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## The Southern California Twin Register at the University of Southern California: II

Laura A. Baker<sup>1</sup>, Mafalda Barton<sup>1</sup>, Dora Isabel Lozano<sup>1</sup>, Adrian Raine<sup>1</sup>, and James H. Fowler<sup>2</sup>

*1 Department of Psychology, University of Southern California, United States of America*

*2 Department of Political Science, University of California, San Diego, United States of America*

### Abstract

The Southern California Twin Register was initiated in 1984 at the University of Southern California, and continues to grow. This article provides an update of the register since it was described in the 2002 special issue of this journal. The register has expanded considerably in the past 4 years, primarily as a result of recent access to Los Angeles County birth records and voter registration databases. Currently, this register contains nearly 5000 twin pairs, the majority of whom are school age. The potential for further expansion in adult twins using voter registration records is also described. Using the Los Angeles County voter registration database, we can identify a large group of individuals with a high probability of having a twin who also resides in Los Angeles County. In addition to describing the expansion of register, this article provides an overview of an ongoing investigation of 605 twin pairs who are participating in a longitudinal study of behavioral problems during childhood and adolescence. Characteristics of the twins and their families are presented, indicating baseline rates of conduct problems, depression and anxiety disorders, and attention-deficit/hyperactivity disorder diagnoses which are comparable to nontwins in this age range.

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The University of Southern California (USC) Twin Register<sup>1</sup> includes both adult and child twins, most of whom reside in Southern California. The register was initiated in 1984 by Laura Baker at USC, based on volunteer twins and their families recruited through advertisements, schools, and mothers of twins clubs. It was expanded in 2000 to 2003 to include a representative sample of school age twins obtained through the local school districts. An important feature of this sample is its ethnic and cultural diversity, which mirrors the current population in the State of California.

Details about the construction and composition of this register were provided in the previous special issue of this journal on twin registers (Baker et al., 2002). This article describes recent expansion of the twin register, along with an overview of a major longitudinal study of a representative sample of 605 twin pairs drawn from this register. Characteristics of the twins and their families are presented in this paper, as they provide normative data which we believe should generalize to the larger population in the entire register, and quite possibly to this birth cohort of twins in general. These data should be informative to other researchers using this twin register as a basis for drawing samples, and to twin researchers at large.

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Address for correspondence: Laura Baker, Department of Psychology, University of Southern California, Los Angeles, CA 90089-1061, USA. E-mail: lbaker@usc.edu

<sup>1</sup>The voter data is based on registered voters, not people who have (necessarily) voted. While there are some eligible who have not registered, motor voter laws ensure a very high rate of registration. People not included in the voter data file will mainly be youth, noncitizens, nondrivers, and felons, probably in that order.

## Update of the Register Since 2002

In the earlier article we reported basic demographic characteristics for 2601 twin pairs, whose birth years span over 70 years (about 1930–2000). The single largest 5-year cohort was 1991 to 1995 ( $n = 789$ ), representing about 28% of the entire register. The larger size of this younger cohort was due to the more recent recruitment efforts for school-age twins as part of a longitudinal twin study being conducted during the time of the earlier article (2000–2005). Since the publication of the earlier article, the register has been updated in three important ways. First, continued sampling from the school districts using the same procedures described in the 2003 paper resulted in an increase of the school-aged group of twins, who were the target population for an ongoing longitudinal study of twins. Second, information about the entire 1993–1995 birth cohort of twins has been obtained through the Los Angeles County Registrar. Third, the status of the older cohort of twins has been updated through (a) a mailing to request current contact information, and (b) searches for more recent addresses for twins in Los Angeles County via voter records. Details for both of these changes to the register are provided here, with updated descriptions for the entire register of twins. We also describe the potential for identifying new adult twin pairs, based on voter record information.

### Addition of the 1993–1995 Los Angeles County Birth Cohort

A computerized sort-match procedure was employed to identify twins from the birth records for this 3-year period, based on information including both the children's and mothers' birthdates and last names. The procedure was performed by programmers in the Los Angeles County registrar's office, providing a data file containing  $n = 12,477$  individuals. Further inspection of this file revealed several individuals who did not appear to be twins ( $n = 193$ , or 1.5% of total sample). After deleting these cases, the remaining cases included 6142 twin pairs, of which 98.3% ( $n = 6039$ ) had two live births. Among the living twin pairs, gender was distributed as follows:  $n = 2073$  male–male (34.3%),  $n = 2165$  female–female (35.9%),  $n = 1801$  male–female (29.8%). Average age of the mothers was 28.69 years ( $SD = 6.28$ ; range = 13–53). Mean birth weight for live-births was significantly different ( $F = 73.20$ ,  $df = 1, 12,108$ ,  $p < .001$ ) between girls (mean = 2384.49,  $SD = 596.59$ ,  $n = 6146$ ) and boys (mean = 2478.59,  $SD = 613.75$ ,  $n = 5964$ ).

The ethnic distributions of the mothers and fathers are provided in Table 1. The gender distribution of the birth cohort sample is comparable to that reported for twins located through school districts (Baker et al., 2002). As in the earlier school-based sample, the birth cohort shows an overrepresentation of Blacks and underrepresentation of Asians compared to Los Angeles County in general, which is most likely due to the different rates of twinning known in these two racial groups.

Los Angeles County voter records have also been obtained for seven elections during 2000 to 2004, and these have been used to obtain more recent contact information for the parents of the twins. Matching voter records to names and birth dates of each parent yielded a total of 1589 families with contact information (including at least an address, phone number, or e-mail address) for at least one parent. Gender distribution of the twin pairs whose parents were identified in the voter files was comparable to the larger cohort: 541 male–male (34.0%); 533 female–female (33.5%); 515 male–female (32.4%). Maternal age of the identified sample is somewhat older (mean = 30.16,  $SD = 6.29$ , range = 15–53 years old) compared to the general cohort. Black and White mothers were also more frequently represented among those matched to the registered voter file ( $n = 267$ , or 16.8% Black;  $n = 627$ , or 39.5% White), while Hispanic mothers were under-represented ( $n = 566$ , or 35.6%) compared to the larger cohort. Similar patterns were also found for fathers identified in the voter file ( $n = 269$ , or 16.9% Black;  $n = 625$ , or 39.3% White;  $n = 540$ , or 34.0% Hispanic). The somewhat older maternal age and

different racial distribution among both parents is likely due to lower voter registration among Hispanic groups and younger women in Los Angeles County.

### **Mailout to Twins and Merging Adult Files With Voter Records**

We have also made recent efforts to update the contact information for twins already in the USC register, that is, those described in the earlier article. First, a mailing (requesting current contact information) was sent to all adult twins who were recruited in the earlier sample, and who were believed to be living in the State of California. Addresses were updated according to information returned by the twins, as well as for those for whom envelopes were returned by the postal services indicating that the twins no longer resided at the address in our files. The voter records previously described in this paper were also used to update contact information for these adult twins. Based on these combined efforts, we estimate that current contact information is available for 888 adult twins, representing 81.5% of the original sample of 1089 adult twin pairs described in the 2002 paper.

Table 2 summarizes the current register size, based on the three expansion efforts, as well as the potential twin sample based on voter records, which is described as follows.

Potential for expansion of adult twin register. We used the Los Angeles County voter registration database to find three categories of individuals: (1) those with the same birth date, birth state, last name, and current address ( $N = 14,482$ ); (2) those with the same birth date, birth state, and current address but with a different last name ( $N = 27,245$ ); and (3) those with the same birth date, birth state, and last name, but with a different current address ( $N = 138,623$ ). Table 2 shows the age distribution of these individuals. For reference, we expect about 1% of the 3,787,319 registered voters to be twins, or about 38,000 total (although not all of these will have a twin who also resides in Los Angeles County). One caveat to consider for this recruitment strategy is that we only access registered voters.<sup>1</sup> However, motor voter registration laws (i.e., new state regulations arising from the National Voter Registration Act of 1993 which encouraged states to permit driver's registering for a driver's license to register to vote on the same document) have dramatically increased the rate of registration since most adults are now very likely to register when they acquire a driver's license. Another potential drawback is the use of last names — female twins who change their last name when they marry may be underrepresented as a result. However, the category 2 procedure will help to mitigate this problem somewhat since it does not rely on matching the last name. Given our success in using similar methods described above for finding current information for individuals already in the twin register, we believe these three categories will provide an excellent resource for recruiting additional adult twins.

### **Study Overview: Risk Factors for Antisocial Behavior**

The earlier article in the twin register issue provided a brief description of a major longitudinal study being conducted on a sample of twins recruited from the USC twin register. Since the time of that publication, the first two waves of this study have been completed. A detailed description of the cohort ( $n = 605$  twin pairs) involved in this study is provided here, along with several preliminary findings pertaining to the characteristics of the children and their families. Given the community nature of this sample, and its unique ethnic and socioeconomic diversity compared to other twin studies, some of these characteristics may serve as normative descriptions of this representative urban sample.

The first and second wave assessments included extensive cognitive, behavioral, and psychophysiological assessments of each child, based on individual testing and interviews of the child and primary care-giver during laboratory visits, as well as surveys completed by teachers through the mail. We employed a wide range of antisocial behavior (ASB) measures

in this study from each informant. Social risk factors were also assessed, including aspects of the home, such as socioeconomic status, parental warmth and affection, parental supervision, discipline and control. Specific environmental factors for each twin were also studied, including individual relationships with each family member, as well as peer-group characteristics. In addition, biological risk factors were assessed, which included psychophysiological indicators of arousal (both electrodermal and cardiac channels), brain activity (both EEG and ERP measures) as well as neuropsychological and cognitive variables. Assessments of other potentially relevant behaviors, such as childhood history of attention-deficit/hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD), depression and anxiety, and substance use were also obtained. The various measures employed at Waves 1 and 2 are listed in Table 2.

## Subjects

Qualifications for participants in the Risk Factors for Antisocial Behavior (RFAB) study were based on age of the twins (9 or 10 years old at the time of the first assessment), their English proficiency (see below), and availability to participate in a 6- to 8-hour laboratory assessment at USC on any day of the week. In addition, the twins' primary caregiver was required to speak either English or Spanish fluently. Child interviews were conducted in English only, while caregiver interviews were conducted in either English or Spanish.

## Assessment of English Proficiency in Twins

Given the large number of tasks and self-reported information required from each twin during the course of this study, it was important that the twins both speak and read English with a certain degree of fluency. Therefore, after agreeing to participate in the study English proficiency scores for twins from Spanish-speaking families were obtained (with parental consent) from the bilingual coordinator in each twins' school. Achievement levels in English proficiency were obtained by reviewing each child's English Language Development score (ELD) or by reviewing their percentiles and stanines in the reading and language subtests on the Stanford 9 or California Achievement Test (CAT) 6. English proficiency scores (ELDs) had a possible range from 1 to 5 (1 = *not able to speak English*; 2 = *able to speak English but with difficulty*; 3 = *speaks English fluently*; 4 = *speaks English very fluently*; 5 = *mastery of the English language*). A minimum ELD score of 3 was required for a child to participate in the study. Even if initial criteria were met, any child whose English proficiency was discovered to be inadequate during their laboratory visit (usually during the consent procedure) was sent home (with small compensation for travel and time). For purposes of participation, both twins were required to meet these standards.

## Laboratory Visit Protocol

The child and caregiver interviews were conducted during a 6- to 8-hour visit to the USC laboratories. The visit was divided into two 3 to 4 hour parts conducted separately in morning and afternoon sessions, with a 45-minute break for lunch in between sessions. Part I included behavioral interviews as well as neurocognitive testing and social risk factor assessment. Part II involved a 2.5-hour psychophysiological assessment, including autonomic (electrodermal and cardiac) and brain (EEG and ERP) measures. One twin would be tested on Part I, while the other would participate in Part II. After lunch, the twins would switch. The order of which twin was to participate in Parts I and II was randomly selected before the families arrived at the laboratory. Both twins were administered the tasks within Part I and Part II in the same order. Cheek swab samples were also collected from the participating families in order to extract DNA and test for zygosity.

During the day while the twins were being assessed, the caregivers were also asked to participate in an extensive interview process that included questions about their own behavior

(including personality and antisocial behavior), substance use, marital satisfaction, as well as detailed information about the twins' behaviors (at home and at school) and the qualities of their own relationship to each twin, including affection, conflict, and discipline. The parents were offered group summaries of study results, in addition to individual reports of their twins' zygosity and cognitive testing results. The families were also compensated (\$100) for their visit to USC, with an additional \$25 bonus for arriving on time at their first scheduled appointment (i.e., without prior cancellation or rescheduling within 24 hours of an appointment).

Examiners consisted of full- or part-time staff members with a BA degree or higher, as well as USC graduate students and upper-class undergraduates. All examiners were rigorously trained on the psychophysiological and neuropsychological testing procedures and in the administration of the behavioral interviews. Training included interexaminer reliability checks, videotaped monitoring to ensure strict adherence to standardized testing protocols, and supervised training sessions for all aspects of testing.

All child interviews were conducted in English, while caregiver interviews were conducted in either English ( $n = 492$ ; 81.3%) or Spanish ( $n = 113$ ; 18.7%), depending on the language preference of the participant. Less than half of Hispanic caregivers (44.0%) preferred the interview in Spanish.

### Teacher Surveys

With parental permission, the twins' teachers were also contacted via mail to fill out comprehensive questionnaires about the twins' behaviors at school and in the classroom. The teachers were sent an extensive diagnostic questionnaire packet, which assesses the twins' behavior in school as well as ADHD symptoms (DuPaul, 1990), emotion regulation symptoms (Shields & Cicchetti, 1995), and the twins' internalizing and externalizing behavioral symptoms (Child Behavior Checklist and Teacher Report Form, CBCLTRF). The teachers were asked to complete these surveys and return them in prepaid, addressed envelopes. Excluding pairs ( $n = 15$ ) who were either home-schooled or for whom parents felt the teachers did not know their children well enough to rate their child, there was a 60% individual return rate for teacher surveys. Approximately 30% of the total sample were in the same classroom, and thus had one teacher provide ratings of both twins in the same family.

### Descriptive Statistics: Behavior Problems

The mean symptom counts and prevalence rates in the twins are presented in Table 3 for conduct disorder (CD), ODD, ADHD, major depressive disorder (MDD), and generalized anxiety (GA), separately for boys and girls. Both caregiver and youth report versions are included for CD. Mean sex differences were tested for both symptom counts and rates of diagnoses. In order to take into account the dependent observations that result in twin studies (i.e., two children per family), multilevel modeling was also used to test for mean sex differences using PROC MIXED in SAS (1997), as outlined by Singer (2003). There are significant sex differences ( $p < .05$ ) for CD symptoms in both youth and parent reports, as well as for ODD and ADHD symptoms (both inattention and hyperactivity/impulsivity) assessed through parent report. As expected, ODD was diagnosed at a higher rate than CD:  $n = 70$  boys (11.9%) and  $n = 49$  girls (8.1%). Both ODD and CD prevalence rates in this ethnically diverse, community sample are comparable to those reported in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; DSM-IV; American Psychiatric Association, 1994).

The diagnosis of ADHD from caregiver reports in this sample occurred in frequencies comparable to population prevalence rates: 15.0% in boys ( $n = 88$ ) and 7.9% in girls ( $n = 48$ ) for any type, with slightly greater numbers of Inattention Only subtype, particularly in boys



(see Table 4). Prevalence rates for other diagnoses of internalizing disorders also appear comparable to population rates in children both for major depression ( $n = 5$  boys, 0.9%;  $n = 11$  girls, 1.8%), as well as GA disorder ( $n = 17$  boys, 2.9%;  $n = 18$  girls, 3.0%).

## Summary

The Southern California Twin register has expanded considerably since first presented in the 2002 paper. Expansion occurred in the school district sample (from  $n = 1512$  pairs in 2002 to  $N = 2136$  pairs in 2006), and the availability of county birth records and voter registration information provided an additional 1589 twin pairs in a narrow age range (born between 1993 and 1995). Voter registration information has also proved to be a valuable resource in finding current contact information for both adult twins and parents of child twins. Moreover, the potential for expanding the adult register using voter records alone appears to be enormous.

Based on a comprehensive study of 605 twin pairs (born between 1990 and 1995), we have further established normative data for the children and their families, both in terms of mental health status of the twins as well as ethnic and socioeconomic characteristics of the families. The twin register at USC remains an important resource for studying a wide range of outcomes in a representative sample of an urban population.

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## References

- Achenbach, TM. Manual for the Child Behavior Checklist/4–18. University of Vermont Department of Psychiatry; Burlington, VT: 1991.
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed.. Author; Washington, DC: 1994.
- Axelrod, BN.; Woodard, JL.; Henry, RR. Wisconsin Card Sorting Task-Revised 64 Card Version. Psychological Assessment Resources Inc; Florida: 1992.
- Baker LA, Barton M, Raine A. The Southern California Twin Register at the University of Southern California. *Twin Research* 2002;5:456–459. [PubMed: 12537876]
- Bechara A, Damasio H, Tranel D, Damasio AR. Deciding advantageously before knowing the advantageous strategy. *Science* 1997;275:1293–1294. [PubMed: 9036851]
- Berry, RJA.; Porteus, SD. Porteus Maze Tests. Psychological Corporation; New York: 1920.
- Cherek DR, Moeller FG, Schnapp W, Dougherty DM. Studies of violent and nonviolent male parolees: I. Laboratory and psychometric measurements of aggression. *Biological Psychiatry* 1997;41:514–522. [PubMed: 9046983]
- Cloninger, CR. TCI -The Temperament and Character Inventory (TCI). A Guide to its development and use. Center for Psychobiology of Personality, Washington; St. Louis: 1987.
- Cockburn MG, Hamilton AS, Zadnick J, Cozen W, Mack TM. Twins as Willing Research Participants: Successes From Studies Nested Within the California Twin Program. *Twin Research and Human Genetics* 2006;9:927–932. [PubMed: 17254432]
- Deater-Deckard K. Within family variability in parental negativity and control. *Journal of Applied Developmental Psychology* 1996;17:407–422.
- Derogatis LR, Melisaratos N. The Brief Symptom Inventory: An introductory report. *Psychological Medicine* 1983;13:595–605. [PubMed: 6622612]
- DuPaul, GJ. The ADHD Rating Scale: Normative data, reliability and validity. University of Massachusetts Medical Center at Worcester; 1990. Unpublished manuscript

- Gatz M, Fratiglioni L, Johansson B, Berg S, Mortimer JA, Reynolds CA, Fiske A, Pedersen NL. Complete ascertainment of dementia in the Swedish Twin Registry: The HARMONY study. *Neurobiology of Aging* 2005;26:439–447. [PubMed: 15653172]
- Kerr M, Stattin H. What parents know, how they know it, and several forms of adolescent adjustment: Further support for a reinterpretation of monitoring. *Developmental Psychology* 2000;36:366–380. [PubMed: 10830980]
- Luby JL, Svrakic DM, McCallum K, Pryzbeck TR, Cloninger CR. The Junior Temperament and Character Inventory: Preliminary validation of a child self-report measure. *Psychological Reports* 1999;84:1127–1138. [PubMed: 10477935]
- Lynam DR. Pursuing the psychopath: Capturing the fledgling psychopath in a nomological net. *Journal of Abnormal Psychology* 1997;106:425–438. [PubMed: 9241944]
- Pang Z, Ning F, Unger JB, Johnson CA, Wang S, Guo Q, Cao W, Lee L. The Qingdao Twin Registry: A Focus on Chronic Disease Research. *Twin Research and Human Genetics* 2006;9:758–762. [PubMed: 17254404]
- Partington, JE.; Leiter, RG. Halstead-Reitan Trail Making Test. Reitan Neuropsychology Laboratory; Arizona: 1949.
- Petersen AC, Crockett L, Richards M, Boxer A. A self-report measure of pubertal status: Reliability, validity, and initial norms. *Journal of Youth and Adolescence* 1988;17:117–133.
- Pokorny AD, Miller BA, Kaplan HB. The brief MAST: A shortened version of the Michigan Alcoholism Screening Test. *American Journal of Psychiatry* 1972;129:342–345. [PubMed: 5053717]
- Raine A, Dodge K, Loeber R, Reynolds C, Loeber M. Proactive and reactive aggression in adolescents: Development of a self-report scale and initial construct validity. *Aggressive Behavior* 2006;32:159–171.
- SAS Institute, Inc.. SAS/SYSTAT® Software: Changes and enhancements through Release 6.12. Author; Cary, NC: 1997.
- Schaffer D, Fisher P, Lucas CP, Dulcan MK, Schwab-Stone ME. NIMH Diagnostic Interview Schedule for Children Version IV (NIMH DISC-IV): Description, differences from previous versions, and reliability of some common diagnoses. *Journal of the American Academy of Child and Adolescent Psychiatry* 2000;39:28–38. [PubMed: 10638065]
- Shields, AM.; Cicchetti, D. The development of an emotion regulation assessment battery: Reliability and validity among at-risk grade-school children; Paper presented at the Biennial meeting of the Society for Research in Child Development; Indianapolis, IN. 1995.
- Singer J. Using SAS PROC MIXED to fit multilevel models, hierarchical models, and individual growth models. *Journal of Educational and Behavioral Statistics* 2003;23:323–355.
- Stocker CM, McHale SM. The nature and family correlates of preadolescents' perceptions of their sibling relationships. *Journal of Social and Personal Relationships* 1992;9:179–195.
- Stocker CM, Dunn J, Plomin R. Maternal Interview of Sibling Relationship. 1987 Unpublished document obtained from C. Stocker
- Straus MA. Measuring intrafamily conflict and violence: The Conflict Tactics (CT) Scales. *Journal of Marriage and the Family* 1979;41:75–88.
- Wechsler, D. Wechsler Abbreviated Scale of Intelligence. Psychological Corporation; New York: 1996.
- Woodcock, RW.; Mather, N. Woodcock-Johnson Tests of Achievement. DLM Teaching Resources; Allen, TX: 1989.

Table 1

Racial Distribution in 1993–1995 Los Angeles Twin Birth Cohort<sup>1</sup>

Race	Total sample		Identified in voter records			
	n	%	Mothers		Fathers	
	n	%	n	%	n	%
American Indian	6	.1	14	.2	0	0
Asian	448	7.4	393	6.5	124	7.8
Black	850	14.1	862	14.3	267	16.8
Hispanic	2868	47.5	2748	45.5	566	35.6
White (non-Hispanic)	1852	30.7	1820	30.1	627	39.5
Other	5	.1	6	.1	1	.1
Unknown	10	.2	196	3.2	4	.3
Total			N = 6039		N = 1589	

Note:

<sup>1</sup> Only pairs with two live-births are included here.



Table 2

Twin Pairs by Year of Birth (from Schools and County Records)

Birth year	Early sample <sup>a</sup>			Current twin records			Potential twin records using voter registration data										
	N	%	School district sample	N	%	1993-1995 county birth cohort <sup>b</sup>	Total	N	%	Same birth date, birth state, last name, and address	N	%	Same birth date, birth state, address, and different last name	N	%	Same birth date, birth state, last name and different address	Total
1940 or earlier	61	6.8					61	574	4.0	2129	2908	7.8	2129	2908	2.1	5611	
1941-1950	65	7.3					65	712	4.9	2201	8065	8.1	2201	8065	5.8	10,978	
1951-1960	107	12.0					107	1409	9.7	4045	21,116	14.8	4045	21,116	15.2	26,570	
1961-1970	115	13.0					115	2158	14.9	5049	28,053	18.5	5049	28,053	20.2	35,260	
1971-1980	274	30.9	4	< 1.0			278	3840	26.5	5894	39,967	21.6	5894	39,967	28.8	49,701	
1981-1985	180	20.3	246	11.5			426	4542	31.4	6077	31,285	22.3	6077	31,285	22.6	41,904	
1986-1990	50	5.6	480	22.5			530	1247	8.6	1850	7229	6.8	1850	7229	5.2	10,326	
1991-1995	2	< 1.0	1316	61.6	100		2907										
1996-2000			33	1.5			33										
2001-2003			10	< 1.0			10										
Unknown	34	3.8	37	1.7			71										
Total	888		2136			1589	4603	14,482		27,245	138,623		27,245	138,623		180,350	

Note:

<sup>a</sup> Early sample includes only pairs with current contact information.

<sup>b</sup> Includes only those identified in voter records.

**Table 3**  
RFAB Study: Summary of Measuring Instruments (Waves 1 and 2)

Child's antisocial behavior and aggression		
Construct	Children's measures	Parent/teacher measures
DSM-IV symptoms	Diagnostic Interview Schedule for Children (DISC-IV; youth version; Schaffer et al., 2000); conduct disorder module only	DISC-IV (parent version): conduct disorder, oppositional defiant disorder, attention-deficit/hyperactivity disorder modules
Delinquent and aggressive behavior	Delinquency Interview for Children (DI-C): property offending, violent offending, substance use, minor rule violations Child Aggression Questionnaire (CAQ; Raine et al., 2006); Reactive, Proactive, Relational Aggression Scales Child Psychopathy Scale (CPS; Lynam, 1997; Youth version)	Child Behavior Checklist (CBCL; Achenbach 1991; caregiver and teacher versions): Delinquency, Aggression, and Externalizing Scales CAQ (caregiver and teacher versions): Reactive, Proactive, Relational Aggression Scales CPS (caregiver version)
Laboratory observation	Point Subtraction Task (Cherek et al., 1997) Videotaped sibling interaction	
Substance use	Substance Use Questionnaire (SU): tobacco, alcohol, illicit drugs DISC-IV (youth version): substance abuse, substance dependence (Wave 2) Alcohol expectancies questionnaire (AEQ; Wave 2)	DISC-IV (Parent version) substance abuse, substance dependence (Wave 2)
Law-breaking behavior/school conduct problems	School records; school district computer databases (Wave 2)	
Child's cognitive, personality, and neuropsychological variables		
Neurocognitive Executive function Attention and impulsivity Decision-making General cognitive functioning	Wisconsin Card Sort 64 (Axelrod et al., 1992; Wave 1); Trails A & B (Partington & Leiter, 1949) Go/NoGo Task; Porteus Mazes (Berry & Porteus, 1920) Gambling Task (Bechara et al., 1997; Wave 2) Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1996; Wave 1)	
Reading ability	Woodcock-Johnson: Letter-Word identification, Word Attack (Woodcock & Mather, 1989; Wave 1) CTOPP Phoneme Deletion (Wave 1)	
Puberty onset		Puberty Status Questionnaire (Petersen et al., 1988)
Personality	Junior Temperament and Character Inventory (JTCI; Luby et al., 1999; Wave 1)	
Academic performance/language proficiency	Standardized Test Scores obtained from schools	Teacher evaluations
Social/environmental risk factors		
SES		Demographic questionnaire
Home neighborhood		Your Neighborhood (Wave 1); US 1990 Census Tract Data
Parenting and parent-child relationship	Parent-to-Child Affect (adapted from Deater-Deckard, 1996) Parental Monitoring (Kerr & Stattin, 2000) Conflict Tactics Scale (CTS; Strauss, 1979)	Parent-to-child affect Parental monitoring Conflict Tactics Scale
Twin relationship	Videotaped observation of sibling interaction Sibling Relationship Interview (SRI; Stocker & McHale, 1992)	Mother's Interview of Sibling Relationship (MISR; Stocker et al., 1987; Wave 1 only)
Social/environmental risk factors		

<b>Child's antisocial behavior and aggression</b>		
<b>Construct</b>	<b>Children's measures</b>	<b>Parent/teacher measures</b>
Construct	Children's measures	Parent/teacher measures
Marital relations		Marital history (Wave 1); current status (Wave 2) Conflict Tactics Scale — current partner (Strauss, 1979) Marital satisfaction — current partner
Stress/life events	Life Events Scale	Perceived stress
Peer group characteristics	Peer Delinquency Scale; Child Friendship Questionnaire (CFQ) Parents and Peers Questionnaire	Peer acceptance and victimization (teachers) Parents and peers questionnaire (caregiver)
Prenatal and perinatal factors	Medical records obtained from hospital regarding pregnancy and delivery	Maternal Health (substance use, illnesses, and stressful events during pregnancy); newborn Information (including birth complications); prenatal psychosocial
Childhood illnesses and traumas		Demographic questionnaire (head injuries; other accidents, childhood diseases, chronic illnesses)
	Other parental behavior and family history assessments	
Construct	Children's measures	Caregiver measures
Caregiver personality		Temperament and Character Inventory (TCI; Cloninger, 1987)
Parents' antisocial behavior Childhood and adolescent delinquency Adult offending, including criminal convictions	ASB Questionnaire (mother, father, stepmother, stepfather)	
Parents' substance use: tobacco, alcohol, other drugs Prenatal use in mother		SU questionnaire (mother, father, stepmother, stepfather; includes Brief MAST; Pokorny et al., 1972) Maternal Health Survey (Wave 1)
Caregiver psychopathology	Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983; Wave 1)	
Parents' ADHD		ADHD Rating Scale (DuPaul, 1990; Wave 1)
Family history: reading disability, ADHD, major psychological disorders		Family history questionnaire (Wave 1)
	Biological risk factors	
Construct	Tasks and measures in children's psychophysiology protocol	
Psychophysiology	Skin-conductance levels (SCL); nonspecific (NS) responses during rest	
Baseline arousal	Heart-rate level (HR) and respiratory sinus arrhythmia (RSA) during rest	
Electrodermal	Resting EEG (Wave 1) Amplitude, latency, recovery of skin conductance response during orienting task	
Cardiovascular	HR and SCL changes during Countdown; EMG and autonomic activity during startle task	
Electrocortical	Avg. SCL, HR, and RSA during Go/NoGo	
Responsivity to stimuli (mild tones)	Hemispheric differences in resting EEG, and ERPs during Oddball, Go/Nogo, Mismatch Negativity (MMN)	
Responsivity to stressors (loud tones)	P3 component of ERPs during Oddball and Go/Nogo tasks (Wave 1)	
Reactivity to cognitive stress	Mismatch negativity (MNN; Wave 1)	
Frontal lobe asymmetry	Movie clips (Wave 1)	
Attention to stimuli	P50 task (Wave 1)	
Preattentive processing		
Emotional responding		
Sensory gating		

Note: Measures included at both Waves 1 and 2 unless otherwise noted.

**Table 4**  
Mean DSM-IV Symptom Counts and Prevalence of Diagnoses for Boys and Girls

Disorder	Boys			Girls			% Diagnosis (n)	
	Mean	SD	n	Mean	SD	n	Boys	Girls
Youth report								
CD	1.12 <sup>a</sup>	1.91	575	0.64	1.29	602	1.6% (9) <sup>c</sup>	0.3% (2)
Caregiver report								
CD	1.44 <sup>a</sup>	2.02	588	0.90	1.54	611	2.7% (16) <sup>b</sup>	1.3% (8)
ODD	4.79	3.29	588	4.36	3.18	608	11.9% (70) <sup>b</sup>	8.1% (49)
MDD	3.27	3.07	588	3.21	3.07	607	0.9% (5)	1.8% (11)
GA	2.81	2.49	588	2.85	2.44	608	2.9% (17)	3.0% (18)
ADHD (any type)	6.40 <sup>a</sup>	5.32	588	4.35	4.50	607	15.0% (88) <sup>b</sup>	7.9% (48)
Inattention only	3.58 <sup>a</sup>	3.20	591	2.32	2.74	619	6.8% (40) <sup>b</sup>	3.1% (19)
Hyperactivity/ impulsivity only	2.79 <sup>a</sup>	2.84	591	1.95	2.50	619	4.8% (28) <sup>b</sup>	2.5% (15)
Combined type							3.4% (20)	2.3% (14)

Note:

<sup>a</sup> Significant sex difference in mean symptom counts ( $p < .05$ )

<sup>b</sup> Significant sex difference in % diagnosis ( $p < .05$ )

<sup>c</sup> Marginally significant sex difference in % diagnosis ( $p < .10$ ).