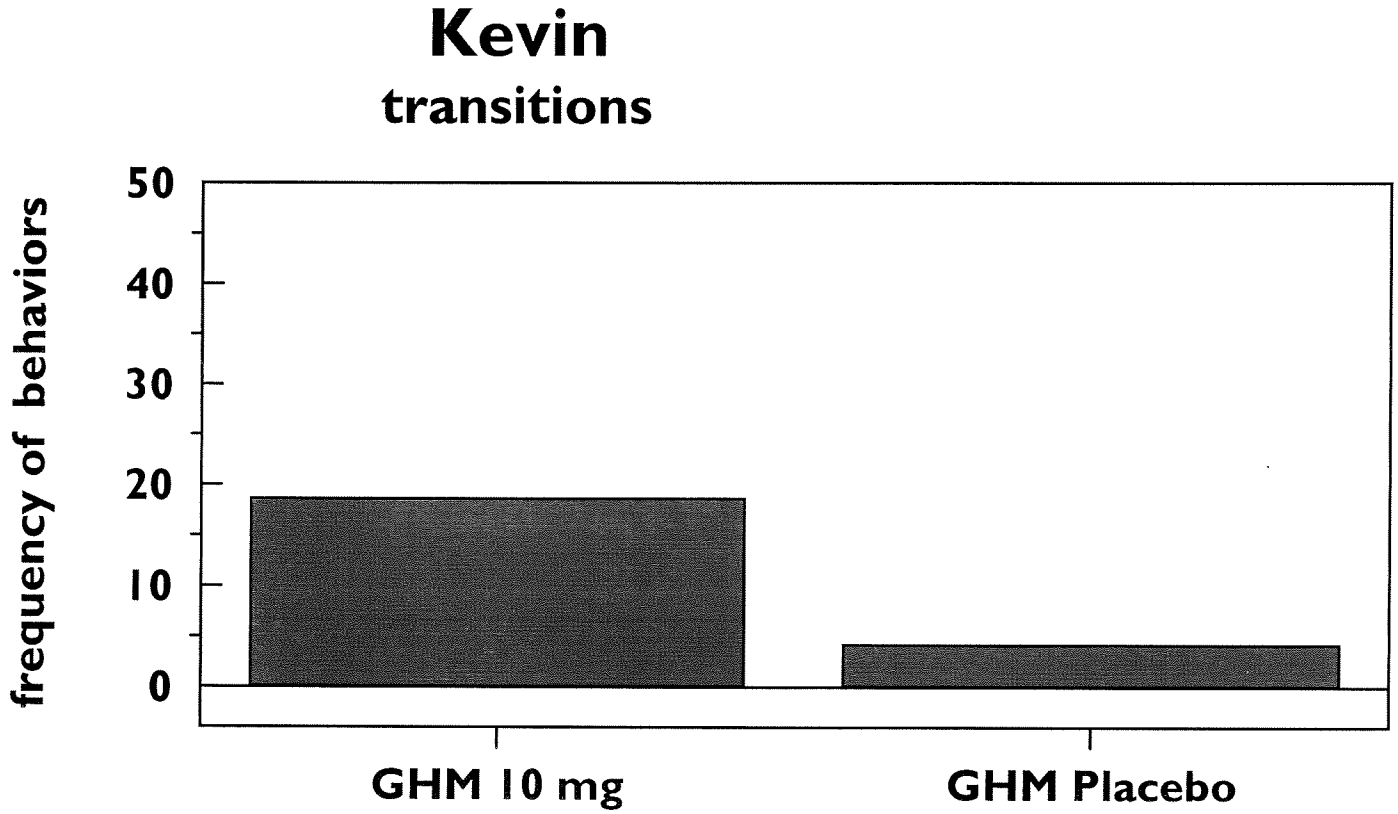

Transitions
Gratuitous Hand
Movement
Kevin
Adderall
No
Medication
Frequency of behavior
0
10
20
30
40
1
2
3
4
5
6
7
8
9
10
11
Session

Figure Q



GHM= Gratuitous Hand Movement

Discussion

We observed 3 children, ages 4-6 when they did and did not receive medication for the simultaneous occurrence of both Attention Deficit Hyperactivity Disorder (ADHD) and anxiety related behaviors. Children were observed while alternating between placebo and a 10-mg dose of Adderall during sports camp, transitions, and recess.

Nathan was the only child to show a difference between total anxiety behavior when he did and did not medication during transitions and recess. Nathan also showed an increase in crying and whining when he did receive medication during transitions and recess. Alison showed an increase in skin picking when she did receive medication during sports activity and an increase in gratuitous hand movement when she received medication during recess and transitions. Kevin showed an increase in skin picking during sports activity when he did receive medication as well as an increase in gratuitous hand movement during transitions when he did receive medication.

This study is unique in several ways. Few, if any, other studies have measured both ADHD-related behaviors and anxiety-related behaviors using direct observational methods. No other studies are known of which these behaviors were observed when children did and did not receive medication. In general, the use of observational methods to study anxiety in children was last used in 1978 (Glennon & Wiesz). Anecdotally, in this study, there were noticeable differences in the children's behavior when they did and did not receive medication. Informally, it was observed that the personalities of the children seemed to change noticeably.

There are also several implications of this study. One possible explanation of the

results is that the increase in anxiety related behaviors in children who did receive Adderall was a side effect of the medication. If so, parent and teacher diagnoses of anxiety would simply be observations of medication side effects. If these observations are not questioned, an inflated rate of comorbidity will occur. At the same time, perhaps the side effects exhibited by these children are more maladaptive than hyperactivity and impulsivity. We must ask ourselves at what point does medication cause these behaviors and are these behaviors worse than the original condition. We must investigate the effects stimulant medication has on each child individually before prescribing dosages. If a little medication helps, a larger dose may not be better.

Perhaps the behaviors displayed by the children are actually anxiety behaviors and not medication side effects. If this is the case, the use of stimulant medication in children displaying anxiety related behaviors must be questioned. Thus, studies that measure both ADHD related behaviors and anxiety related behaviors need to be conducted to thoroughly evaluate medication and other treatments. This is one of the few recent studies that suggests that while stimulant medication may be effective in lowering ADHD related behaviors, it may also increase some anxiety related behaviors in other settings. For these reasons, it is important that anxiety measures are routinely used in both research and applied assessment of medication effects across settings, behaviors, and dosages.

This study also has several limits. First, the observational definitions for anxiety-related behaviors and the behaviors themselves were come upon during the course of the study itself and therefore not tested thoroughly before its onset. As a result of the uncertainty in anxiety-related behaviors and their definitions, interrater reliability was not

as stable as hoped. Second, because of this uncertainty during the beginning of the study, the three checklists for anxiety during transitions, recess, and sports camp were not the same. Thirdly, only one dosage was used during this study, using a range of dosages would have allowed for a better dose-response curve. Finally, the amount of observational time in this study as well as the number of participants was insufficient to really study stable trends in behavior. Because of these limits, this study seems to be most useful if thought of as a pilot study to future research.

Future research in this area is most certainly needed. The effects of stimulant medication, as any other type of medication, on children should be a top research priority because of possible behavioral side effects. Future studies should allow primarily more time for observations. The time allotted to this study (three weeks) was barely enough to find specific anxiety related behaviors for each child and stable observational definitions for these behaviors. With more time, one could distinguish and define these behaviors, as well as the most likely times for them to occur, and design a standard checklist to be used across conditions. Also, after developing a standard checklist for anxiety-related behaviors, this checklist could be combined with an ADHD-related behavior checklist so that the two could be recorded at the same time by the same researcher.

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Appendix A

FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG
WD	WH	WD	WH	WD	WH	WD	WH	WD	WH	WD	WH
PER	SP	PER	SP	PER	SP	PER	SP	PER	SP	PER	SP
TS	CRY 1	TS	CRY 2	TS	CRY 3	TS	CRY 4	TS	CRY 5	TS	CRY 6
FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG
WD	WH	WD	WH	WD	WH	WD	WH	WD	WH	WD	WH
PER	SP	PER	SP	PER	SP	PER	SP	PER	SP	PER	SP
TS	CRY 7	TS	CRY 8	TS	CRY 9	TS	CRY 10	TS	CRY 11	TS	CRY 12
FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG
WD	WH	WD	WH	WD	WH	WD	WH	WD	WH	WD	WH
PER	SP	PER	SP	PER	SP	PER	SP	PER	SP	PER	SP
TS	CRY 13	TS	CRY 14	TS	CRY 15	TS	CRY 16	TS	CRY 17	TS	CRY 18
FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG
WD	WH	WD	WH	WD	WH	WD	WH	WD	WH	WD	WH
PER	SP	PER	SP	PER	SP	PER	SP	PER	SP	PER	SP
TS	CRY 19	TS	CRY 20	TS	CRY 21	TS	CRY 22	TS	CRY 23	TS	CRY 24
FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG
WD	WH	WD	WH	WD	WH	WD	WH	WD	WH	WD	WH
PER	SP	PER	SP	PER	SP	PER	SP	PER	SP	PER	SP
TS	CRY 25	TS	CRY 26	TS	CRY 27	TS	CRY 28	TS	CRY 29	TS	CRY 30
FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG
WD	WH	WD	WH	WD	WH	WD	WH	WD	WH	WD	WH
PER	SP	PER	SP	PER	SP	PER	SP	PER	SP	PER	SP
TS	CRY 31	TS	CRY 32	TS	CRY 33	TS	CRY 34	TS	CRY 35	TS	CRY 36
FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG
WD	WH	WD	WH	WD	WH	WD	WH	WD	WH	WD	WH
PER	SP	PER	SP	PER	SP	PER	SP	PER	SP	PER	SP
TS	CRY 37	TS	CRY 38	TS	CRY 39	TS	CRY 40	TS	CRY 41	TS	CRY 42
FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG
WD	WH	WD	WH	WD	WH	WD	WH	WD	WH	WD	WH
PER	SP	PER	SP	PER	SP	PER	SP	PER	SP	PER	SP
TS	CRY 43	TS	CRY 44	TS	CRY 45	TS	CRY 46	TS	CRY 47	TS	CRY 48
FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG
WD	WH	WD	WH	WD	WH	WD	WH	WD	WH	WD	WH
PER	SP	PER	SP	PER	SP	PER	SP	PER	SP	PER	SP
TS	CRY 49	TS	CRY 50	TS	CRY 51	TS	CRY 52	TS	CRY 53	TS	CRY 54
FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG	FAC	CLG
WD	WH	WD	WH	WD	WH	WD	WH	WD	WH	WD	WH
PER	SP	PER	SP	PER	SP	PER	SP	PER	SP	PER	SP
TS	CRY 55	TS	CRY 56	TS	CRY 57	TS	CRY 58	TS	CRY 59	TS	CRY 60

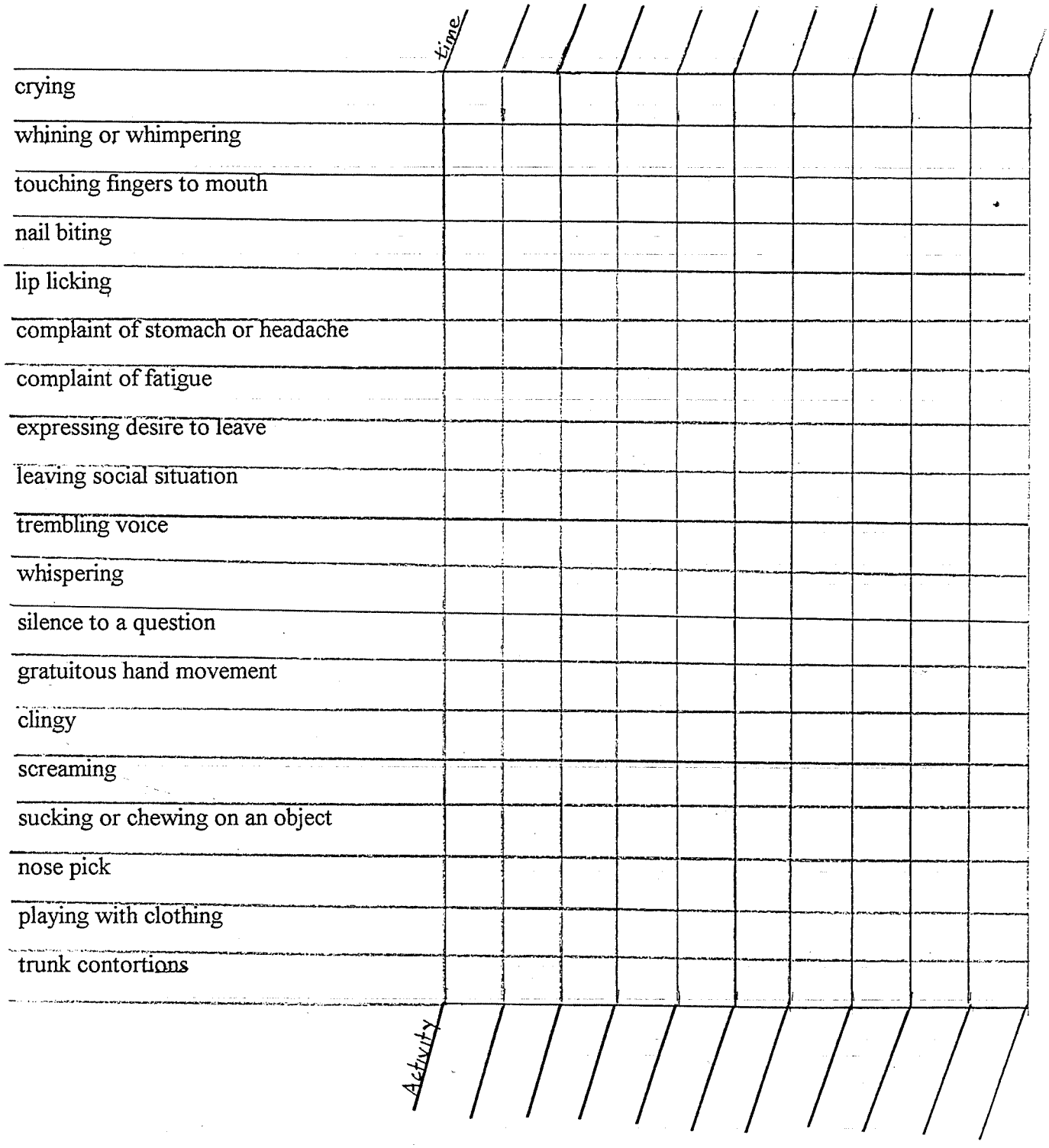
Child's name _____ Date _____

Observer _____ Time _____

Condition _____

Child: ~~**Observer:**~~ ~~**Date:**~~

Transition Checklist: (complete at these points: arrival, going to sports, returning from all ~~ADHD observations~~, ~~to~~ recess, ~~from~~ recess, leaving for the day).



Child: **Observer:** **Date:**

Time:

Recess Checklist: (frequency checklist)

crying

whining or whimpering

touching fingers to mouth

nail biting

lip licking

complaint of stomach or headache

complaint of fatigue

expressing desire to leave

leaving social situation

trembling voice

whispering

silence to a question

gratuitous hand movement

clingy

screaming

sucking or chewing on an object

nose pick

playing with clothing

trunk contortions

speaking with a peer

social withdrawal (write duration)