Negative parental discipline is associated with increased risk of conduct problems. Children who grow up in the same family can face markedly different parental discipline and previous data using the monozygotic (MZ) twin differences design confirm that differences in negative parental discipline are a non-shared environmental risk factor associated with differences in the level of concurrent conduct problems. Longitudinal MZ twin differences data also suggest that maternal negative emotional attitudes towards children at age 5 may be a causal environmental factor for the development of subsequent conduct problems at age 7.

To our knowledge, no research to date has used the MZ twin differences design to assess whether differences in negative parental discipline represent a possible causal environmental factor for the development of conduct problems. Moreover, no MZ twin differences studies have been conducted to assess whether negative parental discipline is a non-shared environmental factor contributing to the development of callous–unemotional traits. Callous–unemotional traits are a well-documented temperamental correlate of severe and persistent antisocial behaviour. Callous–unemotional traits show moderate to strong heritability, as well as non-shared environmental effects. The heritable influences on callous–unemotional traits are substantially shared with conduct problems, but there is only a modest overlap in the non-shared environmental influences for callous–unemotional traits and conduct problems. Several findings have suggested that children with callous–unemotional traits may react less to negative parental practices than their peers with conduct problems, although other findings indicate that parenting may have some impact on the level of callous–unemotional traits in community samples. Taken together, previous findings encourage the investigation of negative parental discipline as a potential non-shared environmental factor contributing to individual differences in callous–unemotional traits. The primary aim of the current study was to use the MZ twin differences design to examine the environmental effects of negative parental discipline on the parent- and teacher-rated conduct problems and callous–unemotional traits from childhood to early adolescence (7–12 years).

Method

Participants were drawn from the Twins Early Development Study (TEDS), a longitudinal study of twin pairs ascertained from population records of twin births in England and Wales between 1994 and 1996. The TEDS has been shown to be reasonably representative of the UK population, and is described in detail elsewhere. The sample for the phenotypic analyses consisted of 4508 MZ twins (46.0% males), born in 1994, 1995 and 1996, who had data available from parents’ or teachers’ ratings (or both) of behavioural problems at 12 years of age (outcome measures). Mothers provided 98.4% of the ratings at age 7. The source of parental data was not collected at age 12, but the percentage of maternal ratings was estimated to be similar to the age 7 data collection by the TEDS coordinator (P. Busfield, personal communication, 2009). The MZ twin differences analyses were thus conducted on 2254 twin pairs. A total of 490 twins were excluded from the analyses because of missing data at 12 years old. Based on the assessment at 7 years, there was no statistical difference between the participants in the final sample and those who were not included on negative parental discipline (mean 0.02 v. 0.10, P > 0.05) and teacher-rated callous–unemotional traits (mean 3.53 v. 3.91, P > 0.05). However, participants in the final sample compared with those excluded had lower levels of teacher-rated conduct problems at 7 years old (mean 0.67 v. 0.93, P < 0.05). Monozygotic twins with severe medical or neurological problems were also excluded from the analyses. Zygosity was assigned using DNA testing in 76.6% of the cases.

Negative parental discipline, conduct problems and callous–unemotional traits: monozygotic twin differences study

Essi Viding, Nathalie M. G. Fontaine, Bonamy R. Oliver and Robert Plomin

Background

Negative parenting practices may be an environmental risk factor for subsequent conduct problems. Research on the association between parenting practices and callous–unemotional traits, a risk factor for conduct problems, has produced mixed findings.

Aims

To investigate whether negative parental discipline is a non-shared environmental risk factor for the development of conduct problems and callous–unemotional traits.

Method

Longitudinal, multi-informant data from a community sample of twins were analysed using the monozygotic (MZ) twin differences design for 4508 twins (2254 twin pairs).

Results

Within MZ twin pairs, the twin receiving more negative parental discipline at 7 years had more conduct problems (but not more callous–unemotional traits) at 12 years.

Conclusions

During the transition to early adolescence, negative parental discipline operates as a non-shared environmental risk factor for development of conduct problems, but not for the development of callous–unemotional traits.

Declaration of interest

None.
For those twins who did not provide DNA samples, parental ratings of physical similarity were used to determine the zygosity. This method assigns zygosity with more than 95% accuracy as validated by genotyping.18

Measures
The descriptive statistics of all measures are presented in Table 1.

Negative parental discipline
Negative parental discipline was assessed using questionnaire items adapted from a semi-structured interview19 at age 7. Parents reported on their use of the following negative discipline strategies with the child: restraining or smacking; sending the child to their room or withdrawing privileges; raising voice or shouting; and ignoring the child when they are misbehaving. The four items were rated on a 4-point scale (from never to often) for the first-born twin, followed by ratings on a 3-point scale (less, same or more) for the second-born twin. This rating method was chosen in order to focus parents on potential differences in their treatment of the two children. For first-born twins, the sum of the respective items was standardised for the whole population to zero mean and unit variance. For second-born twins, this standardised sum was added to the standardised sum of the differential items indicating more or less parental feeling; this composite score was then standardised.20 Cronbach’s alpha for the negative parental discipline was computed separately for the first- and second-born twins because the rating method was not identical for both. Cronbach’s alpha was 0.56 for the first-born twins and 0.65 for the second-born twins.

Conduct problems
Conduct problems at 7 and 12 years were assessed using the Strengths and Difficulties Questionnaire (SDQ),21 a five-item scale including items such as ‘Often fights with other children or bullies them’ and ‘Often lies or cheats’ (see Viding et al).19 None of the items overlapped with any of the conduct problem items. Cronbach’s alphas were 0.46 and 0.54 for the parents’ ratings at ages 7 and 12 respectively, and 0.74 and 0.71 for the teachers’ ratings at ages 7 and 12 respectively. The cross-informant (parent–teacher) cross-sectional and longitudinal correlations for callous-unemotional traits ranged from 0.12 to 0.23 (Table 2). The within-informant longitudinal correlations ranged from 0.27 to 0.32 (Table 2).

Table 1 Children’s conduct problems, callous–unemotional traits and negative parental treatment (n = 4508)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Conduct problems</th>
<th>Callous–unemotional traits</th>
<th>Negative parental disciplinea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents’ ratings</td>
<td>Parents’ ratings</td>
<td>Parents’ ratings</td>
<td>Parents’ ratings, age 7</td>
</tr>
<tr>
<td>Age 7</td>
<td>1.62</td>
<td>3.00</td>
<td>0.02</td>
</tr>
<tr>
<td>Age 12</td>
<td>1.31</td>
<td>2.81</td>
<td>0.02</td>
</tr>
<tr>
<td>Teachers’ ratings</td>
<td>Teachers’ ratings</td>
<td>Teachers’ ratings</td>
<td></td>
</tr>
<tr>
<td>Age 7</td>
<td>0.69</td>
<td>3.54</td>
<td></td>
</tr>
<tr>
<td>Age 12</td>
<td>0.59</td>
<td>3.06</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Correlations between parents’ and teachers’ reports of children’s conduct problems and callous–unemotional traits at 7 and 12 years old

<table>
<thead>
<tr>
<th>Variable</th>
<th>Conduct problems</th>
<th>Callous–unemotional traits</th>
<th>Negative parental disciplinea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parents’ ratings, age 7</td>
<td>Parents’ ratings</td>
<td>Parents’ ratings</td>
<td>Parents’ ratings, age 7</td>
</tr>
<tr>
<td>Age 7</td>
<td>0.32</td>
<td>–</td>
<td>0.02</td>
</tr>
<tr>
<td>Age 12</td>
<td>0.51</td>
<td>–</td>
<td>0.02</td>
</tr>
<tr>
<td>Teachers’ ratings</td>
<td>Teachers’ ratings</td>
<td>Teachers’ ratings</td>
<td></td>
</tr>
<tr>
<td>Age 7</td>
<td>0.24</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Age 12</td>
<td>0.36</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Parents’ ratings</td>
<td>Parents’ ratings</td>
<td>Parents’ ratings</td>
<td></td>
</tr>
<tr>
<td>Age 7</td>
<td>0.27</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Age 12</td>
<td>0.20</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Teachers’ ratings</td>
<td>Teachers’ ratings</td>
<td>Teachers’ ratings</td>
<td></td>
</tr>
<tr>
<td>Age 7</td>
<td>0.04</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Age 12</td>
<td>0.24</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

a. All correlations are significant at \(p<0.001\). Depending on the analysis, \(n=4126–4507\).

d. Longitudinal (within-source) correlations.

c. Cross-source (cross-sectional) correlations.
callous–unemotional traits. We used the COMPLEX analysis option in Mplus, Version 4.2 for Windows (www.statmodel.com) to account for the non-independence of observations (i.e. twins). Second, we examined the MZ twin correlations to ascertain whether there were differences within MZ twin pairs in the negative parental discipline and behavioural problems. Third, we tested if differences between MZ twin pairs in negative parental discipline were associated with differences between MZ twin pairs in their conduct problems and callous–unemotional traits. This MZ twin differences design provides a strong test of the specific unique environmental experiences that make family members different from each other (termed non-shared environmental influences) independently of genetics, because MZ twins share 100% of their genes. This method permits the examination of unique environmental influences on behaviour, free of passive or evocative gene–environment correlations that have been shown to influence parenting–behaviour relationships. Passive gene–environment correlation refers to the phenomenon where the child’s behaviour and the environment provided by the parent are correlated because both share a genetically transmitted liability. Evocative gene–environment correlation refers to a phenomenon where the child’s genetically influenced behaviour evokes different parental treatment.

Missing data were managed through Full Information Maximum Likelihood using Mplus, Version 4.2 on Windows. As expected in a population sample, the conduct problem scales (parents’ and teachers’ ratings) were skewed to the ‘no problem’ end (Table 1). To correct for skew, we applied a logarithmic transformation. However, the pattern of results remained after the transformation, so we report the findings using the untransformed scales. We conducted both phenotypic and MZ twin differences analyses separately for parents’ and teachers’ reports, and separately for conduct problems and callous–unemotional traits (first and third step of the analyses, see above). We examined:

(a) cross-sectional associations (e.g. the association between negative parental discipline at age 7 and conduct problems at age 7);
(b) longitudinal associations (e.g. the association between negative parental discipline at age 7 and conduct problems at age 12);
(c) longitudinal associations controlling for age 7 measures (e.g. the association between negative parental discipline at age 7 and conduct problems at age 12, controlling for conduct problems at age 7).

Participants with Mahalanobis distance scores at \( P < 0.001 \) (outlier cases) were excluded from the regression analyses that examined the behavioural problems at age 12 controlling for age 7 measures.

Prior to conducting the MZ twin differences analyses, two conditions had to be satisfied. First, a phenotypic relationship had to be demonstrated between negative parental discipline and conduct problems, as well as negative parental discipline and callous–unemotional traits. Second, it was important to ascertain that the MZ twins, although genetically identical and growing up in the same family, differed for conduct problems, callous–unemotional traits and negative parental discipline (to allow for the possibility of MZ twin differences in parenting contributing to MZ twin differences in conduct problems and callous–unemotional traits). After these checks, it was possible to test whether MZ twin differences in negative parental discipline were associated with differences between MZ twins in conduct problems and callous–unemotional traits.

### Is negative parental discipline associated with parent- and teacher-rated conduct problems and/or callous–unemotional traits?

The correlations between negative parental discipline and parent- and teacher-rated conduct problems and callous–unemotional traits were modest to moderate (0.11–0.43), but statistically significant both cross-sectionally (at 7 years) and longitudinally (from 7 to 12 years), as shown in Table 3. The correlations between negative parental discipline and callous–unemotional traits from ages 7 to 12 as a function of negative parental discipline at age 7. For analysis of conduct problems, the children's conduct problem score at age 7 was entered, followed by negative parental discipline at age 7 on conduct problems at age 12 (over and above any continuity of conduct problems from ages 7 to 12) was indicated for both parents’ and teachers’ ratings of conduct problems. The same analysis was repeated for callous–unemotional traits. Slightly weaker findings were observed for callous–unemotional traits compared with conduct problems (Table 3). The documentation of statistically significant phenotypic relationships between negative parental discipline and conduct problems/callous–unemotional traits satisfied the first condition for proceeding with the MZ twin differences analyses for both conduct problems and callous–unemotional traits.

### Are there differences between MZ twins on conduct problems, callous–unemotional traits and negative parental treatment?

Table 4 lists the intra-pair MZ correlations indexing similarity between MZ twins in their conduct problems, callous–unemotional traits and negative parental discipline. Although genetically

| Table 3 | Cross-sectional and longitudinal associations between negative parental discipline (at age 7) and children’s conduct problems and callous–unemotional traits (at ages 7 and 12), according to parents’ and teachers’ ratings of conduct problems and callous–unemotional traits* |
|-----------------|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                  | Parents’ ratings | Teachers’ ratings |                  |                  |                  |                  |                  |
|                  | At age 7, cross-sectional r | At age 12, longitudinal r | At age 12, controlling for age 7 behaviour problems, b | At age 7, cross-sectional r | At age 12, longitudinal r | At age 12, controlling for age 7 behaviour problems, b |                  |
| Conduct problems | 0.43 | 0.33 | 0.20 | 0.16 | 0.10 |                  |                  |
| Callous-unemotional traits | 0.15 | 0.13 | 0.09 | 0.16 | 0.11 | 0.07 |                  |
| Negative parental discipline |                  |                  |                  |                  |                  |                  |                  |

* Correlations; b, standardised regression coefficients.

a. All \( P < 0.001 \). Depending on the analysis, \( n = 4026–4465 \).
b. Different teachers rated the children at ages 7 and 12.
identical and growing up in the same family, the MZ twins were not identical on any of the measures at either age. For instance, approximately 25–40% of the variance in children’s conduct problems could be attributed to non-shared environmental factors (plus measurement error): parents’ ratings at 7 years: 1 – 0.73 = 0.27; parents’ ratings at 12: 1 – 0.77 = 0.23; teachers’ ratings at 7 years 1 – 0.69 = 0.31; teachers’ ratings at age 12: 1 – 0.60 = 0.40. Similar findings were observed for callous–unemotional traits (Table 4). This demonstration of non-shared environmental effects satisfied the second condition for proceeding with the MZ twin differences analyses.

### Are MZ twin differences in negative parental discipline related to MZ twin differences in conduct problems and callous–unemotional traits?

Table 5 shows the correlations between MZ twin differences in negative parental discipline and MZ twin differences in parent-rated conduct problems and callous–unemotional traits. The correlations between MZ twin differences in negative parental discipline and parent- and teacher-rated conduct problems were modest, but statistically significant both cross-sectionally (at 7 years old) and longitudinally (from 7 to 12 years old) (Table 5). A longitudinal effect of negative parental discipline at age 7 on conduct problems at age 12 (over and above continuity of conduct problems from ages 7 to 12) was documented for both parents’ and teachers’ ratings of conduct problems. On the other hand, MZ twin differences in negative parental discipline at age 7 were significantly correlated with MZ twin differences in callous–unemotional traits, cross-sectionally for parents’ and teachers’ ratings, but only for parent-rated callous–unemotional traits when examining the data longitudinally. Regression analyses predicting callous–unemotional traits at age 12 controlling for age 7 callous–unemotional traits did not show a longitudinal effect of negative parental discipline at age 7 for either parents’ or teachers’ ratings of callous–unemotional traits.

### Discussion

The primary aim of our study was to investigate the cross-sectional and longitudinal relationships between parent-reported negative parental discipline and parent- and teacher-rated conduct problems and callous–unemotional traits from childhood to early adolescence (7–12 years). To our knowledge this was the first study to investigate the longitudinal effects of negative parental discipline on conduct problems using the MZ twin differences design, although a previous MZ twin differences study has documented a significant environmental effect of maternal negative emotional attitudes on conduct problems in a younger age group. Moreover, the current study was the first to explore negative parental discipline as a non-shared environmental candidate for callous–unemotional traits. The strengths of the study include longitudinal, multi-informant data spanning a 5-year period, as well as the genetically informative MZ twin differences design.

### Negative parental discipline as an environmental risk factor for conduct problems

We found a longitudinal association between negative parental discipline and conduct problems. Specifically, the member of the MZ twin pair who had received more parent-reported negative parental discipline at age 7 was more likely to have higher levels of conduct problems at age 12 than the co-twin. This finding held even after the initial MZ twin differences in conduct problems at age 7 were controlled for in the analyses. Importantly, this finding was robust both within (parent-rated conduct problems) and across informants (teacher-rated conduct problems). Although previous phenotypic research has demonstrated an association between negative parental discipline and subsequent conduct problems, no previous studies have explored the role of negative parental discipline as a specific non-shared environmental risk factor for conduct problems.
of callous–unemotional traits. It is possible that the relation-
longitudinal relationship between parenting variables and level
analyses in both this and other studies have demonstrated a
phenotypic contribution of negative parental discipline and subsequent
callous–unemotional traits is somewhat surprising as phenotypic
problems. Therefore the different pattern of findings with regard
to callous–unemotional traits, this explanation is
unlikely. The internal consistencies for callous–unemotional traits
and conduct problems were very similar for both parent and
parenting and callous–unemotional traits, this explanation is
conceptually plausible that moderate internal
discipline for differences in subsequent callous–unemotional
as well as those with birth complications or low
language development and twin pregnancies are associated with
differences in the negative parental discipline at age 7 accounted
for a disappointingly small amount of differences in parent- and
teacher-rated conduct problems at age 12 over and above conduct
Our study is not without its limitations. On the face of it,
differences in the negative parental discipline at age 7 accounted
for for identical twins. However, this is unlikely to account for the
dependent variables that would jeopardise the conclusions from the twin studies,

Negative parental discipline and conduct problems in early adolescence

Our study focused on children's outcomes during the period of
entry to adolescence, for which there are no previous longitudinal
MZ twin differences data. This period is critical since it covers a
time when children may be starting delinquent careers. The
current study suggests that negative parental discipline may be
one specific non-shared environmental risk factor that
contributes to conduct problems in early adolescence.

The strength of the MZ differences design in
documenting a non-shared environmental effect

The MZ twin differences design ensures that pure non-shared
environmental effects, rather than gene–environment interaction
or evocative gene–environment correlation, are quantified.
Because the members of the MZ twin pair are genetically identical
to each other, any environmental effects operate upon genotype
effects that do not differ between the members of the MZ twin
pair. Of course we cannot rule out that some unmeasured, early
non-genetic influences between the MZ twins could have
contributed to our findings. To minimise this confound, all twins
with documented medical, neurological and physical health
diagnoses, as well as those with birth complications or low
birth-weight, were excluded from our analyses.

Negative parental discipline and callous–unemotional traits

Several studies have reported that non-shared environmental
influences are important in explaining the variance in callous–
unemotional traits (see for example Viding et al.8) yet we found no
longitudinal environmental effect of differential negative parental
discipline for differences in subsequent callous–unemotional
traits. Although it is conceptually plausible that moderate internal
consistency of the measures could have been responsible for the
difficulty in uncovering a true relationship between differential
parenting and callous–unemotional traits, this explanation is
unlikely. The internal consistencies for callous–unemotional traits
and conduct problems were very similar for both parent and
teacher ratings; in fact, teacher-rated callous–unemotional traits
and conduct problems were very similar for both parent and
techniques that would jeopardise the conclusions from the twin studies,
such as our current investigation. Although twins are delayed in
language development and twin pregnancies are associated with

Negative parental discipline is not a uniform non-
shared environmental risk factor for both conduct
problems and callous–unemotional traits

Analyses investigating the aetiology of conduct problems and
callous–unemotional traits suggest that although non-shared
environmental influences are important for both conduct
problems and callous–unemotional traits, there is only a modest
overlap for these influences between the two domains.8 The data
from the current analyses are thus in line with the notion that
much of the non-shared environmental influences important for
callous–unemotional traits. The newly expanding literature on callous–unemotional
traits in childhood is pointing to such traits as indicative of poor
long-term outcomes, particularly for adult psychopathy and
criminality.5 Moreover, studies have indicated substantial genetic
influence on these traits6,7 and there are data suggesting that these
children may be less responsive to some parenting intervention
programmes than children with conduct problems alone.27 Along-
side such findings, the current study serves to emphasise a
considerable challenge remaining for researchers and clinicians
alike; that is, to identify and subsequently target environmental,
including parenting, factors that may be addressed in order to
ameliorate callous–unemotional traits.

Study limitations

Our study is not without its limitations. On the face of it,
differences in the negative parental discipline at age 7 accounted
for a disappointingly small amount of differences in parent- and
teacher-rated conduct problems at age 12 over and above conduct
problems at age 7 (0.5–1.4% of the variance accounted for).
However, such effect sizes are common for the studies utilising
the MZ twin differences design, and are likely to reflect the fact
that unlike phenotypic analyses of the effects of supposed 'environmental' variables on variance in children's outcomes, the
MZ twin differences design does not include genetically mediated
associations between the environment and children's behav-
iour.3,28,29 It is becoming increasingly clear through studies like
ours that the variance in children's behaviour is accounted for
different aspects of the environment, as well as many
diverse genetic factors.

A further limitation concerns the internal consistency of the
measures of negative parental discipline, conduct problems and
callous–unemotional traits, which was only moderate in some
cases (Cronbach's alphas ranging between 0.46 and 0.74). This
could have produced more conservative estimates of the
magnitude of association between the measures of conduct
problems and callous–unemotional traits and the measure of
negative parental discipline. Moreover, we cannot rule out that
non-systematic measurement error stemming from the moderate
reliability of our measures did not inflate the difference scores
for identical twins. However, this is unlikely to account for the
systematic pattern of our findings that demonstrate a non-shared
environmental effect on conduct problems, but not on callous–
unemotional traits, across raters.

Another limitation that critics of the twin method often
highlight is that there may be important twin–singleton differ-
ences that would jeopardise the conclusions from the twin studies,
such as our current investigation. Although twins are delayed in
language development and twin pregnancies are associated with
increased rate of obstetric complications, neither concern is particularly relevant for twin data on conduct problems and callous–unemotional traits. Twins with obstetric complications were excluded from our analyses and language delay found in twins is very mild, representing variation in the normal range.30

Implications of the current findings

Negative parental discipline represents a non-shared environmental risk factor for development of further conduct problems during the transition to early adolescence. However, negative parental discipline does not appear to represent a non-shared environmental risk factor for callous–unemotional traits during this period. Previous research suggests that the non-shared environmental influences for conduct problems and callous–unemotional traits are largely independent3 and findings from this study highlight negative parental discipline as a possible causal risk factor for the development of conduct problems, but not callous–unemotional traits. The phenotypic relationship that is observed between negative parental practices and level of callous–unemotional traits may reflect genetic endowment (both provided by the parent as well as evoked by the child’s temperament) within families who have a child with callous–unemotional traits.

References

Negative parental discipline, conduct problems and callous–unemotional traits: monozygotic twin differences study
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