Sources of Individual Differences in Stressful Life Event Exposure in Male and Female Twins

P. Kevin Bolinskey, Michael C. Neale, Kristen C. Jacobson, Carol A. Prescott, and Kenneth S. Kendler

Medical College of Virginia of Virginia Commonwealth University, Richmond, USA

The roles of genetic and environmental influences on stressful life events were examined in 3938 twin pairs (MZ, same-sex DZ, and opposite-sex DZ) using a sex-limitation model. Life events were assessed by personal interview, and were categorized as being either personal (i.e., events that occur directly to the individual) or network (i.e., events that occur to someone within the individual's social network, thus affecting the individual indirectly). Consistent with previous reports, genetic factors were found to exert more influence on personal events than network events. Genetic correlations between males and females suggest that many of the same genetic factors are acting within both genders.

The role of stressful life events (SLEs) in the onset of psychiatric disorders has been the topic of much research among epidemiologists, developmentalists, and behavioral geneticists. The notion that SLEs not only precede, but also cause, psychiatric disorders is a deceptively intuitive one. For example, a layperson, upon hearing that a friend or acquaintance is experiencing an episode of depression, may identify a specific event in that person's life as the "reason" that their friend is depressed. If our hypothetical layperson is unfamiliar with their friend's life events, however, they may ask "What caused the depression?" More often than not, an easily identifiable event can be associated with the onset of the disorder, and this event will make sense as a causal explanation. Despite the simple logic of this notion, researchers have struggled to identify specificity between SLEs and the onset of the various psychiatric disorders, as similar SLEs are experienced by a greater number of individuals who do not develop psychiatric disorders than by those who do (Kessler, 1997). This paradoxical relationship between stressful life events and psychiatric disorders is one of the indicators of the complexity of psychiatric disorders, where simple cause and effect relationships do not generally apply, or do so only in certain subsets of the population.

Other research has demonstrated that SLEs do not occur randomly in the population. Kessler (1997), for example, has suggested that few life events occur for reasons that are unrelated to the outcome of interest. Indeed, research has indicated high levels of intra-individual stability in the number of SLEs across two distinct periods of time, as the total number of life events in each of these times is often substantially correlated within individuals (Andrews, 1981; Eaton, 1978; Fergusson & Horwood, 1984). Furthermore, the total number of SLEs that an individual experiences can be predicted by stable personal characteristics, including social class (Brown & Harris, 1978) and personality (Brett et al., 1990; Saudino et al., 1997).

Several studies (Foley et al., 1996; Kendler et al., 1993; Plomin et al., 1990; Saudino et al., 1997) have examined the relative contributions of genetic and environmental influences to the experience of SLEs, and have demonstrated that both genetic factors and familial environment substantially influence personal and social factors that predispose individuals to experiencing SLEs. For example, Bebbington and colleagues (Bebbington et al., 1988; McGuffin et al., 1988) have shown that levels of SLEs are increased in the relatives of depressed patients versus controls, although Farmer and colleagues (Farmer et al., 2000) suggested that familial similarities in SLEs with depression may largely result from shared experiences.

Kendler and colleagues (Foley et al., 1996; Kendler et al., 1993) suggested that SLEs can be classified as either network events — those which occur within one's social network — or personal events — those in which the respondent is directly involved — and that stable individual differences are more important determinants of personal SLEs. This finding was partially replicated by Saudino et al. (1997) who found evidence for genetic influence on controllable life events in female twin pairs, but not in male twin pairs. Recently Kendler and colleagues

Address for correspondence: P. Kevin Bolinskey, Virginia Institute of Psychiatric and Behavioral Genetics, 800 East Leigh St., Suite 1, PO Box 980126, Medical College of Virginia, Richmond, VA 23298-0126, USA. Email: pkbolinskey@vcu.edu

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(Kendler et al., in press) have suggested that SLEs involving loss — especially separation initiated by the other party — and personal humiliation/devaluation are particularly depressogenic.

Although several studies have examined the relative influence of genetic and environmental factors with regard to experiencing SLEs, relatively few studies (Kendler et al., 1993; Saudino et al., 1997) have directly estimated the effects of gender on SLEs and examined whether the same genetic and familial influences lead to SLEs for both males and females. The present study addresses this need. Whereas previous studies relied on undated questionnaire-based assessments of SLEs for their analyses, the current study makes use of dated, interview-based data.

Methods

Participants

Participants in the current study consisted of Caucasian twins and co-twins ascertained from the Virginia Twin Registry, a longitudinal study of genetic and environmental risk factors for common adult psychiatric disorders (Kendler et al., 1992). Zygosity was determined by standard questions (Eaves et al., 1989), photographs, and, if necessary, DNA testing (Spence et al., 1988). Data for the same-sex female twins (577 MZ pairs; 415 DZ pairs) come from the second wave of interviews of the female twin pairs (i.e., FF2 interview data), whereas data for the same-sex male twins (866 MZ pairs; 650 DZ pairs) and opposite-sex twins (1430 pairs) come from the first wave of interviews conducted with male and male-female twin pairs (i.e., MF1 interview data).

Measures

Life events over the preceding 13 months (e.g., August 1995 to August 1996, for an interview conducted in August 1996) were measured by 39 interview items, which were divided into network or personal events. Following the precedent of Kendler et al. (1993), 14 network events consisting of death or illness/injury for each of seven classes of individuals in the participant's social network (spouse, child, parent, twin, other sibling, other relative, close non-relative) were analyzed as two separate categories: network death or network illness/injury. The remaining 25 items were formed into nine categories of personal events based on item content: relationship difficulties, other separation, illness/injury, robbery/assault, legal difficulties, housing problems, work difficulties, financial difficulties, and a single category consisting of interpersonal difficulties for 10 classes of individuals in the participant's social network (spouse, child, parent, twin, other sibling, in-laws, other relative, close friend, neighbor, co-worker). Although Kendler et al. (1993) included interpersonal difficulties as a network event, its position as a network event is questionable, as the respondent is directly involved in the event; thus, we chose to include this type of event in the personal events category. A twin's score in an individual category reflects the total number of items positively endorsed within that category. In addition, we summed the scores within personal and network events to create "personal" and "network" variables; we also summed across all events to create an amalgam score, which we labeled "total" (see Table 1).

Table 1

Number of Stressful Life Events by Type and Zygosity Group

	Zygosity Group				
	Female		Male		Opposite Sex
	MZ	DZ	MZ	DZ	DZ
	N = 577	*N* = 415	*N* = 866	*N* = 650	*N* = 1430
Total Events	2041	1617	3594	2864	6700
Personal Events	1234	1012	2129	1626	3846
Relationship Problems	191	168	345	216	584
Other Separation	190	142	239	151	484
Illness/Injury	98	86	167	166	356
Assault/Robbery	53	42	119	97	192
Legal Difficulties	9	13	93	82	123
Housing Problems	49	36	57	51	107
Work Difficulties	97	95	250	182	375
Financial Difficulties	90	74	123	121	265
Interpersonal Difficulties	457	356	736	560	1360
Network Events	807	605	1465	1238	2854
Death in Network	333	243	680	592	1278
Illness in Network	474	362	785	646	1576

Note: *N* = number of twin pairs.

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Design and Procedures

Total number of events in each category was treated as ordinal data and analyzed using Mx (Neale et al., 2002). Cases with missing data were included in the analyses (Neale, 2000). A sex-limitation model (see Figure 1) was used to analyze the five zygosity/gender groups (i.e., female MZ, female DZ, male MZ, male DZ, and opposite sex twin pairs) simultaneously in a multiple-groups analysis (Neale et al., 2002; Neale & Cardon, 1992). Data were analyzed to estimate total additive genetic, common environmental, and non-shared environmental influences on SLEs for each gender. In addition, the genetic correlation for males and females was estimated for each variable.

Results

As can be seen in Table 2, additive genetic effects account for approximately 25% of the observed variance in total SLEs, whereas shared environmental effects account for only 10–13% of the observed variance; non-shared environmental factors account for 61–65% of the observed variance. Furthermore, these estimates are fairly consistent across gender and the genetic correlation across gender was estimated to be + .48.

Parameter estimates were also similar across genders within the category of personal events, as males and females evidenced similar genetic (29% compared to 28%) and shared environmental variance (9% for both genders) to females; the genetic correlation was estimated to be .28 within the personal category. Within the subcategories of personal events, males tended to show greater genetic effects in "physical" categories, such as illness/injury and assault/robbery, whereas females tended to show greater genetic effects in categories such as other separation, interpersonal difficulties, legal difficulties, and financial difficulties.

In males, there was less evidence of additive genetic effects than in females (9% compared to 21%), but equivalent common environmental effects (26%) in the network events category; the genetic correlation within the network events category was estimated to be zero. Within the network events subcategories, estimates of additive genetic effects on death within one's social network were higher for females (31% to 23%) than for males, although the estimates for additive genetic effects on illness within one's social network were almost equal.

Discussion

To our knowledge, the present study provides the first examination of gender differences of SLEs assessed by dated, interview-based data. The results, although not as strong as some previous findings, are similar.

The parameter estimates for total number of SLEs, which includes both personal and network events, were very similar for males and females, with confidence intervals that displayed substantial overlap. Overall, genetic factors accounted for approximately 25% of the observed variance in the experience of SLEs in each gender, whereas shared environment accounted for only 10 to 13% of the

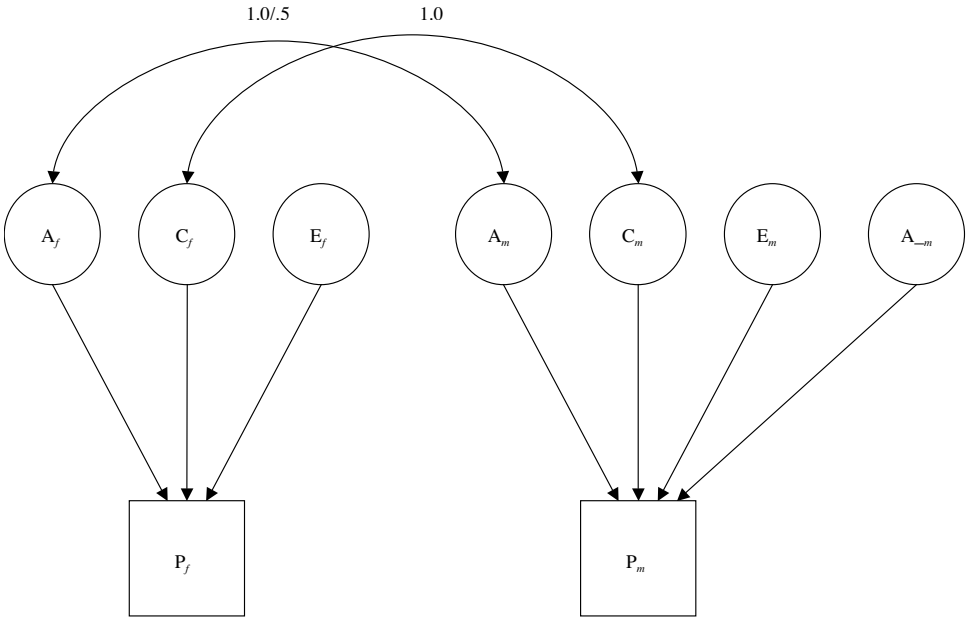

Figure 1

General Sex-Limitation model. Shared variance of parameter A is 1.0 for MZ twins and .5 for DZ twins. $A_{\_m}$ is the genetic variance that is unique to males.

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Table 2

Model Parameters by Gender and Zygosity

		Gender				
		Female		Male		
		Estimate	95% CI	Estimate	95% CI	r_g
Total Events	A	.26	.03–.46	.25	.17–.40	.48
	C	.13	.13–.32	.10	.00–.26	
	E	.61	.54–.68	.65	.59–.72	
Personal Events	A	.28	.00–.46	.29	.28–.45	.96
	C	.09	.01–.31	.09	.01–.26	
	E	.63	.59–.72	.62	.55–.73	
Relationship	A	.05	.00–.29	.03	.00–.22	1.00
	C	.07	.01–.19	.07	.07–.20	
	E	.88	.82–.99	.90	.78–. 99	
Other Separation	A	.37	.00–.56	.00	.00–.30	.00
	C	.07	.00–.48	.16	.00–.29	
	E	.56	.43–.73	.84	.70–.97	
Illness/Injury	A	.00	.00–.35	.34	.00–.49	.25
	C	.11	.00–.29	.01	.00–.39	
	E	.89	.65–1.00	.65	.51–.84	
Assault/Robbery	A	.00	.00–.54	.34	.09–.52	1.00
	C	.32	.00–.52	.01	.00–.19	
	E	.68	.44–.92	.65	.48–.83	
Legal Difficulties	A	.85	.00–.97	.36	.00–.55	.00
	C	.00	.00–.66	.00	.00–.33	
	E	.15	.02–.66	.64	.00–.55	
Housing Difficulties	A	.00	.00–.30	.00	.00–.10	.90
	C	.00	.00–.21	.20	.12–.42	
	E	1.00	.50–1.00	.80	.51–1.00	
Work Difficulties	A	.30	.14–.37	.22	.04–. 32	1.00
	C	.00	.00–.17	.00	.00–.19	
	E	.70	.52–85	.78	.57–1.00	
Financial Difficulties	A	.37	.00–.56	.17	.00–.43	.54
	C	.00	.00–.39	.08	.00–.34	
	E	.63	.43–.85	.76	.57–.94	
Interpersonal Difficulties	A	.34	.05–.51	.04	.00–.32	.03
	C	.07	.00–.30	.19	.00–.30	
	E	.59	.49–.70	.77	.67–.85	
Network Events	A	.21	.00–.46	.09	.00–.30	.42
	C	.26	.06–.45	.26	.09–.38	
	E	.53	.45–.61	.65	.57–.72	
Death in Network	A	.31	.31–.61	.23	.01–.47	.00
	C	.35	.08–.57	.26	.06–.43	
	E	.34	.27–.43	.51	.44–.59	
Illness in Network	A	.11	.00–.33	.11	.00–.33	.00
	C	.34	.09–. 49	.21	.05–. 35	
	E	.55	. 46–.65	.68	.59–.77	

Note: *A* = additive genetic effects; *C* = shared environmental effects; *E* = non-shared environmental effects; r_g = genetic correlation.

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observed variance. Non-shared environment demonstrated the largest effects for both males and females, accounting for 65% and 61% of the observed variance in SLEs, respectively.

Kendler and colleagues (Foley et al., 1996; Kendler et al., 1993) noted that SLEs within the personal events categories demonstrate larger genetic effects than network events, as these are events in which the respondent is an active participant, and our results provide additional support for that finding. Again, parameter estimates for both genders were remarkably similar, with genetic factors accounting for approximately 28% of the observed variance and shared environment accounting for approximately 9% of the observed variance. Non-shared environment, again, accounted for the largest percentage of the observed variance, as model parameters suggested that approximately 62% of this variance could be accounted for by non-shared environment.

Within the summed category of network events, however, the parameter estimates were somewhat different for males and females, although there remains a great deal of overlap in the confidence intervals of the estimates. For both genders, common environmental effects accounted for 26% (male 95% CI = .06–.46; female 95 % CI = .09–.38) of the observed variance. In females, however, genetic effects accounted for a little more than 10% more of the observed variance than it did in males (21%, 95% CI = .00–.46, and 9%, 95% CI = .09–.38, respectively); examination of the individual events within this category suggests that this difference is largely attributable to a death within the respondents social network. This phenomenon remains unexplained, although it is possible that female MZ twins share more of their social networks than do female DZ twins, or males, in general. If the decedent that the respondent refers to was in both twins' social network, the observed correlations will necessarily be higher.

Overall, familial (genetic and shared environmental) effects accounted for between 35% and 39% of the observed variance in SLEs. This is very similar to the findings of Kendler et al. (1993), who found that familial effects accounted for a little over 40% of the observed variance in SLEs measured by self-report. That genetic factors appear to exert their strongest influence on personal events is also very similar to the findings of Kendler and colleagues, and the moderate genetic correlation between males and females for personal events suggests that many of the same genetic factors are associated with the potential to experience these SLEs in males and females. This latter finding differs from those of Saudino et al. (1997) who found genetic influence on life events only among females.

Limitations to the present study include the interview-based nature of the data, as we must rely on the respondent to accurately report SLEs. This concern is especially relevant in association studies of SLEs and depression, as Cohen et al. (1988) have demonstrated that the onset of a depressed mood can significantly increase the reports of past SLEs, leading to artificially elevated measures of association. Kessler (1997) has suggested that the use of informants or archival data would lessen the possibility of such confounds, but noted that such a study is often impractical, as it is beset with its own difficulties.

An additional limitation concerns the stability of our findings. It is our belief that the broader categories of personal and network events, as well as the omnibus category of total events, provide more stable and accurate estimations of familial influences on life events than do individual events. Many of the confidence intervals around our estimates of individual events include zero and those that do not often display wide confidence bands, nonetheless. This is largely a function of a relatively small (for this type of analysis) sample size, along with the comparative rarity of some of the particular life events. For example, the large estimate for genetic influence on legal difficulties in females and the corresponding wide confidence interval for the estimate results from having only one DZ twin pair concordant for legal difficulties. Also of concern is the possibility that the psychometric properties of summed scale scores may be less than ideal, and may underestimate familial resemblance for liability to life events. Thus, parameter estimations for single categories of events must be interpreted with caution.

The current study joins the large body of research that has demonstrated that SLEs do not necessarily occur at random within the general population, but may be reflective of a predisposition to expose oneself to non-optimal environments and situations. Future studies will examine the extent to which personality characteristics, such as neuroticism, are associated with the experience of SLEs, and to what extent that association can be explained by familial factors.

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