The Role of Contextual Risk, Impulsivity, and Parental Knowledge in the Development of Adolescent Antisocial Behavior

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A multitude of individual and contextual risk factors have been associated with the development of antisocial behavior (ASB) in adolescence (e.g., Loeber, 1990). According to ecological (Bronfenbrenner, 1977) and transactional (Sameroff, 2000) models, these factors interact in determining human development. Although recent research on the development of ASB has increasingly paid attention to interrelations between individual and contextual characteristics (e.g., Meier, Slutske, Arndt, & Cadoret, 2008; Trentacosta, Hyde, Shaw, & Cheong, 2009; Vazsonyi, Cleveland, & Wiebe, 2006) studies of this kind are still relatively scarce. The present study will focus on the development of ASB in an age period in which ASB shows a sharp increase, i.e., from early to mid adolescence, and consider the roles of individual, and parenting, family, and neighborhood contextual factors.

**Neighborhood Risk, Family Risk, Impulsivity, and the Development of ASB**

Neighborhood, family, and individual factors have consistently been shown to pose risk for the development of ASB (e.g., Loeber & Stouthamer-Loeber 1986; Lipsey & Derzon, 1998; Leventhal & Brooks-Gunn, 2000). Neighborhood risk can be defined in terms of neighborhood structure, and neighborhood social processes. Neighborhood structure refers to compositional characteristics of communities, such as rates of unemployment (e.g., Vazsonyi et al., 2006). Neighborhood social processes may include measures of informal social control (“the capacity of a group to regulate its member according to desired principles – to realize collective [...] goals”; Sampson, Raudenbush, & Earls, 1997), or perceived neighborhood danger (e.g., Ingoldsby & Shaw, 2002). Both neighborhood structural characteristics and social processes have been linked with ASB in youth (e.g., Jencks & Mayer, 1990; Leventhal & Brooks-Gunn, 2000; Sampson et al., 1997; Wilson, 1987). Early adolescence is an important developmental period for the study of neighborhood effects, as adolescents spend increasingly more time in their communities. At this age, youth have greater autonomy and increased opportunity for unsupervised activities (e.g., Leventhal & Brooks-Gunn, 2000).

In addition to high-risk neighborhoods, adverse family situations may pose a risk for the development of ASB. Notably, youths who live with a single mother or father (e.g., Breivik & Olweus, 2006; Loeber & Stouthamer-Loeber, 1986) are at increased risk for the development of ASB. As past studies have also documented, however, family and neighborhood risk are highly likely to co-occur. In general, family socioeconomic status (SES) is lower in single parent families, as compared to two-caregiver households (Bulanda, 2008). Accordingly, single parent families may be over-represented in disadvantaged neighborhoods, and the children of these families are likely exposed to additional risk factors. Moreover, single parents who reside in disadvantaged neighborhoods may experience more difficulties in parenting their adolescent child than those in more advantaged neighborhoods, e.g., because these parents are also exposed to more stressors (e.g., Wilson, 1987).

Ultimately however, the influence of neighborhood structural and social processes, and of family risk, may be conditional on the child’s individual vulnerability to engage in ASB. One of the
most important individual risk factors for the development of ASB is high levels of impulsivity (e.g., Loeber, 1990). Impulsivity has been defined as “a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individual or to others” (Moeller, Barrett, Dougherty, Schmitz, & Swann, 2001, p. 1784), and has been linked to persistent delinquency across the adolescent years (Carrasco, Barker, Tremblay, & Vitaro, 2006). Consistent with expectations from Bronfenbrenner’s biocultural ecological model (1977), as well as Sameroff’s transactional model (2000), the link between impulsivity and ASB has been shown to be stronger for children living in more disadvantaged neighborhoods (Lynam, Caspi, Moffitt, Wikström, Loeber, & Novak, 2000; Meier et al., 2008), though not all studies have found such interactive effects (see, e.g., Vazsonyi et al., 2006). To our knowledge, no studies have yet focused on interactions between family risk and child impulsivity. We hypothesize here, that neighborhood structural and social process risk factors, single parenthood, and impulsivity put early adolescents at risk for the development of ASB. In addition to main effects of these risks, we also expect to find that the effect of impulsivity on ASB is stronger in high risk as opposed to low risk neighborhoods, and in single parent as opposed to two-caregiver families.

*Sociocultural Contexts as Risk or Protective Factors*

Parental Monitoring as a Protective Factor

Even if exposed to all these risk factors, not all early adolescents actually develop ASB problems. Some contextual factors may provide protection rather than put the adolescent at risk. One of the strongest protective factors against early adolescent ASB is parental monitoring (“a set of correlated parenting behaviors involving attention to and tracking of the child’s whereabouts, activities, and adaptations”; Dishion & McMahon, 1998, p. 61; Burke, Pardini, & Loeber, 2008; Hoeve, Dubas, Eichelsheim, van der Laan, Smeenk, & Gerris, 2009; Lahey, van Hulle, D’Onofrio, Rodgers, & Waldman, 2008; Loeber & Dishion, 1983). Parental monitoring is thought to enable parents to effectively control their child’s behavior, resulting in less involvement in risk behaviors (e.g., Rai, Stanton, Wu, Li, Galbraith, Cottrell et al., 2003; Ramirez, Crano, Quist, Burgoon, Alvaro, & Grandpre, 2004). Parental monitoring has been shown to protect against the development of ASB for male as well as female adolescents (e.g., Hoeve et al., 2009; Lahey et al., 2008; Laird, Criss, Pettit, Dodge, & Bates, 2008), and across different ethnic groups (Forehand, Miller, Dutra, & Watts Chance, 1997). Although levels of parental monitoring typically decrease across adolescence (e.g., Burke et al., 2008), evidence suggests that it remains important for adolescent adjustment until at least mid-adolescence (e.g., Lahey et al., 2008; Laird et al., 2008).

Research has not only linked parental monitoring to ASB, but evidence is also accumulating that parental monitoring itself is associated with, and affected by other risk factors, including neighborhood, family, and child individual factors. Neighborhood structural risk may affect parental monitoring in different ways. Fauth, Leventhal, and Brooks-Gunn (2007) showed that parental monitoring decreased in families who moved out of poor neighborhoods (by way of a court-ordered neighborhood desegregation program). This decrease may reflect the fact that parents
adjust their level of monitoring according to the level of neighborhood risk. That said, neighborhood stress has also been shown to decrease parental monitoring through increasing parents’ psychological distress (Kotchick, Dorsey, & Heller, 2005). Low levels of informal social control in the neighborhood are likely to decrease parental monitoring, for instance because in neighborhoods with low levels of informal social control, residents are less likely to share their observations of youth behavior in the neighborhood with the parents. Further, single parents generally know less about their child’s whereabouts than coupled parents (Pettit, Laird, Dodge, Bates, & Criss, 2001; Pardini, Fite, & Burke 2008). Thus, single parents may find it harder to counter neighborhood risk than coupled parents. Finally, child impulsivity correlates negatively with parental monitoring (Flannery, Vazsonyi, Torquati, & Fridrich, 1994). Importantly, although not studied in a longitudinal framework to date, reciprocal effects between parental monitoring and child characteristics are likely. That is, impulsive children may be especially hard to monitor without the help of neighbors or a partner. Given these potential combined and cumulative effects of environmental risk on parental monitoring, it is important to address them simultaneously and across time.

Recently, support for the notion that monitoring might constitute one of the more proximal pathways through which other risks have their effects on the development of ASB is beginning to show. Some recent studies have shown that neighborhood risk affects male adolescents’ ASB (Chung & Steinberg, 2006; Tolan, Gorman-Smith, & Henry, 2003) and child externalizing problems (Kohen, Leventhal, Dahinten, & McIntosh, 2008; Mrug & Windle, 2009) through poor parenting. Further, it has been shown that single parent households increase the risk for adolescent ASB, through low levels of parental monitoring (Breivik, Olweus, & Endresen, 2009). These findings suggest that contextual risk on ASB is (partly) mediated by poor parental monitoring. Accordingly, we hypothesize, that the influence of neighborhood risk, single parenthood, and impulsivity, as well as their possible interactions increase ASB in part through decreasing parental monitoring.

We chose a specific operationalization of parental monitoring. It has been shown that parents may overestimate their knowledge of young people’s whereabouts, and that adolescent reports reflect actual parental knowledge more accurately (Laird, Pettit, Bates, & Dodge, 2003). Accordingly, as in other studies (Dishion & McMahon, 1998; Laird et al. 2008; Pettit et al., 2001; Trentacosta et al., 2009) parental monitoring was operationalized here as adolescents’ reports of parental knowledge of youth whereabouts, rather than as active parental surveillance.

Finally, in the present study we test for the possibility of gender differences in these various processes. Male and female youth differ not only in levels of impulsivity (Else-Quest, Hyde, Goldsmith, & van Hulle, 2006), parental knowledge (Kim, Hetherington & Reiss, 1999), and ASB (e.g., Moffitt, Caspi, Rutter, & Silva, 2001), but there also exists some evidence that neighborhood and family risk may differentially impact male and female development (e.g., Zahn-Waxler, Shirtcliff, & Marceau, 2008). For instance, neighborhood risk is thought to be more important for male adolescents, compared to females (e.g., Kroneman, Loeber & Hipwell, 2004), whereas family factors are sometimes found to be more strongly linked to female than to male ASB (see Zahn-
Therefore, we tested whether interrelations between the variables studied depend on the adolescent’s gender. We hypothesize that neighborhood risk will have a stronger effect on male ASB, whereas living with a single parent is relatively more important for female ASB.

METHODS

Sample

Participants were from the Edinburgh Study of Youth Transitions and Crime (ESYTC; Smith & McVie, 2003), a large-scale, representative cohort of children (4,597; 51% male) constituted at age 12 and studied annually to age 17. The initial recruiting sample \((N = 4469)\) at wave 1 included 92% of the total population of youths, who were enrolled as first year pupils at Edinburgh secondary schools in autumn of 1998. Of these, 156 opted out, and 13 could not be surveyed due to logistic reasons \((n = 8)\) or difficulties understanding the questionnaires \((n = 5)\), resulting in a response rate of 96.2% at wave 1 (McVie, 2001). At the following waves, students, who transferred to participating schools, were also asked to participate; this resulted in the sample of 4,597. For a full description of response rates per wave, see McAra & McVie (2007). The majority of participants (94.2%) were Caucasian; 1.6% were of Pakistani origin, 1.1% Chinese, 0.7% African, 0.7% Indian, 0.3% Bangladeshi, and 1.4% from other ethnic groups.

Procedure

Parental consent was obtained for all children who participated in the study. Trained researchers administered the self-report questionnaires to study members in classrooms. Absent students, at each data collection wave, were captured via follow-up visits to the school and by home visitation. To reassure participants about reporting sensitive information and to encourage honest reporting, particularly about their own behavior, a complete guarantee of confidentiality was given to each child.

Measures

The frequency of ASB in the previous year was assessed using self-reports at ages 13 and 15 years with the following nine items (response scale 0 = never to 7 = most days): 1) shoplifting, 2) breaking into a house/building, 3) joyriding, 4) disturbance of peace, 5) vandalize property, 6) arson, 7) break into car to steal something, 8) carried a knife or weapon for protection or in case it was needed in a fight, and 9) used force, threats, or a weapon to get money or something else from somebody. We created a composite score, ranging from 0 to 63 at each age available, by summing scores on all items. Coefficient alphas were .74 and .76 for age 13 and 15 respectively. Because the measure of ASB was extremely skewed, due to a preponderance of scores at the scale-minimum
(i.e., over-dispersion of zeros), the ASB scores at ages 13 and 15 were log-transformed. On transformation, the skewness improved (see Table 6.1).

*Neighborhoods* in Edinburgh were defined using a geographic information system (GIS) and census level information (Smith & McVie, 2003). Postcode data were collected from the school records of all cohort members at sweep 1, thereby allowing individuals to be allocated to one of these neighborhoods. Postcode information was available for 3,972 (92%) of all eligible participants at sweep 1. A small proportion of these (291) were not resident within the city of Edinburgh, therefore, a total of 3,681 (85%) of cohort members at sweep 1 were allocated to one of the 91 Edinburgh neighborhoods at age 12. The average neighborhood cluster size was 112 (range 36 – 462).

*Neighborhood economic deprivation* was determined by combining the neighborhood allocation with data from the 2001 census, which provided a range of demographic, housing, health, education and cultural information about the population as a whole, and per neighborhood. The four variables used as indicators of neighborhood economic deprivation were 1) % of population consisting of lone parent with dependent children; 2) % of households with more than one person per room; 3) % of population in local authority (public) housing; 4) % of population who are unemployed. For each adolescent a neighborhood economic deprivation score was computed by summing the values of these four indicators applicable to his/her allocated neighborhood. For some eligible participants no postcode information was available in the school records, while for others postcode data were present, but they were not resident within the city of Edinburgh. For these participants no deprivation score was computed. The measure showed satisfactory fit in a CFA (CFI = 0.99; TLI = 0.97; RMSEA = 0.15) and the standardized loadings of the four indicators were all greater than 0.80. Because it is the truly disadvantaged who are most at risk of being affected (cf. Crane, 1991), we identified the top 10% of the neighborhood economic deprivation score to indicate those most at risk (cf. Ingoldsby, Shaw, Winslow, Schonberg, Gilliom & Criss, 2006; Wikström & Loeber, 2000; Wilson, 1987). This resulted in a dichotomized measure of extreme neighborhood economic deprivation scored 0 = low economic deprivation and 1 = high economic deprivation. Accordingly, 204 male and 191 female adolescents lived in deprived neighborhoods versus 1,658 male and 1,624 female adolescents lived in non-deprived neighborhoods.

*Informal social control* was measured via a modified version of an existing scale (Sampson, Raudenbush, & Earls, 1997). The self-report items comprised two questions (‘would adults try to stop’ and ‘would someone call the police’) for three scenarios: 1) “if someone was spray painting a wall in your neighborhood”, 2) “if someone was trying to steal a car in your neighborhood” and 3) “if teenagers were fighting in the street in your neighborhood” (6 items: Cronbach’s alpha = .58). Due to the low alpha, we estimated a confirmatory factor analysis to help discriminate the acceptability of the measure. The analysis showed adequate model fit (CFI = 0.96; TLI = 0.87; RMSEA = 0.08) and the standardized loadings varied from .30 to .62. As for the measure of neighborhood economic deprivation, we used scale scores to identify the 10% of neighborhoods lowest in informal social control.
Family type was derived from participant reports and was coded as 0 = two-caregiver family (64%), and 1 = single parent family (29%). Information on family type was missing for the remaining 7% of the sample.

Low family income was derived from school and Education Department records of eligibility for free school meals; 13% of the sample was eligible (Smith & McVie, 2003).

Impulsivity was measured via a modified version of the Eysenck Impulsivity Scale (Eysenck, Easting, & Pearson, 1984) through self-reports at age 12 by the following six items: 1) Planning takes the fun out of things, 2) I get into trouble because I do things without thinking, 3) I put down the first answer that comes into my head on a test, and often forget to check it later, 4) I get involved in things that I later wish I could get out of, 5) I sometimes break rules because I do things without thinking, 6) I get so excited, about doing new things that I forget to think about problems that might happen (Cronbach’s alpha = .86). This scale discriminates children with conduct problems from controls, and predicts future conduct problems (Luengo, Carrillo-de-la-Peña, Otero, & Romero, 1994).

Parental knowledge was assessed using adolescent report at ages 13 and 15 (both Cronbach’s αs = .72) with the following three items: “In the last year, how often did your parents know 1) where you were going, 2) who you were with, and 3) what time you would be home” on a four point scale (1 = most days, 2 = at least once a week, 3 = less than once a week, 4 = never). Scores were recoded so that higher scores indicate higher levels of parental knowledge.

Attrition and Missing Data

Complete data for ASB was available for 94% of the original sample at age 13 and 90% at age 15. Complete data for parental knowledge were available for 93% of the original sample at age 13, and for 89% at age 15. Self-reported risk data were missing for small proportions of the sample at age 12, ranging from 7% (family type) to 11% (low informal social control). Children missing census-based neighborhood characteristics (20% of the total sample; N = 917) were more likely to be entitled to free school meals (24% vs. 16%), $\chi^2$ (DF = 1, N = 3,706) = 17.57, $p < .001$, and scored slightly higher on self-reported impulsivity at age 12, $t$(4185) = 2.11, $p < .05$. They did not differ from the rest of the sample on any of the other study variables.

Analyses

Path analysis models were run in Mplus5 (Muthén & Muthén, 2007). Analyses proceeded in three major steps. In Step 1, an autoregressive cross-lagged model of age 13 and age 15 parental knowledge, and adolescent ASB was defined. In this model, we tested for main effects of the age 12 predictors of neighborhood economic deprivation, low informal social control, single parent family, and adolescent impulsivity. To ascertain that the neighborhood economic deprivation variable captured a neighborhood level risk and was not confounded with family level economic deprivation, all pathways were controlled for low family income. Age 13 and age 15 variables were
allowed to correlate. To control for non-independence of the data, youth were clustered within neighborhoods defined by the GIS scores. Using this baseline model, we added two-way interactions between the age 12 variables as predictors in Step 2. Each of the five two-way interactions (Neighborhood economic deprivation X Impulsivity, Low informal social control X Impulsivity, Single parent family X Impulsivity, Neighborhood economic deprivation X Single parent family, Low informal social control X Single parent family) was always tested alone, i.e., without the other interaction terms in the same model, to avoid a model with interactions depending upon other interactions, yielding non-interpretable results. Finally, we tested for indirect influences of age 12 variables via age 13 parental knowledge on age 15 ASB using the IND statement in Mplus. Because male and female adolescents differed on levels of all continuous study variables (see Table 6.1), and because there are reasons to expect gender differences in links between risk factors and male and female ASB (e.g., Kroneman et al., 2004), separate models were run for males and females.

All models were corrected for non-normal distributions by maximum likelihood estimation with robust standard errors (MLR). Missing data were accounted for by full information maximum likelihood estimation. Model fit was determined through the Comparative Fit Index and Tucker-Lewis Index (CFI & TLI; exact fit = 1.00, close fit 0.95 - 0.99, acceptable fit 0.90 – 0.95; Bentler & Bonett, 1980) and root mean square error of approximation (RMSEA; exact fit = 0.00, close fit 0.06 – 0.01, acceptable fit 0.08 – 0.06; Browne & Cudeck, 1993).

RESULTS

Descriptive Statistics

Descriptive statistics for all continuous study variables are presented in Table 6.1 by gender. Male and female adolescents differed significantly on levels of all variables, with males reporting higher levels of ASB, and impulsivity, and lower levels of parental knowledge than females.
Table 6.1

Descriptive Statistics of the Main Continuous Study Variables for Male and Female Adolescents

<table>
<thead>
<tr>
<th></th>
<th>Male adolescents</th>
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<th>Female adolescents</th>
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<th>p</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>Skew</td>
<td>Kurtosis</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>ASB Age 13</td>
<td>4.59</td>
<td>7.09</td>
<td>2.46</td>
<td>7.61</td>
<td>2.49</td>
<td>4.50</td>
</tr>
<tr>
<td>Log transformed ASB Age 13</td>
<td>.48</td>
<td>.48</td>
<td>.49</td>
<td>-1.05</td>
<td>.32</td>
<td>.40</td>
</tr>
<tr>
<td>ASB Age 15</td>
<td>6.09</td>
<td>8.79</td>
<td>2.13</td>
<td>5.45</td>
<td>3.72</td>
<td>6.24</td>
</tr>
<tr>
<td>Log transformed ASB Age 15</td>
<td>.55</td>
<td>.52</td>
<td>.35</td>
<td>-1.25</td>
<td>.41</td>
<td>.45</td>
</tr>
<tr>
<td>Impulsivity Age 12</td>
<td>14.02</td>
<td>5.49</td>
<td>-.47</td>
<td>-.22</td>
<td>12.53</td>
<td>5.62</td>
</tr>
<tr>
<td>Parental Knowledge Age 13</td>
<td>9.52</td>
<td>2.07</td>
<td>-.70</td>
<td>.02</td>
<td>9.94</td>
<td>1.94</td>
</tr>
<tr>
<td>Parental Knowledge Age 15</td>
<td>9.01</td>
<td>1.99</td>
<td>-.41</td>
<td>-.06</td>
<td>9.38</td>
<td>1.91</td>
</tr>
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</table>

Note. ASB = antisocial behavior. T-values as obtained from independent samples t-tests.
### Table 6.2

Zero-order Correlations Between the Study Variables for Male and Female Adolescents

<table>
<thead>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Neighborhood economic deprivation</td>
<td>--</td>
<td>-.06</td>
<td>.14</td>
<td>.28</td>
<td>.05</td>
<td>-.01&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.05</td>
<td>.06</td>
<td>.06</td>
</tr>
<tr>
<td>2 Neighborhood low informal social control</td>
<td>.13</td>
<td>--</td>
<td>.06</td>
<td>.04&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.09</td>
<td>-.04&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.00&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.08</td>
<td>.06</td>
</tr>
<tr>
<td>3 Single parent family</td>
<td>.15</td>
<td>.07</td>
<td>--</td>
<td>.27</td>
<td>.07</td>
<td>-.10</td>
<td>-.07</td>
<td>.13</td>
<td>.15</td>
</tr>
<tr>
<td>4 Free meals</td>
<td>.29</td>
<td>.07</td>
<td>.30</td>
<td>--</td>
<td>.08</td>
<td>.02&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.05</td>
<td>.08</td>
<td>.10</td>
</tr>
<tr>
<td>5 Impulsivity</td>
<td>.07</td>
<td>.07</td>
<td>.10</td>
<td>.10</td>
<td>--</td>
<td>-.26</td>
<td>-.19</td>
<td>.32</td>
<td>.32</td>
</tr>
<tr>
<td>6 Parental knowledge age 13</td>
<td>-.06</td>
<td>-.13</td>
<td>-.09</td>
<td>-.01&lt;sub&gt;a&lt;/sub&gt;</td>
<td>-.22</td>
<td>--</td>
<td>.45</td>
<td>-.44</td>
<td>-.40</td>
</tr>
<tr>
<td>7 Parental knowledge age 15</td>
<td>-.05</td>
<td>-.07</td>
<td>-.02&lt;sub&gt;a&lt;/sub&gt;</td>
<td>.00&lt;sub&gt;a&lt;/sub&gt;</td>
<td>-.16</td>
<td>.42</td>
<td>--</td>
<td>-.26</td>
<td>-.35</td>
</tr>
<tr>
<td>8 Antisocial behavior age 13</td>
<td>.09</td>
<td>.09</td>
<td>.13</td>
<td>.06</td>
<td>.31</td>
<td>-.42</td>
<td>-.31</td>
<td>--</td>
<td>.63</td>
</tr>
<tr>
<td>9 Antisocial behavior age 15</td>
<td>.05</td>
<td>.07</td>
<td>.11</td>
<td>.05</td>
<td>.31</td>
<td>-.31</td>
<td>-.33</td>
<td>.65</td>
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</table>

*Note.* All correlations are significant with $p$ at least < 0.05, one-tailed, unless marked with subscript $a$.

Correlations for male adolescents are below, correlations for female adolescents are above the diagonal.
Associations Among Study Variables

Zero-order correlations between all study variables for male and female adolescents are in Table 6.2. Correlations between neighborhood economic deprivation and low informal social control on the one hand, and ASB on the other were generally small and positive for both males and females. As expected, single parent family and impulsivity correlated positively with ASB, and the risk factors also correlated significantly with each other: Neighborhood economic deprivation and low social control were positively linked with single parent family (for male and female adolescents) and with impulsivity (for male adolescents only). Single parent family and impulsivity also correlated positively. Associations between risk factors and parental knowledge generally also showed the expected pattern, with neighborhood risk, single parent family status, and impulsivity all correlating negatively with parental knowledge (though not all correlations between neighborhood risk and parental knowledge reached statistical significance).

Step 1: Main Effects of Neighborhood Risk, Family Risk, and Impulsivity on the Simultaneous Development of Parental Knowledge and Adolescent ASB

The main effects model for male adolescents (see Figure 6.1) fit the data well: $\chi^2(8) = 51.00$, $p < .001$; CFI = .99, TLI = .93, RMSEA=.05 (90% CI = .04 - .07). The model revealed significant effects for each of the age 12 predictors on levels of ASB one year later. Low informal social control, single parent family, and impulsivity were also negatively linked with parental knowledge at age 13. The autoregressive cross-lagged part of the model showed moderate stability of parental knowledge, and high stability of ASB between the ages of 13 and 15 years. In addition, parental knowledge at age 13 was negatively linked to age 15 ASB, and age 13 ASB was negatively related to age 15 parental knowledge.

The main effects model for female adolescents (see Figure 6.2) also showed good model fit: $\chi^2(8)=41.34$, $p < .001$; CFI = .98, TLI = .94; RMSEA=.05 (90% CI = .03 - .06). For females, the main effects of neighborhood economic deprivation and low informal social control on age 13 parental knowledge and ASB failed to reach significance. However, as for male participants, single parent family and impulsivity were positively related to ASB. Parental knowledge was predicted by single parent family and by impulsivity (negative associations). Similar to results for male adolescents, the autoregressive cross-lagged part showed moderate stability of parental knowledge, and high stability of ASB. Parental knowledge at age 13 predicted age 15 ASB, and age 13 ASB predicted age 15 parental knowledge (negative associations).

In order to test for possible gender differences in path estimates in the main effects model, multigroup models were specified by gender. A fully constrained model (i.e., a model in which all estimates were constrained to be equal for male and females adolescents) was compared to models in which individual path estimates were freed one at a time (i.e., allowed to vary across gender). Comparison of these models revealed significant differences between male and female adolescents in the link from low informal social control to parental knowledge at age 13 (which was only
significant for males) \( \Delta \chi^2 (1) = 7.16, p < .01 \), and in the link from parental knowledge at age 13 to ASB at age 15, \( \Delta \chi^2 (1) = 7.80, p < .01 \) (which is significant for both genders, but stronger for females).

In the next step of the analyses, two-way interactions were added one by one to the main effects model. For male participants, none of the interactions was significant. For girls, two significant interaction effects were found: (1) impulsivity interacted with neighborhood economic deprivation in the prediction of parental knowledge, and (2) impulsivity interacted with family type in the prediction of parental knowledge. Model fit for the model including the impulsivity X neighborhood economic deprivation interaction was good: \( \chi^2(10)=43.64, p < .001 \); CFI= .98, TLI=.94; RMSEA=.04 (90% CI = .03 - .06), and the same was true for the model including the impulsivity X family type interaction: \( \chi^2(10)=45.55, p < .001 \); CFI= .98, TLI=.94; RMSEA=.05 (90% CI = .03 - .06). Plots displaying standardized mean scores of parental knowledge for girls with low (1 SD below the mean) or high (1 SD above the mean) impulsivity in economically deprived versus economically non-deprived neighborhoods (Figure 6.3) and from two-caregiver versus single parent families (see Figure 6.4), illustrate the nature of these interactions. Figure 6.3 illustrates that the link between impulsivity and parental knowledge is weaker in disadvantaged as compared to more advantaged neighborhoods. Tests of simple slopes support this conclusion (\( \beta = -.17, p < .05 \) for high neighborhood economic deprivation; \( \beta = -.28, p < .001 \) for low neighborhood economic deprivation). Figure 6.4 illustrates that the link between impulsivity and parental knowledge is stronger in two-caregiver (simple slope: \( \beta = -.30, p < .001 \)) as compared to single parent families (simple slope: \( \beta = -.15, p < .05 \)).

Follow-up tests for gender differences in the path estimates of age 12 interaction terms and age 13 variables were conducted. The path estimates did not differ significantly for male and female adolescents, which may indicate that similar interaction effects may be at work for male adolescents, but that these failed to reach statistical significance in the present sample.
Figure 6.1. Standardized path estimates from the structural model on neighborhood and family risk, and impulsivity on parental knowledge, and adolescent antisocial behavior (ASB) for male adolescents. All paths are controlled for low family income. All interaction terms were tested alone, i.e., without the other interaction terms in the model. Only statistically significant ($p \text{ at least } < .05$) paths are shown. EcoDep = Neighborhood Economic Deprivation. Imp = Impulsivity. LowSocCon = Low Informal Social Control. SingPar = Single Parent Family.
Figure 6.2. Standardized path estimates from the structural model on neighborhood and family risk, and impulsivity on parental knowledge, and adolescent antisocial behavior (ASB) for female adolescents. All paths are controlled for low family income. All interaction terms were tested alone, i.e., without the other interaction terms in the model. Only statistically significant (p at least < .05) paths are shown. EcoDep = Neighborhood Economic Deprivation. Imp = Impulsivity. LowSocCon = Low Informal Social Control. SingPar = Single Parent Family.
Figure 6.3. Graphic representation of the interaction between neighborhood economic deprivation and impulsivity in the prediction of parental knowledge for female adolescents.
Figure 6.4. Graphic representation of the interaction between family type and impulsivity in the prediction of parental knowledge for female adolescents.
Table 6.3
Significant Indirect Effects of Parental Knowledge in Links Between Risk and Male and Female Antisocial Behavior

<table>
<thead>
<tr>
<th></th>
<th>Age 12</th>
<th>Age 13</th>
<th>Age 15</th>
<th>B</th>
<th>SE</th>
<th>β</th>
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<td>.003</td>
<td>.006*</td>
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<td>.001</td>
<td>.013*</td>
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<td>Female adolescents</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
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<td>.004</td>
<td>.012**</td>
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<td></td>
</tr>
<tr>
<td>Impulsivity Knowledge</td>
<td>ASB</td>
<td>.003</td>
<td>.001</td>
<td>.039***</td>
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<td></td>
</tr>
<tr>
<td>Neighborhood Economic Deprivation X Impulsivity Knowledge</td>
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<tr>
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<td>.001</td>
<td>.027**</td>
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</tbody>
</table>

Note. ASB = Antisocial Behavior. *** p < .001. ** p < .01. * p < .05.

Step 3: Indirect Effects of Parental Knowledge on Associations Between Risk Factors and ASB

Several significant indirect pathways were identified for both male and female adolescents (Table 6.2), suggesting that effects of other risks were partially mediated through effects on parental knowledge. For male adolescents, both age 12 low informal social control and impulsivity predicted higher age 15 ASB via changes in age 13 parental knowledge. For female adolescents, four significant indirect pathways were found: age 12 single parent family predicted higher age 15 ASB via changes in age 13 parental knowledge, and age 12 impulsivity predicted higher ASB at age 15 via changes in parental knowledge at age 13. In addition, the age 12 interactions between neighborhood economic deprivation and impulsivity, and between single-parent family and impulsivity predicted age 15 ASB via age 13 parental knowledge.

DISCUSSION

In this study, we investigated main and interactive effects of neighborhood and family risk, and adolescent impulsivity on early-mid adolescent ASB. In addition, we examined effects of these risk factors on parental knowledge, and the intervening role of parental knowledge in links between risk factors and ASB. Employing data from a large-scale representative sample of adolescents in Scotland, we showed (1) main effects of the risk factors under investigation on adolescent ASB and parental knowledge, (2) interactive effects of impulsivity with economic deprivation and family
type on parental knowledge for female adolescents, (3) indirect effects of risk factors on youth ASB via parental knowledge, and (4) gender differences in these effects.

Several results of the present study support previous research on risk factors for the development of ASB in adolescence. As in earlier studies, neighborhood economic deprivation and low informal social control (e.g., Loeber & Wikström, 1993; Sampson et al., 1997), and living in a single parent household (e.g., Breivik & Olweus, 2006), were each associated with increased levels of ASB. Similarly, in agreement with earlier research, adolescent impulsivity and ASB were strongly associated (e.g., Beauchaine & Neuhaus, 2008; Carrasco et al., 2006). Further, the results corroborate earlier research on the role of parental knowledge in youth ASB (e.g., Lahey et al., 2008; Laird et al., 2008), showing that parental knowledge early in adolescence is linked with subsequent decreases in ASB, while earlier involvement in ASB is also associated with subsequent decreases in parental knowledge. A novelty of the current study is that we examined the complex interplay of neighborhood, family, and personal characteristics influencing parental knowledge and antisocial behavior in one model using longitudinal data. Importantly, in doing so the present study extends what has been reported previously, by (1) demonstrating main and interactive effects of neighborhood, family, and individual risk factors on the development of ASB in male and female adolescents separately, and (2) demonstrating that risk factors from all levels partly affect ASB through parental knowledge.

**Neighborhood Risk, Family Risk, Impulsivity and the Development of ASB in Male and Female Adolescents**

The first question of the present study concerned main and interactive effects of contextual risk factors including neighborhood economic deprivation, neighborhood low informal social control, and living in a single parent-family, together with child impulsivity on the development of ASB. When all four risk factors were evaluated in one model, we found main effects only for all risk factors for male participants. For females, there were no significant main or interaction effects of neighborhood risks on ASB. The finding that neighborhood risks affect male adolescents’ development, but not female adolescents’ development directly, is consistent with the hypothesis that neighborhood factors are more influential for boys’ than for girls’ development (Kroneman et al., 2004). In contrast, impulsivity was related to higher levels of male and female adolescent ASB alike, and so was living with a single parent. Thus, considering only main effects, it appears that individual and family risk contribute to the development of ASB in adolescents of both genders, but that male adolescents are additionally affected by the effects of neighborhood risk in the form of high economic deprivation and low informal social control.

**The Intervening Role of Parental Knowledge**

The second main goal of this study was to evaluate the hypothesis that both contextual risk and impulsivity partly affect adolescent ASB through their effects on parental knowledge. We
confirmed this hypothesis: neighborhood risk, family risk, and impulsivity were not only linked with the development of youth ASB directly, but also indirectly, via decreasing levels of parental knowledge. For male adolescents, age 12 impulsivity and low informal social control in the neighborhood increased age 15 ASB via decreasing parental knowledge at age 13. For female adolescents, main and interaction effects of impulsivity and living with a single parent increased ASB at age 15 through decreases in parental knowledge. Additionally, for females the interaction between neighborhood economic deprivation and impulsivity also affected age 15 ASB through changes in age 13 parental knowledge. Though the effects may seem small (standardized betas of indirect pathways range from .006 to .039), they are in line with what has been reported previously. For instance, Kohen and colleagues reported an indirect effect from neighborhood cohesion via family functioning and consistent parenting on verbal ability with a beta of .001, and Mrug and Windle (2009) reported an indirect effect of neighborhood poverty through neighborhood disorganization and parenting on children’s externalizing problems of .04. Thus, like interaction effects, indirect effects are generally small. Nevertheless, the indirect effects found in the present study add to our insight into potential influences on early adolescent ASB, despite its strong stability (betas of .63 and .57 for males and females, respectively, in the present study). As such the effects found offer pointers for potential ‘down-stream’ effects if a certain risk was targeted by an indicated prevention effort. Findings of the present study replicate and extend the findings of two previous studies of adolescent antisocial behavior. A cross-sectional study showed that weak neighborhood social organization is linked to ASB partly through parenting for male adolescents (Chung & Steinberg, 2006). Another, longitudinal one showed that parenting practices partially mediate the effects of neighborhood social processes on gang membership across the 11 – 14 year period in male youths from poor urban communities (Tolan et al., 2003). Importantly, the present study increased extant knowledge through demonstrating the importance of impulsivity as a moderator of contextual risk for females.

Of interest, the differential importance of neighborhood and family factors found for the development of male versus female adolescents’ ASB is also reflected in effects on parental knowledge. Low informal social control decreased parental knowledge for males but not females. This finding may reflect that male adolescents tend to spend more time in the community than their female peers (Kroneman et al., 2004), making parents of sons more dependent on neighbors’ support in keeping track of their child. In neighborhoods with higher levels of social control, parental knowledge may stem in part from neighbors, who care what youngsters are up to in the streets, and share their observations with these youngsters’ parents. Watchful neighbors may also contribute to youth disclosure (“I’ll tell them who I hang out with, because otherwise they might hear it from someone else”). In addition, standards of parenting may differ in neighborhoods with high versus low levels of informal social control.

In our study, for female adolescents, neighborhood economic deprivation affected parental knowledge in conjunction with female adolescents’ impulsivity, i.e. impulsivity had a stronger impact in decreasing parental knowledge in non-deprived neighborhoods. Parents in low risk neighborhoods may feel safer to let their daughter do as she pleases, whereas parents in high risk
neighborhoods may try to remain knowledgeable even if their daughter is highly impulsive. Living with a single parent was associated with a decrease in parental knowledge for male and female youths. For females, however, this effect was also dependent upon their impulsivity levels. The link between high impulsivity and decreased parental knowledge appears stronger in two-caregiver families, indicating that two-caregivers, more than single parents, benefit from low levels of their daughter’s impulsivity. This effect also shows that highly impulsive female adolescents are always harder to parent, even with the help of a partner, than less impulsive females. These interaction effects can be interpreted as showing that female adolescents’ personality affects parenting more in low (low neighborhood economic deprivation and two-caregiver families) as compared to high risk contexts (high neighborhood economic deprivation and single parent families).

Risk factors were not only differentially important for the developmental course of parental knowledge for male and female adolescents, but the protective effect of parental knowledge on adolescent ASB is also significantly stronger for female as compared to male adolescents. This finding is consistent with research showing that family support predicts less delinquency among girls but not boys (Windle, 1992), and thus with suggestions that females benefit more from positive parenting behaviors than males.

The Role of Impulsivity

We did not find a neighborhood risk by impulsivity interaction in the prediction of male ASB, which is in line with results reported by Vazsonyi and colleagues (2006), but may seem to contradict results of two other studies (Lynam et al., 2000; Meier et al., 2008). It needs to be considered, however, that results of the present study are not directly comparable with those of earlier studies testing interactions between impulsivity and neighborhood risk, for instance because we additionally included parental knowledge in our model. We did find, however, that impulsivity interacted significantly with neighborhood economic deprivation for female adolescents in the prediction of parental knowledge, which in turn lead to changes in ASB two years later. In addition, impulsivity interacted with contextual risk in the form of living with a single parent for female adolescents in the prediction of parental knowledge. Effects of the risk factors studied here (on both the development of ASB and on parental knowledge), are in line with the ecological systems model of influences on risk development, which distinguishes between different environmental layers of influence, that form nested structures (cf. Bronfenbrenner 1977). In accordance with this model, (1) the proximal factor adolescent impulsivity appeared as the main player in the prediction of ASB as well as parental knowledge development, and (2) it was shown that the impact of impulsivity is moderated in part by the more distal family and neighborhood risk factors (at least for females), and may be attenuated by adequate levels of parental monitoring for both male and female adolescents. The moderating role of child impulsivity on parenting factors in predicting antisocial outcomes for girls has also been demonstrated in earlier studies (e.g., Leve, Kim, & Pears, 2005), but these were not directly comparable using different risk factors and different age periods for study.
As such, findings provide support for the statement that “temperamental impulsivity is usually not enough – except in perhaps the most extreme cases – to result in psychopathology in the absence of additional vulnerabilities and/or risk factors” (Beauchaine & Neuhaus, 2008, p. 140). In this context, it should be pointed out that, while some effect sizes, particularly for effects of neighborhood risk and parental knowledge, seem rather small in comparison to those for child impulsivity, these appeared (1) with other variables known to affect ASB in the same model, (2) while controlling for low family SES, and (3) while clustering within neighborhoods to account for the non-independence of data. For future research, these findings imply that it is important to consider child factors in conjunction with contextual factors from both the family and the community level. For a better understanding of the development of youth ASB, it is also recommended to consider possible gender differences in the impact of (contextual) risk factors.

Study Limitations and Future Directions

A number of limitations need to be acknowledged. First, the measures of impulsivity, neighborhood informal social control, parental knowledge, and antisocial behavior were all obtained via self-reports, raising the possibility of shared method variance. Nevertheless, self-reports were chosen for good reason: Adolescents are likely to be well-aware of informal social control in their neighborhoods, and of their own impulsivity and their parents’ knowledge on their whereabouts. For relatively mild delinquency that will lead to only few convictions, self-reported measures are considered as most suitable and reliable (Jolliffe, Farrington, Hawkins, Catalano, Hill, & Kosterman, 2003), since adolescents are unsupervised by teachers and parents during the times in which they are most likely to be involved in aggressive and delinquent behaviors (U.S. Department of Education, 2000). Further, self-reports of ASB show significant association to official court records of aggressive acts (see Loeber & Farrington, 2000). Nevertheless, replications in samples where these constructs are assessed independently would be of considerable value. Second, the present results may be sample dependent, as more than 90% of the adolescents in the present study were white and from an urban community in Scotland, limiting the generalizability of our findings. Third, as Kerr and Stattin (2000; Kerr, Stattin, & Trost, 1999) pointed out, parental knowledge may be derived from youth disclosure, or active parental surveillance. As our measure of parental knowledge did not distinguish its source, our findings may not be directly comparable to those of studies that did. And although recent research supports the importance of parental knowledge, independently of whether derived from active surveillance or child disclosure (Lahey et al., 2008; Hoeve et al., 2009), it might be informative to investigate models such as the one tested here, with measures which distinguish the source of parental knowledge. Such distinctions could have important implications for the interpretation of the results, for instance, whether negative associations between adolescent impulsivity and parental knowledge are mainly due to the fact that impulsive children disclose less of their activities to their parents, or whether parents have a harder time monitoring highly impulsive children. Similarly, since recent research has supported the usefulness of a distinction between aggressive and non-aggressive forms of ASB, both in factor
analytic (e.g., Tackett, Krueger, Iacono, & McGue, 2005) and longitudinal research designs (e.g., Barker, Séguin, Raskin White, Bates, Lacourse, Carbonneau et al., 2007), it would be interesting to see if the contextual risk and protective factors in the present study affect different forms of ASB in different ways.

Taken together, results of the present study clearly demonstrate that while prevention and intervention efforts at the individual level may be helpful, efforts may also usefully be aimed at the family and community levels. As the present study shows, parenting early adolescent children may be harder for some parents than for others, namely those living in neighborhoods with low levels of informal social control, and single parents. Further, parent-support groups may be offered, especially for single parents in the community. Even simply providing a meeting point for single parents may enhance mutual social support, either emotionally or functionally by teaming up in parenting activities (see Connell & Kubisch, 2001). At the community level, increasing social control in the community by fostering a sense of community and shared responsibility, for instance through neighborhood social activities, may decrease youth antisocial behavior not only directly but also indirectly, by increasing neighborhood support for parents.