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Personality and the experience of environmental adversity

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ABSTRACT

Background. While psychiatric epidemiology often focuses on the causal relationship between environmental adversity and the individual (e.g. environment to person), individuals probably make important contributions to the quality of their environments (person to environment).

Method. In a population based sample of >7000 male and female adult twins, we examined the relationship between the personality trait of neuroticism (N) and the occurrence of stressful life events (SLEs) and the quality of interpersonal relationships (IPR). We compared the magnitude of the prediction of twin 1's self-reported SLEs and IPR from: (*i*) twin 1's self-reported N; (*ii*) twin 2's report of twin 1's N; and (*iii*) twin 2's report of twin 2's N in monozygotic pairs.

Results. In our entire sample, self-report N significantly predicted the occurrence of most SLEs and all dimensions of IPR. Using the co-twin's report of N produced associations that were of the same magnitude for SLEs and modestly weaker for IPR. In monozygotic pairs, the level of N in one twin predicted SLEs and IPR in the co-twin at levels similar to those found for the co-twin's report of N. Repeating these analyses with a prospective subsample produced similar results.

Conclusion. An individual's personality in adulthood plays a significant role in influencing exposure to some forms of environmental adversity and this association is not the result of reporting bias. Furthermore, this relationship is largely mediated by a common set of familial factors that predispose both to a 'difficult' temperament and to environmental adversity. Developmental models of psychiatric illness should adopt an interactionist view of individuals and their environment (person and environment).

INTRODUCTION

… the interactional approach … emphasizes the dynamic, continuous and reciprocal process of interaction between the individual and the environment. (Magnusson, 1988, p. 23).

Traditional epidemiological models of disease emphasize the unidirectional causal relationship between the environment and the individual. However, at least five lines of evidence in psychiatric epidemiology suggest that the relationship between individuals and one key set of risk factors – environmental adversity (EA) – is bidirectional in nature.

First, several dimensions of personality – particularly neuroticism (N) – correlate substantially with measures of EA (Henderson *et al.* 1981; Monroe & Steiner, 1986; Sarason *et al.* 1986; Headey & Wearing, 1989; Windle, 1992; Magnus *et al.* 1993). Secondly, the quality of interpersonal relationships (IPR) is strongly influenced by the personal characteristics of the individuals involved, including their level of emotionality and reactivity (Bell, 1968; Reiss *et al.* 1999; Eisenberg *et al.* 2002). Thirdly, individuals play a substantial role in selecting their peer group, a crucial part of their social environment (Rose, 2002). Fourthly, longitudinal

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studies show stable individual differences in 'event-proneness' (McFarland, 1957; Gottfredson, 1981; Tsuang *et al.* 1985). Fifthly, behavioural genetic studies demonstrate modest but significant heritabilities for several forms of EA (Plomin *et al.* 1990; McGue & Lykken, 1992; Kendler *et al.* 1993; Lyons *et al.* 1993; Foley *et al.* 1996) including poor IPR (Bergeman *et al.* 1990; Kessler *et al.* 1992; McGue & Lykken, 1992; Kendler, 1997).

This paper tries to clarify further the nature of this individual–environment interaction by studying the relationship among N, SLEs and IPR using a longitudinal twin design. We illustrate this design assuming a twin pair consisting of twin 1 and twin 2 (Fig. 1). We predict, using cross-sectional and prospective data, self-report measures of EA in one twin (here twin 1) from: (*i*) self-report N in twin 1 (path 1); (*ii*) report of N in twin 1 by twin 2 (path 2); and (*iii*) self-report of N in twin 2 in monozygotic (MZ) twin pairs (path 3).

A limitation of prior studies relating personality to EA has been that both measures were obtained by self-report from the same individual. With this design, the observed association could result from correlated reporting biases. That is, some individuals with a 'plaintive set' may over-report both their own worries and anxieties (reflected in their high N scores – path c) and exaggerate the real problems they have encountered in their lives (reflected in their high measures of EA – path d). The degree to which such biases contribute to the association between N and EA can be assessed by comparing the magnitude of paths 1 and 2 in Fig. 1. Unlike path 1, where the same individual reports both N and EA, in path 2 different individuals report on N (twin 2) and EA (twin 1), thereby eliminating the correlated reporting bias.

We also seek to gain insight into the aetiology of the association between N and EA. N is a heritable trait (Szmukler *et al.* 1986; Eaves *et al.* 1989; Loehlin, 1992; Loehlin *et al.* 1998; Lake *et al.* 2000) and prior studies suggest that the association between N and SLEs may be partly mediated by common familial risk factors (Billig *et al.* 1996; Saudino *et al.* 1997). Since MZ twins share both their genes and their rearing environment, the contribution of familial factors to the association between N and EA can be approximated by comparing the magnitude of path 3 with those of paths 1 and 2. For example, if familial factors were entirely responsible for the relationship between N and EA, then the EA experienced by twin 1 in an MZ pair could be equally predicted by the levels of N in twin 1 (reported either by twin 1 via path 1 or by twin 2 via path 2) and the level of N measured in twin 2 (path 3).

METHOD

Sample

The twins in this study derive from the population-based Virginia Twin Registry (Kendler & Prescott, 1999) which now constitutes part of the Mid-Atlantic Twin Registry. These female–female (FF) twin pairs, from birth years 1934–1974, became eligible if both members previously responded to a mailed questionnaire in 1987–1988, the response rate to which was ~64%. They have been approached for four subsequent waves of personal interviews from 1988 to 1997, with cooperation rates ranging from 85 to 92%. The male–male and male–female (MMMF) twin pairs, covering the birth years 1940–1974 were ascertained in a separate study – with an initial cooperation rate of 72·4% – and have been approached for two waves of interviews from 1993 until 1998. Zygosity was determined by a combination of standard questions (Eaves *et al.* 1989), photographs and DNA analysis (Spence *et al.* 1988; Kendler & Prescott, 1999).

Measures

N was measured using the 12-item scale from a short version of the EPQ (Eysenck *et al.* 1985) assessed at multiple waves in this study. Our interviews assessed the occurrence, to the nearest month, of 11 'personal' stressful life events (events occurring primarily to the informant): 'assault' (assault, rape or mugging), 'divorce/separation' (divorce, marital separation, broken engagement or break-up of other romantic relationship), 'major financial problem', 'serious housing problems', 'serious illness or injury', 'job loss' (laid off from a job or fired), 'legal problems' (trouble with police or other legal trouble), 'loss of confidant' (separation from other loved one or close friend other than spouse/partner), 'serious marital problems',

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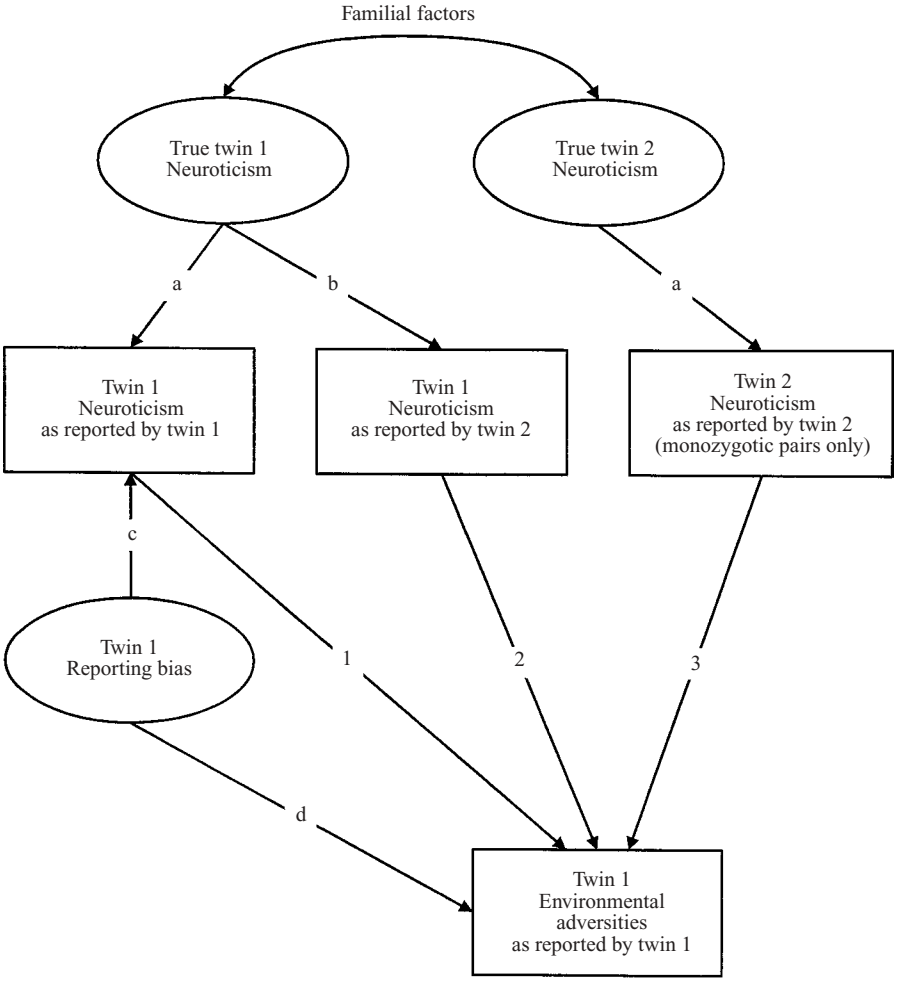


FIG. 1. Analytic models to examine the relationship between neuroticism and environmental adversities. This figure outlines the conceptual model for the analyses presented in this paper. Latent variables are depicted in ovals and observed variables in rectangles. We assume a twin pair in which the members are termed twin 1 and twin 2. We seek to predict environmental adversities as reported by twin 1 from three different reports of neuroticism (N): twin 1's neuroticism as reported by twin 1 (path 1), twin 1's neuroticism as reported by twin 2 (path 2) and twin 2's neuroticism as reported by twin 2 (path 3) in monozygotic pairs only. Path a reflects an individual accuracy in reporting his or her own neuroticism while path b reflects an individual's accuracy in reporting neuroticism in his or her co-twin. The figure also includes a reporting bias whereby an individual's overall outlook on the world (e.g. plaintive set *v.* 'rose-coloured glasses') may bias both how he sees himself (via path c) and how he perceives the world around them (via path d). We suggest that a comparison of paths 1 and 2 provide insight into the degree to which reporting bias influences the observed relationship between an individual's own report on their personality and their experience of adversities. Comparing path 3 with paths 1 and 2 provides insight into the degree to which the association between neuroticism and environmental adversities is mediated by familial factors.

(involving a marital or marriage-like intimate, cohabiting relationship), 'robbed' and 'serious difficulties at work'. We also assessed four classes of 'network' events, meaning events that occur primarily to, or in interaction with, an individual in the respondent's social network. These event classes consisted of: (*i*) 'getting along with' – serious trouble getting along with an individual in the network; (*ii*) 'crisis' – a serious personal crisis of someone in the network; (*iii*) 'death' – death of an individual in the network; and (*iv*) 'illness' – serious illness of someone in the network. Because of possible greater sensitivity to events occurring to individuals especially close to the respondents, we divided the social network of the twins into

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proximal and distal. Proximal members of the network included the respondent's spouse, child, parent, cotwin, and other non-twin siblings. Distal members of the network included the two categories of 'other close relative' and 'someone else close to you'. We did not collect information on crises in the distal network.

Eight dimensions of interpersonal relationships (IPR) (termed social support in our previous reports) were derived by factor analysis from a 24-item social interaction measure included in our interview and developed and used at the Institute for Social Research (Kessler *et al.* 1992; Kendler, 1997; Wade & Kendler, 2000). These dimensions included spouse problems, spouse support, relative problems, relative support, friend problems, friend support, confidants and social integration. The spouse items (which applied only to individuals who reported being married or being in an enduring intimate relationship) were measured on a five-point interval scale, ranging from 'a great deal' to 'not at all'; analyses involving spouse support included only those twins who had an intimate relationship. The other items relating to the function of SS were measured on a four-point scale, ranging from 'often' to 'never'. Higher scores on the 'confidants' and 'social integration' scales indicated more confidants and greater social integration.

Statistical analysis

Our main analyses strove to maximize sample size and power. We used measures of SLEs and IPR from the third wave of the FF and the second wave of the MMMF samples. We included only complete pairs so that the samples on which we had self-reported and co-twin reported N would be the same. Self-report and MZ co-twin measures of N were obtained from the first interview wave of both studies. Using the same items for self-report N, twins were also asked to report on the personality of their co-twin in the initial screening questionnaire in the FF sample and in a questionnaire given in the second-wave of the MMMF sample. Therefore, in this total sample, N was assessed at an earlier wave than SLEs and IPR except for co-twin reported N from the MMMF sample.

To obtain a more global assessment of the relationship between N, SLEs and IPR, we constructed composite measures for SLEs and IPR. For SLEs, this measure was the sum of reported event categories. For IPR, the composite measure was the sum of all eight individual dimensions, correcting for direction of effect. This measure was available only for individuals who were currently in an intimate marriage-like relationship, so sample sizes are smaller than for the composite SLE measures.

We examined these composite measures not only for the total sample but also for its three constituent subsamples: male–male (MM) pairs, the FF pairs and the opposite-sex male–female (MF) pairs. The FF pairs were of particular interest because only in that sample were all three paths (in Fig. 1) estimated using prospective data (the third FF interview wave which was separated from the questionnaire assessment by $6{\cdot}4 \pm 0{\cdot}4$ years). We included the MF pairs to examine whether sex differences impacted on the relationship between co-twin reported N and a twins SLEs and IPR.

We implemented the Chow test (Chow, 1960) in PROC GENMOD in SAS to test for the equality of the regression coefficients for paths 1, 2 and 3. Each possible combination of equalities (e.g. paths $1=2>3$, $1>2=3$, etc.) were compared with the model which assumed all three paths were significantly different. We report only the best-fitting of these models. These analyses were performed only on the aggregate measures of SLE and IPR.

All of our analyses accounted for the correlational structure of the twin data using independent estimating equations (Sutradhar & Das, 1999). For the analyses of individual SLEs, we employed logistic regression, while for the analysis of both individual IPR dimensions and the composite IPR score, we utilized linear regression. For the SLE composite, we employed Poisson regression. For all analyses, N scores were standardized. Therefore, in the SLE analyses, the OR reflects the increased chance of reporting an event for every S.D. increase in N. *P* values are reported two-tailed.

RESULTS

Total sample – predicting stressful life events

Using the entire sample, measures of self-report N were significantly associated with the

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Table 1. *The impact of self-reported Neuroticism (N), N as reported by the co-twin, and N of the MZ co-twin on self-reported stressful life events*

Life event category	Self-report ($N=5575$)		Co-twin report ($N=5575$)		MZ co-twin score ($N=2328$)	
	OR	95% CI	OR	95% CI	OR	95% CI
Assault	1·06	0·86–1·32	1·05	0·79–1·31	0·81	0·54–1·23
Divorce–Separation	1·16***	1·07–1·27	1·24****	1·14–1·34	1·24**	1·08–1·42
Financial	1·09*	1·02–1·17	1·15****	1·08–1·23	1·28****	1·14–1·45
Housing	1·23*	1·04–1·44	1·30**	1·12–1·51	1·28	0·97–1·09
Illness	1·10**	1·03–1·18	1·16****	1·09–1·24	1·23***	1·09–1·39
Job loss	1·33****	1·18–1·49	1·26****	1·13–1·41	1·25*	1·04–1·51
Legal problems	1·27****	1·12–1·43	1·43****	1·27–1·61	1·17	0·95–1·44
Loss of confidant	1·00	0·91–1·09	1·00	0·91–1·09	1·07	0·93–1·23
Marital problems	1·33****	1·30–1·49	1·24****	1·14–1·35	1·42***	1·13–1·47
Robbed	0·93	0·81–1·06	1·00	0·88–1·14	0·99	0·78–1·26
Work problems	1·28****	1·19–1·37	1·20****	1·12–1·29	1·10	0·97–1·24
Extended network						
Getting along	1·18****	1·09–1·28	1·21****	1·12–1·30	1·15*	1·00–1·32
Death	1·08*	1·02–1·16	1·05	0·98–1·11	1·01	0·90–1·12
Illness	1·03	0·96–1·11	0·91*	0·84–0·98	0·83**	0·72–0·95
Close network						
Getting along	1·43****	1·32–1·54	1·43****	1·34–1·54	1·35****	1·19–1·55
Crises	1·09**	1·03–1·16	1·08**	1·02–1·15	1·13*	1·03–1·24
Death	1·17**	1·05–1·32	1·24****	1·12–1·37	1·21*	1·01–1·46
Illness	1·13***	1·06–1·20	1·13****	1·06–1·20	1·24****	1·12–1·38

* $P<0·05$; ** $P<0·01$; *** $P<0·001$; **** $P<0·0001$.

occurrence of 14 of 18 SLEs (all but assault, loss of confidant, robbed and illness in the extended network) (Table 1), with highest ORs seen for getting along with individuals in the close social network, marital problems, job loss and work problems.

Utilizing levels of N as reported by the co-twin, significant positive associations were seen for 13 of the 14 events significantly associated with self-report N. In general, the ORs were quite similar using co-twin reported N and self-report N.

Looking within MZ twin pairs, the level of N in one twin significantly predicted the occurrence of SLEs in the co-twin for 11 of the 18 categories. The ORs, which were highest for marital problems and problems getting along with individuals in the close social network, were also similar in magnitude to those seen with self- or co-twin reported N.

A comparison of our composite measure for SLEs in the total sample (Table 2) shows that the overall magnitude of paths 1, 2 and 3 are very similar. The Chow test for the equality of regression coefficients indicated that the best-fit model assumed the equality of all the coefficients.

Total sample – predicting interpersonal relationships

Including the entire sample, self-reported N significantly predicted all eight dimensions of IPR (Table 3) being positively associated with problems in the relationship with the spouse, relatives and friends and negatively associated with the level of support from the spouse, relatives and friends. In addition, N was negatively associated with the number of confidants and the degree of social integration.

Using levels of N as reported by the co-twin, significant associations were still seen with all eight IPR dimensions, although the magnitude of the association was generally lower than that seen using the self-report scores.

The level of N in the MZ co-twin significantly predicted six of the eight dimensions of IPR (all but friend problems and number of confidants). For these six dimensions, the magnitude of the association was similar to that seen using the co-twin reported levels of N.

A comparison of our composite measure for IPR (Table 2) suggests that, as assessed by a β coefficient, the overall magnitude of path 1 is moderately greater than that of path 2 which

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Table 2. *The impact of self-report Neuroticism (N), N as reported by the co-twin and N of the MZ co-twin on composite measures of self-reported stressful life events (SLE) and interpersonal relationships (IPR)*

	$\beta \pm$ S.E.			
Sample	Self-report (1)	Co-twin teport (2)	MZ co-twin score (3)	Best-fit model
SLE				
Total	+0·11±0·01**** $N=5575$	+0·11±0·01**** $N=5575$	+0·11±0·02**** $N=2328$	1=2=3
MM	+0·16±0·02**** $N=2224$	+0·14±0·02**** $N=2224$	+0·13±0·02**** $N=1498$	1=2=3
FF	+0·09±0·02**** $N=1367$	+0·11±0·02**** $N=1367$	+0·08±0·02** $N=830$	1=2=3
MF	+0·13±0·02**** $N=1984$	+0·11±0·02**** $N=1984$		1=2
IPR				
Total	−0·30±0·02**** $N=3947$	−0·20±0·02**** $N=3947$	−0·16±0·03**** $N=1638$	1>2=3
MM	−0·31±0·03**** $N=1584$	−0·22±0·03**** $N=1584$	−0·21±0·04**** $N=1055$	1>2=3
FF	−0·20±0·03**** $N=971$	−0·15±0·03**** $N=971$	−0·11±0·04** $N=583$	1=2=3
MF	−0·30±0·03**** $N=1392$	−0·16±0·03**** $N=1392$		1>2

** $P<0·01$; **** $P<0·0001$.

Table 3. *The impact of self-reported Neuroticism (N), N as reported by the co-twin, and N of the MZ co-twin on self-reported interpersonal relationships*

	$\beta \pm$ S.E.		
	Self-report†	Co-twin report‡	MZ co-twin score§
Marital problems	+0·25±0·02****	+0·16±0·02****	+0·17±0·03****
Marital support	−0·20±0·02****	−0·15±0·02****	−0·13±0·03****
Relative problems	+0·16±0·01****	+0·12±0·01****	+0·09±0·02*
Relative support	−0·12±0·01****	−0·11±0·01****	−0·06±0·02*
Friend problems	+0·11±0·01****	+0·06±0·01****	+0·02±0·02
Friend support	−0·16±0·01****	−0·08±0·01****	−0·07±0·02**
Number of confidants	−0·10±0·01****	−0·06±0·01****	−0·02±0·02
Social groups	−0·08±0·01****	−0·07±0.01****	−0·12±0·02****

† $N=3978$ for marital variables and $N=5548$–5568 for other variables.
‡ $N=3978$ for marital variables and $N=5548$–5568 for other variables.
§ $N=1655$ for marital variables and $N=2309$–2364 for other variables.
* $P<0·05$; ** $P<0·01$; **** $P<0·0001$.

is, in turn, modestly greater than path 3. The best-fit model from the Chow test for the equality of regression coefficients indicated that the βs were equal for the co-twin and MZ co-twin reports of N but these were both smaller in absolute magnitude than that found for self-report.

Analyses in male–male, female–female and male–female pairs

The composite analyses were repeated in the MM, FF and MF pairs, the FF pairs being of special interest because only in this subsample could all three analyses be performed prospectively (Table 2). In the prediction of SLEs from N, all three subsamples broadly resembled the results found in the total sample. For each of these subsamples, including the FF pairs, the best-fit model in the Chow test indicated equality of the regression coefficients.

For the prediction of IPR, the pattern seen in the MM and MF subsample was very similar to that seen in the full sample. Intriguingly, with the prospective FF sample, the best-fit Chow

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model indicated equality of the three regression coefficients.

Prediction of environmental adversity from neuroticism scores in monozygotic *versus* dizygotic co-twins

Predicting EA in one twin from the N score of the MZ co-twin does not permit us to distinguish between the effects of genetic and familial environmental factors. To explore this matter further, we examined, using our composite measures, whether the ability of N in one twin to predict EA in the co-twin was greater in MZ than in same-sex DZ pairs. In our total sample, this was true both for our measures of SLEs ($z = 2{\cdot}63$, $N = 3953$, $P = 0{\cdot}008$) and for IPR ($z = 2{\cdot}03$, $N = 2805$, $P = 0{\cdot}04$).

DISCUSSION

This report had two major goals: to quantify the relationship between the personality trait of N and EA, and to understand further the aetiology of this relationship. We will examine these goals in turn.

The magnitude of the relationship between neuroticism and environmental adversity

We found robust evidence that N predicted risk for both SLEs and IPR. Not all individual SLEs were equally predicted by N. For example, the risk of being robbed or assaulted was consistently unrelated to levels of N. By contrast, N strongly predicted risk for marital problems, job loss, financial difficulties or problems getting along with people in their social network.

The strength of the relationship with N also differed substantially across the various dimensions of IPR. The quality of the marital relationship was the dimension of IPR most strongly related to N. The other dimensions –including relationships with relatives, friends and measures of social integration – were all quite similar in the magnitude of their relationship with N.

These results are consistent with several previous reports of adolescents and young to middle-aged adults which found that N or N-like traits strongly predict SLEs (Fergusson & Horwood, 1987; Bolger & Schilling, 1991; Magnus *et al.* 1993), difficulties (Ormel & Wohlfarth, 1991) and level of social support (Eisemann, 1984; Windle, 1992). In accord with our findings, two of these studies examined subtypes of adversities and found that the effect of N was highest on 'interpersonal conflicts' (Bolger & Schilling, 1991) and adverse financial and occupational events (Headey & Wearing, 1989). Our findings are also in accord with work done in children where measures of 'negative emotionality' (a construct quite closely related to N) robustly predict future social competence and adjustment (Eisenberg *et al.* 2002).

The causal nature of the relationship between neuroticism and environmental adversity

We first sought to evaluate the hypothesis that the N–EA relationship was 'artefactual', resulting solely from 'reporting bias'. As seen in Fig. 1, this hypothesis relies critically on the fact that the same person reports both on their personality and on their experience of EA. If different individuals reported on N *versus* on EA, this hypothesis predicts that the association should largely or entirely disappear. Because our dataset included co-twin reported N, we were able to evaluate this 'reporting bias' hypothesis. We were able to do this by comparing the magnitude of the association between our measures of EA as reported by the subject and the level of N as reported by that subject (path 1) or that subject's co-twin (path 2).

Using our composite measure of total reported SLEs, paths 1 and 2 were estimated to be of the same magnitude in our entire sample. These results suggest that little of the observed association between N and SLEs is due to reporting bias. This is consistent with one prior examination of this question where, in married couples, no relationship was found between the level of N and the probability of reporting a marital dispute (Bolger & Schilling, 1991). For our aggregate measure of IPR, path 2 was significantly smaller (in absolute magnitude) than path 1 in our total sample but not in our smaller prospective sample. This would suggest that 'reporting bias' may explain a moderate proportion of the N–IPR relationship. (This is not however, the only possible interpretation of this data as it is possible that an individual is simply a more accurate observer of their own N than is their co-twin – that is, in Fig. 1 path a > path b.)

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IPR might be relatively susceptible to reporting bias because it involves subjective judgements (e.g. about the quality of care and the level of tension) that might be more influenced by personality than the more objectively occurring SLEs. But these biases may be more important when personality and IPR are assessed at the same rather than at different times of measurement.

Our second approach to clarifying the aetiological nature of the relationship between N and EA was to utilize MZ twin pairs. Since MZ twins reared together share the same genetic and familial–environmental background, the degree to which familial factors contribute to the N–SA relationship can be assessed by a comparison of the magnitude of paths 3 *versus* paths 1 and 2. Paths 1 and 3 are comparable because both involve self-reported measures of N. However, paths 2 and 3 are comparable because neither include the effects of reporting bias. Using our composite measures of SLEs and IPRs, path 3 was consistently statistically significant. With SLEs, path 3 was identical to paths 1 and 2 with the total sample, and only very slightly lower in the prospective FF sample. For IPRs, path 3 was significantly lower than path 1 in our total, MM and MF samples but not in our prospective FF sample. In no sample, did path 3 differ significantly from path 2. In accord with two prior twin studies (Billig *et al.* 1996; Saudino *et al.* 1997), these results suggest that familial factors make a major contribution to the observed association between N and EAs, that might be somewhat stronger for SLEs than for IPR. These results are also consistent with previous evidence from this study that certain SLEs (Kendler & Karkowski-Shuman, 1997) and dimensions of social support (Wade & Kendler, 2000) are associated with genetic risk to MD which is in turn correlated with N (Fanous *et al.* 2002).

This pattern of results suggests the existence of a set of shared familial factors which both influence the levels of N and predispose an individual to select themselves into or create for themselves high-risk environments. While we sought to avoid formal twin model-fitting in this manuscript, consistent with the results of prior studies (Billig *et al.* 1996; Saudino *et al.* 1997), our analyses of MZ and DZ twins suggest that the familial factors that predispose both to N and to EAs are at least partly genetic in nature.

Limitations

These results should be viewed in the context of two potentially significantly methodological limitations. First, this sample is restricted to a single race (white) and a single geographical region (Virginia) and so these findings may not generalize to other samples. Secondly, our model, as outlined in the figure, assumes that the report of one twin on the N score of his or her co-twins has no reporting bias. This may be an over-simplification as individuals often have biased views of the characteristics of their relatives (Chapman *et al.* 1994; Heun *et al.* 2000) and these may be correlated in twin pairs. However, a previous formal examination of this question in this dataset found evidence for a bias in co-twin ratings for extraversion but not N (Heath *et al.* 1992).

Implications

These findings are inconsistent with an aetiological model for psychiatric illness in which individuals are passive recipients of environmental adversity. Instead, these results provide further support for an interactionist model of human behaviour in which there is a bidirectional causal relationship between persons and their social and physical environments (Endler, 1983; Magnusson, 1988). Individual differences in personality, which result partly from genetic influences, significantly impact on the way in which humans structure the world around them (Rutter & Silberg, 2002). These differences make individuals more or less likely to experience stressful events and to have poor quality interpersonal relationships, which in turn 'feed back' on the individual, influencing their risk for subsequent psychiatric illness (Kessler, 1997; Henderson, 1998; Kendler *et al.* 2002).

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