



The genetic and environmental overlap between aggressive and non-aggressive antisocial behavior in children and adolescents using the self-report delinquency interview (SR-DI)

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ABSTRACT

Purpose: This study investigated genetic and environmental commonalities and differences between aggressive and non-aggressive antisocial behavior (ASB) in male and female child and adolescent twins, based on a newly developed self-report questionnaire with good reliability and external validity – the Self-Report Delinquency Interview (SR-DI).

Methods: Subjects were 780 pairs of twins assessed through laboratory interviews at three time points in a longitudinal study, during which the twins were: (1) ages 9–10 years; (2) age 11–13 years, and (3) age 16–18 years.

Results: Sex differences were repeatedly observed for mean levels of ASB. In addition, diverse change patterns of genetic and environmental emerged, as a function of sex and form of ASB, during the development from childhood to adolescence. Although there was some overlap in etiologies of aggressive and non-aggressive ASB, predominantly in shared environmental factors, their genetic overlap was moderate and the non-shared environmental overlap was low.

Conclusions: Taken together, these results reinforced the importance of differentiating forms of ASB and further investigating sex differences in future research. These results should be considered in future comparisons between youth self-report and parental or teacher report of child and adolescent behavior, and may help elucidate commonalities and differences among informants.

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Introduction

The genetic and environmental influences on antisocial behavior (ASB) have been studied extensively in twin, adoption and family designs. There is consistent support for the roles both genes and environment play in the development of ASB (Rhee & Waldman, 2002). More recently, however, distinctions have been drawn between aggressive (fighting, weapon-use) and non-aggressive (theft, vandalism) forms of ASB (Burt, 2012a, 2012b). Genetic studies support this distinction. For example, aggressive ASB shows primarily genetic influence (Edelbrock et al., 1995; Thalia et al., 1999; Ghodsian-Carpey & Baker, 1987; Hudziak et al., 2003), whereas non-aggressive ASB shows roughly equal influence of genes and shared environment (Bartels et al., 2003; Edelbrock et al., 1995; Eley, Lichtenstein, & Moffitt, 2003). A recent meta-analysis of 103 twin and adoption studies also revealed clear evidence of etiological distinctions between aggressive and non-aggressive ASB (Burt, 2009). Aggressive ASB showed approximately 65% genetic influences

with little influence of shared family environment, especially after childhood. In contrast, while genetic influence was also important for non-aggressive ASB, (48% of influences), there was also an important role for shared environmental effects (18% of influences) (Burt, 2009).

One weakness in the literature on child and adolescent ASB, however, is that it has relied heavily on measures obtained through parent or teacher reports (Hinshaw & Zupan, 1997). These reports are fallible for several reasons. First, parents and teachers may not be aware of certain behaviors in which the child may engage. These include both covert ASB such as stealing and lying, which may not be observed by anyone, and behaviors which may be overt but unobserved by adults, such as bullying and relational forms of aggression among peers. Additionally, parents do not generally observe behaviors at school, while teachers do not observe behaviors in the child's home. For these reasons, some ASB may be unnoticed by the adults who are asked to rate children in widely used instruments such as the Child Behavior Checklist (Achenbach, McConaughy, & Howell, 1987).

It is also well known that inter-rater correlations for children's externalizing behavior problems are low to moderate at best, ranging from $r = 0.2$ (between self-reports and teacher ratings) to 0.3 (between teacher and parent ratings) (Achenbach et al., 1987). To the

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extent that children's behavior varies across situations, opportunities for raters to observe certain behaviors will differ, contributing to low agreement. Parents and teachers also have different reference groups to which the child may be compared (e.g., siblings or a few peers in the neighborhood, vs. a larger group of peers at school), which may influence ratings.

One alternative to parent and teacher ratings of ASB is through self-report measures, which have been used successfully in past research on adolescents and adults. Self-report has proved to be a valid and reliable source of information for drug use, sexual behavior, violence, theft, and other illegal behaviors (Elliott & Huizinga, 1989; Loeber et al., 1991; Moffitt et al., 1994; Rowe, 1983; Turner et al., 1998). These methods have the advantage of detecting covert behaviors that may be known only to the perpetrator, in addition to overt behaviors that are known to other reporters or available in official records. The lack of any published self-report instrument of ASB in children led us to develop such a measure for use in a large-scale, comprehensive twin study of risk factors for ASB: the University of Southern California (USC) Risk Factors for Antisocial Behavior (RFAB) twin study (Baker et al., 2012). In constructing this instrument – the Self-Report Delinquency Interview (SR-DI) – we considered two primary factors: (1) it should include lifetime and recent offending, to aid in the distinction between individual children with life-course persistent behavior and more transient groups who engage in ASB only during specific developmental periods and; (2) it should measure a wide variety of ASB, so that different etiologies may be investigated for different forms of ASB (e.g. aggressive and non-aggressive). Considering past findings of the distinctions between aggressive and non-aggressive ASB (Burt, 2009, 2012a, 2012b), it is important to distinguish among forms of ASB so that different etiologies may be investigated.

In the present study, we examined the internal and external validity of the SR-DI – a self-report measure specifically developed for the USC RFAB twin study. To date, no study has investigated the developmental changes in genetic and environmental components in self-report ASB over the span of childhood and adolescence. This paper aims to fill this gap with three assessments using the SR-DI when the twins were age 9–10, 11–13, and 16–18 years old. Based on previous studies, we hypothesized high shared environmental overlap and moderate genetic overlap between aggressive and non-aggressive ASB as measured by the SR-DI within each assessment. Additionally, we also hypothesized that shared environment would play a bigger role in non-aggressive ASB, highlighting an etiological distinction between the two forms of ASB.

Method

Participants

The current sample was drawn from participants in the University of Southern California (USC) Risk Factors for Antisocial Behavior (RFAB) twin study. RFAB is a prospective study of the interplay of genetic, environmental, social, and biological risk factors on the development of aggressive and other antisocial behavior from childhood to emerging adulthood. Participating families of twins were recruited from the Los Angeles community and the sample is representative of the ethnic and socio-economic diversity of the greater Los Angeles area. In the first assessment (Wave 1) the twins were 9–10 years old (*mean age* = 9.59, *SD* = 0.58). In the second assessment (Wave 2), the twins were 11–13 years old (*mean age* = 11.79, *SD* = 0.92). In the third assessment (Wave 3), the twins were 14–15 years old (*mean age* = 14.82, *SD* = 0.83), and during Wave 4 the twins were 16–18 years old (*mean age* = 17.22, *SD* = 1.23). The present analyses are based on data from Waves 1, 2 and 4, in which the SR-DI was administered. The total sample contains 1,569 subjects (780 twin pairs), including 168 monozygotic (MZ) male, 171 MZ female, 128 dizygotic (DZ) male, 120 DZ female, 200 DZ male–female pairs.

Complete details of the procedures and measures can be found elsewhere (Baker et al., 2012; Baker, Barton, Lozano, Raine, & Fowler, 2006; Baker, Barton, & Raine, 2002).

Zygosity determination

Zygosity for the majority (87%) of same-sex twin pairs was determined using DNA microsatellite analysis (>7 concordant and zero discordant markers = MZ; one or more discordant markers = DZ). For the remaining same-sex twin pairs, zygosity was established by questionnaire items about the twins' physical similarity and the frequency with which people confuse them. The questionnaire was used only when DNA samples were insufficient for one or both twins. When both questionnaire and DNA results were available, there was a 90% agreement between the two (Baker et al., 2006).

Measures

The *Self-Report Delinquency Interview (SR-DI)* was developed as a self-report measure of ASB suitable for children and adolescents. This instrument was adapted from several existing measures, including the Self-Report Delinquency in Adolescence (SRA) from the Pittsburgh Youth Study (Loeber & Farrington, 1998), which was in turn developed from Elliott's self-report delinquency interview in the National Longitudinal Survey (Elliott & Huizinga, 1989).

The SR-DI includes questions concerning 33 different antisocial behaviors at home and school in two broad categories: (1) non-aggressive (items concerning truancy, lying, and minor rule violations, obtaining goods and services without paying, and thievery (items concerning shoplifting, stealing money and other items from family, friends, and others)); and (2) aggressive (violence against siblings and other children outside the family, and property damage: items concerning vandalism, graffiti, arson).

Children were asked first about whether or not they have ever done various behaviors in each of the 33 items. For any item endorsed, the child was then asked how often each behavior occurred during the *past year*. In the present study, our analysis was based on the total score of the *ever* questions. The complete SR-DI with 33 questions was only administered in Wave 4, while for Waves 1 and 2, only 22 out of the 33 questions were asked (see the Appendix for details).

Validity and internal consistency of the Delinquency Interview (SR-DI): non-aggressive and aggressive sub-scales

The internal consistency was good, with Cronbach's $\alpha = 0.78$ for all items in Wave 1 ($\alpha = 0.74$ for non-aggressive items and 0.72 for aggressive ones); $\alpha = 0.81$ for items in Wave 2 ($\alpha = 0.78$ for non-aggressive items and 0.76 for aggressive ones); and $\alpha = 0.72$ for all items in Wave 4 ($\alpha = 0.62$ for non-aggressive items and 0.68 for aggressive ones).

The construct validity of the SR-DI was carefully examined (see Table 4). The SR-DI aggressive and non-aggressive subscales at each of the three waves were each significantly correlated with parent-reported CBCL Delinquency (Rule-Breaking) and CBCL Aggression. These findings are in line with other findings concerning correlations between self-reports and other ratings of behavior problems in youth (Achenbach et al., 1987), and together suggest that construct validity of the SR-DI in the present sample.

Statistical analyses

In the classical twin design, co-variances between monozygotic (MZ) and dizygotic (DZ) twins are used to decompose the variance of a measured trait into genetic and environmental components. MZ twins share their common environment and are assumed to share 100% of their genes. DZ twins also share their common environment

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