

Intergenerational transmission of psychopathy and mediation via psychosocial risk factors

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Background

Intergenerational continuities in criminal behaviour have been well documented, but the familial nature of psychopathic personality is less well understood.

Aims

To establish if there is an association between the psychopathic traits of a community sample of men and their offspring and whether psychosocial risk factors mediate this.

Method

Participants of the Cambridge Study in Delinquent Development ($n=478$ dyads) were assessed for psychopathy using the PCL: SV. Multilevel regression models were used to investigate intergenerational continuity and mediation models examined indirect effects.

Results

The fathers' psychopathy was transmitted to both sons and daughters. The transmission of Factor 1 scores was mediated via the fathers' employment problems. For male offspring, the Factor 2 scores were mediated via the fathers' drug use, accommodation and employment problems. For female offspring, Factor 2 scores were mediated via the fathers' employment problems.

Conclusions

Understanding of the specific role of certain psychosocial risk factors may be useful in developing preventive measures for the development of psychopathy.

Declaration of interest

None.

Intergenerational continuities in criminal and antisocial behaviour have been demonstrated by several studies,^{1–3} yet the transmission of psychopathic personality traits from parents to their offspring is less well understood. Studies of adults and adolescents suggest that psychopathic traits are moderately heritable,⁴ of early onset⁵ and fairly stable from adolescence through to adulthood.⁶ Parental psychopathy may also have an indirect influence on offspring through environmentally mediated processes such as the family's socioeconomic circumstances or parenting practices.⁷ Although there has been a fair amount of research into the biological and neurocognitive aetiology of psychopathy,^{8–11} psychosocial factors that may influence its development have received far less attention.

Evidence for a relationship between parental and offspring psychopathy is limited. A recent cross-sectional study of a non-referred sample of 83 children found a significant association between maternal affective features of psychopathy and the callous unemotional traits of their children, aged 10 years old. The analysis also suggested that parenting dysfunction fully mediated the relationship.¹² Studies examining the influence of parental psychopathology on the development of problem behaviour in offspring have traditionally focused on mothers,¹³ but it is also important to understand the role of fathers as men are more likely to have psychopathic traits and engage in persistent antisocial behaviour.¹⁴ Interest in subthreshold psychopathy has recently been increasing,^{15,16} and studies provide evidence that psychopathy may be a dimensional construct,¹⁷ often accompanied by less-serious antisocial behaviour.¹⁸ Although individuals in community samples that meet diagnostic thresholds are a minority, there are often several individuals below them who also experience significant symptoms and impairment.¹⁹ No large-scale family study has explored the influence of paternal psychopathic traits on offspring psychopathic traits. Therefore, the present research provides a unique opportunity to examine this prospectively in two consecutive generations in a large community sample, and also to examine whether psychosocial risk factors can help explain intergenerational continuities.

Method

Study design and participants

The father and offspring dyads are participants in the Cambridge Study in Delinquent Development (CSDD),²⁰ a prospective longitudinal study of the development of delinquent behaviour in a community sample of 411 males. The study began in 1961–2, with the original cohort containing all boys aged 8 or 9 years old from the registers of six schools in south London.

Procedures

Between 1984 and 1986, when they were aged 32, 378 of the men (93.80% of those still alive) participated in a social interview. The social interview asked questions about their accommodation, education, employment, family relationships, parenting, social life, substance misuse, involvement in antisocial behaviour and criminal convictions. They were last contacted in the period 1999 to 2004, then aged approximately 48, for a social interview and health questionnaire; 365 of 394 men who were still alive were interviewed (92.64%). Of these, 304 (83.29%) also completed the health interview, including the Psychopathy Checklist: Screening Version (PCL: SV)²¹ assessment, which was carried out separately.

Between 2004 and 2013, 550 of their offspring (84.23%) were also interviewed and assessed for psychopathy. At the time of the interview, their average age was 25.38 (s.d. = 3.63). We sought the parents' agreement to the offspring interview, to meet the standards of the South East England Regional Medical Ethics Committee. At each interview, written informed consent was obtained from all participants.

The data from the 550 offspring interviews was then matched with their fathers' data; some of the offspring could not be matched because of the father's death ($n=7$), the father's refusal ($n=48$) or the offspring's psychopathy assessment not being completed because the interview was conducted over the telephone ($n=17$). Therefore, this analysis is based on a sample

of 478 man and child dyads (243 fathers and sons, and 235 fathers and daughters). The original male participants are referred to as G2 (generation two) and their biological children, G3 (generation three).

Assessment of psychopathy

Psychopathy was assessed using the PCL: SV.²¹ The evaluation was conducted using information provided by the study participant and behavioural observations made by trained interviewers during a face-to-face interview. Criminal records were obtained for all participants from the Home Office extract of the Police National Computer (PNC) at the Ministry of Justice in London and these provided collateral information. The PCL: SV assessments for the G2 fathers and their G3 offspring were conducted by different researchers during separate phases of the study. The PCL: SV is conceptually and empirically related to its predecessor, the Psychopathy Checklist: Revised (PCL-R),²² and is adapted for use with community samples. Its reliability as a measure of psychopathy is reported elsewhere.²³ In this study interrater reliability was verified after attendance at a training workshop and several sessions where a random sample of 48 participants was rated. The intraclass correlation coefficients (ICC) for Factors 1 and 2 were 0.839 and 0.853 respectively.

Psychosocial risk factors

Five dichotomous composite psychosocial risk factors were created based on criteria that had previously been used to calculate life success scores for the G2 men at age 32.²⁴ These variables were: accommodation problems (two or more of: not a home owner, poor home conditions and more than two addresses in the past 5 years); cohabitation problems (three or more of: not living with a partner, not married or cohabiting for 5 years or more, divorced in the past 5 years and not getting on well with his partner); employment problems (three or more of: currently unemployed, low occupational class, low wages and unemployed for more than 9 months in the past 5 years); alcohol misuse (three or more of: driving while under the influence of alcohol, a heavy drinker, a binge drinker and a CAGE²⁵ score of two or more); drug use (any illegal drug in the past 5 years). Two additional risk factors were created using data from the G2 fathers' interview at age 32: teenage father (at the birth of first child); large family (father living with four or more children). Finally, three risk factors were created using data from the offspring interview: disrupted family (father left the family home before the child's sixteenth birthday); poor supervision (parents never knew where their child was going when they went out before age 16); harsh discipline (parents hit their children with an implement as a form of discipline). The selection of psychosocial risk factors was based on previous CSDD analyses conducted on the G2 males that found these factors to be important predictors of delinquency;²⁶ antisocial personality at age 32;²⁷ and PCL: SV scores at age 48.²⁸

Statistical analyses

The three relationships in Fig. 1 were modelled using the random effects generalised least squares (GLS) regression XTREG routine or logistic regression XTLOGIT routine in Stata version 12.1 statistical software for Windows. Estimates are based on robust standard errors, which take into account the non-independence of children from the same family.

Statistical mediation analysis^{29,30} was used to determine whether any of the psychosocial risk factors could help explain intergenerational continuities in psychopathy. Only psychosocial risk factors that demonstrated significant relationships for both paths *a* and *b* were tested as potential mediators (Fig. 1). The

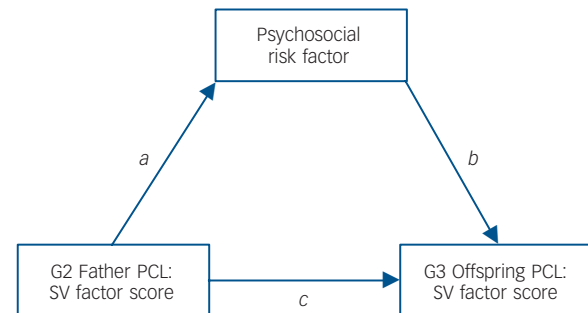


Fig. 1 Mediation model of the intergenerational transmission of psychopathy via psychosocial risk factors.

G2, Generation two; G3, Generation three; PCL: SV, Psychopathy Checklist: Screening Version.

direct and indirect effects were computed using the product of coefficients approach.³⁰ A bootstrap approach was used to evaluate the significance of the mediator using the cluster(varname) option with the BOOTMM command. This method calculated bias corrected confidence intervals for the indirect effect. Final models are shown with only significant mediators (where the confidence interval does not contain zero). When more than one psychosocial risk factor met the criteria for possible mediation, a multiple mediator model was used.³¹

Results

The Factor 1 scores for the G2 males ranged from 0 to 8 (out of a possible maximum of 12), with a mean of 1.17 and a standard deviation of 1.69. The Factor 1 scores for the G3 male offspring ranged from 0 to 10, with a mean of 1.92 and a standard deviation of 2.11. The Factor 1 scores of the G3 female offspring ranged from 0 to 9, with a mean of 0.95 and a standard deviation of 1.59. The Factor 2 scores for the G2 males ranged from 0 to 11 (out of a possible maximum of 12), with a mean of 2.45 and a standard deviation of 2.76. The Factor 2 scores for the G3 male offspring ranged from 0 to 10, with a mean of 2.53 and a standard deviation of 2.34. The Factor 2 scores of the G3 female offspring ranged from 0 to 9, with a mean of 1.42 and a standard deviation of 1.68.

Association between paternal and offspring psychopathy

The parameter estimates for the multilevel random-effects regression models that relate the PCL: SV factor scores of the G2 fathers to those of their male offspring are presented in Table 1. The results indicated that there was evidence of intergenerational transmission for both factors; the fathers' Factor 1 score was significantly associated with their male offspring's Factor 1 score. For every one-unit increase in the fathers' Factor 1 score, the sons' Factor 1 score increased significantly ($b = 0.41$, 95% CI 0.24–0.59, $P < 0.001$). This was also true for the relationship between the fathers' Factor 2 score and the sons' Factor 2 score ($b = 0.30$, 95% CI 0.20–0.42, $P < 0.001$). The results for female offspring also reveal that the fathers' factor scores were significantly associated with those of their daughters for Factor 1 ($b = 0.15$, 95% CI 0.03–0.28, $P < 0.05$) and for Factor 2 ($b = 0.20$, 95% CI 0.11–0.28, $P < 0.001$).

Paternal psychopathy and psychosocial risk factors

Presented in Table 2 are the results of the multilevel logistic regression analyses for the psychosocial risk factors. The fathers'

Table 1 Parameter estimates of multilevel random-effects regression models relating generation two (G2) Psychopathy Checklist: Screening Version (PCL: SV) factor scores to generation three (G3) PCL: SV factor score of male and female offspring

	G3 Males (n = 243)		G3 Females (n = 235)	
	b (s.e.)	P	b (s.e.)	P
G2 Factor 1	0.41 (0.09)	<0.001	0.15 (0.07)	0.02
G2 Factor 2	0.30 (0.06)	<0.001	0.20 (0.04)	<0.001

high psychopathy score meant that several of the psychosocial risk factors were more likely to be present, although all of the odds ratios were less than 2.00, so would not conventionally be considered large.³² For male offspring the largest odds ratios (ORs) were found relating the fathers' factor scores to his drug use: for Factor 1, OR = 1.73, 95% CI 1.39–2.16, *P* < 0.001 and for Factor 2, OR = 1.72, 95% CI 1.46–2.02, *P* < 0.001. For female offspring, the largest odds ratios were for the fathers' alcohol misuse: for Factor 1, OR = 1.50, 95% CI 1.26–1.79, *P* < 0.001 and for Factor 2, OR = 1.67, 95% CI 1.44–1.93, *P* < 0.001.

Psychosocial risk factors and offspring psychopathy

Prevalences for the psychosocial risk factors in the male and female offspring samples as well as parameter estimates for their relationship with the factor scores of the male and female

offspring are shown in Table 3. Many of the psychosocial risk factors were found to have a significant relationship with the factor scores of the G3 offspring, particularly for the male offspring. The fathers' employment problems, his alcohol misuse, a disrupted family and poor supervision all had significant relationships with both factors' scores of male and female offspring.

All psychosocial risk factors that were found to have a significant association with the G2 fathers' PCL: SV factor scores, and in turn also had significant associations with the factor scores of the G3 offspring were taken forward to be investigated as potential mediators in the next analysis.

Mediation analysis

The mediation of the effect of the fathers' factor scores on their offspring's factor scores are shown in Tables 4 and 5 for male and female offspring, respectively. The age of the G3 participants at the time of the PCL: SV assessment was found to be related to their PCL: SV score, so this variable was included in the mediation models as a control variable. For male offspring (Table 4), the proportion of the total effect of the fathers' Factor 1 score that is mediated is 0.263, the small indirect effect through the fathers' employment problems was significant. The bootstrap results shown that both the direct and the indirect effects are statistically significant. The effect of the fathers' Factor 2 score is mediated through the fathers' accommodation problems, employment

Table 2 Parameter estimates for random effects logistic regression models predicting psychosocial risk factors in male and female offspring

Psychosocial risk factors	Male offspring, OR (95% CI) (n = 243)		Female offspring, OR (95% CI) (n = 235)	
	G2 Factor 1	G2 Factor 2	G2 Factor 1	G2 Factor 2
Accommodation problems	1.21* (1.01–1.45)	1.19** (1.06–1.32)	1.28** (1.10–1.49)	1.21*** (1.10–1.34)
Cohabitation problems	1.24 (0.99–1.54)	1.25** (1.10–1.43)	1.35*** (1.15–1.59)	1.51*** (1.33–1.73)
Employment problems	1.67*** (1.37–2.04)	1.42*** (1.26–1.61)	1.44*** (1.23–1.70)	1.27*** (1.14–1.41)
Alcohol misuse	1.46*** (1.22–1.77)	1.50*** (1.31–1.71)	1.50*** (1.26–1.79)	1.67*** (1.44–1.93)
Drug use	1.73*** (1.39–2.16)	1.72*** (1.46–2.02)	1.33** (1.12–1.57)	1.56*** (1.35–1.79)
Teenage father	1.08 (0.81–1.44)	1.11 (0.95–1.31)	1.11 (0.91–1.35)	1.05 (0.92–1.20)
Disrupted family	1.17 (0.97–1.42)	1.19** (1.06–1.33)	1.35*** (1.16–1.58)	1.35*** (1.21–1.50)
Large family	1.16 (0.87–1.55)	1.08 (0.91–1.28)	0.96 (0.75–1.23)	0.99 (0.85–1.15)
Poor supervision	1.43* (1.05–1.93)	1.17 (0.97–1.41)	1.25 (0.98–1.59)	1.22* (1.03–1.44)
Harsh discipline	0.89 (0.61–1.29)	1.02 (0.84–1.23)	1.28* (1.04–1.57)	1.15 (0.99–1.33)

G2, generation two.
P* < 0.05, *P* < 0.01, ****P* < 0.001.

Table 3 Descriptive data and univariate relationships of psychosocial risk factors and generation three (G3) offspring Psychopathy Checklist: Screening Version (PCL: SV) factor scores

Psychosocial risk factors	Male offspring (n = 243)			Female offspring (n = 235)		
	Prevalence, n (%)	Factor 1, b (s.e.)	Factor 2, b (s.e.)	Prevalence, n (%)	Factor 1, b (s.e.)	Factor 2, b (s.e.)
Accommodation problems	69 (28.40)	1.13 (0.29)***	1.55 (0.33)***	89 (38.53)	0.43 (0.25)	0.59 (0.25)*
Cohabitation problems	32 (13.17)	0.63 (0.40)	1.17 (0.46)*	37 (16.02)	0.67 (0.33)*	1.20 (0.34)***
Employment problems	50 (20.58)	1.51 (0.32)***	2.01 (0.36)***	51 (22.08)	0.84 (0.28)**	1.03 (0.29)***
Alcohol misuse	92 (37.86)	0.76 (0.27)**	1.02 (0.32)**	98 (42.42)	0.63 (0.24)*	0.81 (0.25)**
Drug use	35 (14.40)	1.33 (0.37)***	2.16 (0.43)***	34 (14.72)	0.50 (0.34)	0.70 (0.35)*
Teenage father	20 (8.23)	1.67 (0.48)***	1.73 (0.56)**	28 (11.91)	0.59 (0.39)	0.67 (0.40)
Disrupted family	56 (24.03)	0.76 (0.32)*	0.74 (0.36)*	77 (33.77)	0.64 (0.22)**	0.61 (0.24)*
Large family	18 (7.41)	2.19 (0.49)***	2.00 (0.61)**	24 (10.21)	0.47 (0.46)	0.07 (0.48)
Poor supervision	13 (5.35)	3.91 (0.55)***	4.62 (0.60)***	13 (5.53)	1.41 (0.42)**	2.07 (0.42)***
Harsh discipline	17 (7.00)	0.97 (0.53)	1.86 (0.57)**	18 (7.66)	0.41 (0.39)	1.62 (0.39)***

P* < 0.05, *P* < 0.01, ****P* < 0.001. Totals may not match n, as some data were missing for some categories.

Table 4 Mediation of the effect of the fathers' Psychopathy Checklist: Screening Version (PCL: SV) factor scores on their male offspring's PCL: SV factor score through psychosocial risk factors, controlling for age of offspring at assessment

G3 males (sons $n=243$, fathers $n=161$)	Product of coefficients, b (s.e.)	Bootstrapping, BCa 95% CI ^a
<i>Factor 1</i>		
Indirect effect		
Employment problems	0.108 (0.037)	(0.026 to 0.227)
Direct effect	0.301*** (0.090)	(0.124 to 0.478)
Proportion of total effect mediated	0.263	
Ratio of indirect to direct effect	0.357	
Ratio of total to direct effect	1.357	
<i>Factor 2</i>		
Indirect effects		
Accommodation problems	0.037 (0.016)	(0.005 to 0.084)
Employment problems	0.068 (0.026)	(0.005 to 0.150)
Drug use	0.098 (0.035)	(0.014 to 0.218)
Total indirect effect	0.202 (0.043)	(0.087 to 0.335)
Direct effect	0.101 (0.065)	(-0.026 to 0.228)
Proportion of total effect mediated	0.666	
Ratio of indirect to direct effect	1.993	
Ratio of total to direct effect	2.993	

G3, generation three.
a. BCa, bias corrected and accelerated: 5000 bootstrap samples.
* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Table 5 Mediation of the effect of the fathers' Psychopathy Checklist: Screening Version (PCL: SV) factor scores on their female offspring's PCL: SV factor score through psychosocial risk factors, controlling for age of offspring at assessment

G3 females (daughters $n=235$, fathers $n=160$)	Product of coefficients, b (s.e.)	Bootstrapping, BCa 95% CI ^a
<i>Factor 1</i>		
Indirect effect		
Employment problems	0.048 (0.021)	(0.008 to 0.132)
Direct effect	0.095 (0.059)	(-0.020 to 0.210)
Proportion of total effect mediated	0.333	
Ratio of indirect to direct effect	0.500	
Ratio of total to direct effect	1.500	
<i>Factor 2</i>		
Indirect effect		
Employment problems	0.033 (0.014)	(0.007 to 0.097)
Direct effect	0.159*** (0.038)	(0.084 to 0.234)
Proportion of total effect mediated	0.172	
Ratio of indirect to direct effect	0.208	
Ratio of total to direct effect	1.208	

G3, generation three.
a. BCa, bias corrected and accelerated: 5000 bootstrap samples.
* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

problems and drug use. All three indirect effects are significant, but the direct effect is not. The indirect effect through accommodation problems is quite small ($b=0.037$), and the indirect effects through employment problems ($b=0.068$) and drug use are somewhat larger ($b=0.098$). The total indirect effect ($b=0.202$) is twice the size of the direct effect ($b=0.101$). The proportion of the total effect that is mediated is 0.666.

The results for female offspring (Table 5) show that the effect of the fathers' Factor 1 score on their female offspring's Factor 1 score is again mediated through the fathers' employment problems. However, only the indirect effect is significant ($b=0.048$), and it is somewhat smaller than the direct effect ($b=0.095$). The proportion of the total effect that is mediated is 0.333. Finally,

the effect of the fathers' Factor 2 score on the daughter's Factor 2 score is mediated once again, through the fathers' employment problems. Bootstrap results reveal that both direct and indirect effects are significant, with the size of the indirect effect ($b=0.033$) being very small, compared with the direct effect ($b=0.159$), with the proportion of the total effect mediated being 0.172.

Discussion

Main findings

Intergenerational pathways for criminal and antisocial behaviour have been demonstrated by several empirical studies, but this is not the case for psychopathic personality traits, which are often found in violent and persistently antisocial individuals. The results from this study provide the first evidence that the psychopathic personality traits of a community sample of men have a significant association with the psychopathic personality traits of their male and female offspring.

Most significantly, this study suggests that the fathers' employment problems play an important role in explaining the intergenerational transmission of psychopathic personality traits (Factor 1 scores) to both male and female offspring. Previous analyses of CSDD data³³ demonstrated that the psychopathic traits of the G2 males were not an asset in achieving life success. Other studies have shown that a fathers' occupational status had a significant positive relationship with emotionally detached (high score Factor 1, low score Factor 2) prisoners³⁴ and in a third study, Lynam *et al.*³⁵ found that the socioeconomic status of the family (based on parental education and occupation) interacted with psychopathy in early adolescence to predict adult psychopathy scores. The transmission of the fathers' Factor 2 scores was also mediated by accommodation problems and drug use. This could be because of inconsistent parenting as a result of drug dependence.

Taken together, these findings are suggestive of several mechanisms that could be underlying the intergenerational transmission of psychopathic personality traits. A recent study found that subclinical psychopathy was related to counterproductive work behaviours³⁶ and it could be the case that fathers with psychopathic traits and chronic employment problems spend more time in the family home, which has a negative impact on their offspring, as other studies have found.³⁷ It is likely that these families would also experience financial hardship, social deprivation and parental conflict, which could contribute to childhood maltreatment and neglect, and these hypotheses certainly require further exploration.

Limitations

The study has several limitations that should be mentioned briefly; first, the Psychopathy Checklist has been subject to much debate,^{38,39} particularly because of its over- and underinclusivity of items for measuring the psychopathy construct, and interpretation of these results should bear these criticisms in mind. Second, we relied on the offspring's retrospective report of parenting, and there exists the possibility of recall bias. Third, this analysis treats intergenerational relationships as a unidirectional process, whereas there is increasing evidence for bidirectional processes.^{40,41} Future intergenerational studies should also take into account the influence of the characteristics of the child on the parent.

Implications

Despite these limitations, to the best of our knowledge, no prior studies have examined the familial nature of psychopathy

prospectively in two consecutive generations using a measure that is known to be reliable and valid. This is also the first study to demonstrate mediation of the intergenerational relationship via psychosocial risk factors and further replication of these findings using different samples and alternative measures of the psychopathy construct are needed. Most importantly, the identification of specific risk factors that can partly explain intergenerational associations can provide important information for policymakers and practitioners by highlighting those who are particularly at risk, in the hope that resources could be more effectively focused on specific areas for intervention (i.e. particularly targeting families with histories of unemployment and substance misuse problems), as findings from this study and others suggest that high heritability does not equal immutability.

Our findings suggest several possibilities; first, this study found that certain psychosocial risk factors could explain the relationship between the psychopathy of fathers and their offspring. However, second, the association could also be explained by environmental risk factors that both generations are exposed to. Also, third, unmeasured genetic factors could account for the majority of intergenerational transmission. Finally, it is most likely that both genetic and environmental factors explain the development of psychopathic personality features in childhood and adolescence and their persistence into adulthood. Behavioural genetics studies have found that although genetic and environmental factors are equally responsible, the expression of a particular gene may vary according to the presence of other genes, as well as environmental factors, which themselves may be able to alter the way genes are expressed. It is also thought that non-shared environmental factors are responsible for variation in psychopathic traits from childhood through to adulthood.⁴² Further analyses of data from prospective longitudinal studies are crucial to test these intergenerational hypotheses. Further knowledge of the role of psychosocial risk factors in the aetiology of psychopathy has the potential to facilitate far more effective risk-focused prevention in the future.

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words

Biological psychiatry

Philip Cowen

Guze's famous essay on biological psychiatry – 'Is there any other kind?' – argued that humans are biologically evolved creatures, therefore biological processes must contribute importantly to psychiatric disorder. True enough, though perhaps it was inevitable that 'biological' psychiatry would be defined in opposition to other kinds of psychiatry like 'psychosocial', which would then return to depict it as mindless, blind to context and medically hegemonic. Pluralism is a great relief. Biological processes are always involved, and we can try to utilise them for understanding and treatment if it helps – but we don't have to. Biopsychosocial psychiatry – is there any other kind?

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