Twin and Genetic Effects on Life Events

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Twin studies that examine the effect of specific environmental risk factors on psychiatric disorders assume that there are no differences in prevalences of these risk factors between twins and singletons. Violation of this assumption signifies that the results from twin studies might not generalize to singletons. Another assumption, not only often underlying twin studies but also epidemiological research, is that life-events are not influenced by familial factors. We tested differences in prevalences of experienced life events in a Dutch sample of 2086 monozygotic (MZ) twins, 2090 dizygotic (DZ) twins and 1307 of their siblings. Self-reported data on life events (illness of self, illness of a significant other, spouse/romantic relationship, divorce/break-up of a relationship, death of a significant other, traffic accident, robbery, violent assault, sexual assault) were available from a survey-study. We further investigated whether familial resemblance was present for the exposure to these life events and, if so, whether this resemblance was due to genetic or common environmental factors. No differences were found in the prevalences of life events between MZ twins, DZ twins and their siblings. There was evidence for familial aggregation of all life events, except for traffic accidents in women. Results indicated genetic control on the presence of a spouse or involvement in a relationship. Familial resemblance of illness and death of a significant other was mainly due to common environment. For the other life events, it was not possible to distinguish between genetic and common environmental effects.

Genetic epidemiological research in psychiatric disorders has suggested that these disorders are likely to be influenced by multiple genes of modest effect as well as by environmental risk factors (Tandon & McGuffin, 2002). Twin studies not only allow the exploration of the question to what extent genes and environment influence these disorders, but are also a good design to study the effects of specific environmental risk factors as well as the interaction or correlation between genes and environment. For example, large population-based twin samples can be used as epidemiological samples to investigate environmental risk factors (e.g., Kendler, Thornton, & Gardner, 2001; Kendler, Thornton, & Prescott, 2001; Kendler et al., 2003, 2004). An interaction between genotype and environment can be studied by comparing the heritability of the disorder in twin pairs in which a) neither twin is exposed to an environmental risk factor; b) one of the twins is exposed to the risk factor; c) both twins are exposed to the risk factor (Boomsma et al., 1999; Boomsma & Martin, 2002; Heath et al., 1998). Purcell (2002) developed several models to investigate gene–environment interaction in a twin design with quantitative measurements of risk factors. Gene–environment correlation can also be incorporated in these models (Purcell, 2002). Alternatively, monozygotic (MZ) twins discordant for the presence of a disorder can be compared on the absence or presence of a certain environment or on the amount of exposure to environmental conditions, which might also provide insight into the risk factors (Kendler & Gardner, 2001).

An important assumption underlying this kind of research is that twins do not differ from singletons regarding their exposure to the environment under study. When this assumption is violated, results of twin studies might not generalize to the general population. Mostly, this seems a reasonable assumption, for example, in the case of death or physical illness in the family. However, this might be different for other life events, such as divorce/break-up of a relationship or physical illness of self. Some researchers have suggested that the intimate relationship that exists between twins excludes or discourages outside relationships (Clark & Dickman, 1984; Zazzo, 1976). As a consequence, twins will have a lower marriage rate and more problems in marriage than nontwins (Zazzo, 1976). MZ twins might be especially at risk. At least in childhood, they tend to spend more time together, for example, because they are more likely to share the same room (Pearlman, 1990). So far, the few empirical studies that have addressed this issue have not confirmed this hypothesis. MZ twins do not report significantly higher levels of intimacy with their co-twin or significantly lower levels of intimacy with their closest friends when compared to dizygotic (DZ) twins (Foy et al., 2001). Twins who report high levels of intimacy with their co-twin do not report significantly lower levels of intimacy with their closest friends (Foy et al., 2001).

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Finally, MZ twins, DZ twins and singletons do not seem to differ significantly with respect to marital status, number of years married, whether married before, number of previous marriages and number of years divorced (Pearlman, 1990).

Twins might also differ from singletons regarding physical health. At birth, twins are on average 1000 g lighter than singletons and they are born on average approximately 3 weeks preterm, with a higher frequency of delivery by caesarean section (Alexander & Salihu, 2005). Are twins, due to this difficult start, more prone to diseases? This does not seem to be the case with respect to a wide range of disease characteristics such as bone mineral density, osteoarthritis, blood pressure or diabetes mellitus (Andrew et al., 2001; de Geus et al., 2001; Kyvik, 2000).

Most twin and other epidemiological studies of environmental risk factors also assume that the exposure to life events is random and not influenced by familial factors, either genetic or common environmental factors. If this assumption does not hold and the exposure to a life event is, for example, partly genetically influenced, this signifies that the relationship between a life event and a disorder might be caused by shared genes. The twin design also enables investigation of this assumption. Results so far have suggested familial resemblance in the exposure to life events (Bolinskey et al., 2004; Kendler et al., 1993). In life events that partly result from the respondent's own behavior, familial resemblance seems to be due to genetic factors (Bolinskey et al., 2004; Kendler et al., 1993).

The aim of the current study is twofold. The first goal is to investigate whether twins differ from singletons regarding their exposure to life events. The prevalence of life events is compared between MZ twins, DZ twins and their siblings, stratified according to sex and age. Since siblings of twins are matched regarding parental socioeconomic status and upbringing, they are the perfect control group. Data on the following life events will be analyzed: divorce/break-up of a relationship, illness of self, illness of a significant other, death of a significant other, traffic accident, robbery, violent assault, sexual assault. As the proportion of participants who report a divorce can be related to the proportion of participants who have a spouse or who are involved in a relationship, the number of participants with a spouse or a romantic relationship was also compared in the three groups. If we do not find differences between MZ twins, DZ twins and singletons, this signifies that twin studies can indeed be used to investigate these life events. In that case, the second goal is to examine in the twins whether the exposure to life events is familial and, if so, whether this familial resemblance is due to shared genes. We begin with a general approach of calculating odds ratios (OR) and comparing concordance rates between MZ and DZ twin pairs with a Pearson χ^2 test. Next, life events are analyzed in a threshold model, which provides the opportunity to investigate to what extent familial resemblance is due to genetic and common environmental effects.

Methods

Participants

This study is part of a longitudinal survey study of the Netherlands Twin Register (NTR) that has assessed families with adolescent and young adult twins roughly every 2 years since 1991. Sample selection and response rates are described in detail in Boomsma et al. (2002). Data were used from the survey that was sent to twins and their siblings in 2000 (Vink et al., 2004). For the majority of the twin pairs, zygosity was determined from questions about physical similarity and confusion of the twins by family members, friends and strangers. Information on zygosity was available from DNA polymorphisms for 726 same-sex twin pairs. The agreement between zygosity diagnoses from questionnaire and DNA data was 97%. Twins with unknown zygosity or participants younger than 18 years of age were excluded from the study.

The population consisted of 608 MZ male twins, 385 DZ male twins, 1478 MZ female twins, 798 DZ female twins, 907 DZ twins of opposite sex, 517 brothers and 790 sisters, in total 1883 men and 3600 women. For the first part of the study, men and women were stratified according to age into three groups of approximately the same size. Mean ages were around 21 years, 27 years and 42 years (Table 1). Less than a quarter of the singleton siblings were in an age group different to their twin siblings. For the analyses of familial resemblances in life events, data were analyzed from 1450 complete and 1276 incomplete twin pairs. The group of complete pairs consisted of 222 MZ male, 119 DZ male, 578 MZ female, 261 DZ female and 270 DZ twins of opposite sex. The twins from incomplete pairs came from 486 MZ and 790 DZ pairs.

Instrument

In the demographic section of the 2000 survey participants were asked if they had a spouse or were involved in a romantic relationship. An adapted version of a Dutch life-event scale (Schokverwerkings Inventarisatie Lijst = SchIL; Van der Velden et al., 1992) asked about the experience of the following life events: death of a spouse, father, mother, child, sibling or significant other; illness of self or a significant other; divorce/break-up of a relationship; traffic accident; violent and sexual assault and robbery. Response categories were *never experienced*, *0–6 months ago*, *6–12 months ago*, *1–5 years ago* and *more than 5 years ago*. In the current study the response categories were reduced to *no* (never) or *yes* (all other categories). We did not analyze death of family members, as answers will be similar for twins and siblings from the same family. Death of a spouse or child was not analyzed either, because the prevalences were very low in this relatively young sample.

Statistical Methods

Differences between prevalences in life events of MZ twins, DZ twins and singletons were tested with a Pearson χ^2 using SPSS for Windows, Release 11.0 (2001). For each life event, OR and tetrachoric correlations were calculated for MZ and DZ twin pairs to study familial influences. In contrast to OR, tetrachoric correlations were calculated on data from both complete and incomplete twin pairs simultaneously by using the raw data option in Mx (Neale et al., 1999). If familial influences were present, a Pearson χ^2 test was used to compare the proportion of MZ and DZ twin pairs who were concordant exposed, discordant or concordant not exposed to examine whether this familial resemblance could be due to genetic influences. In Mx, a threshold model was used to partition the variance of the underlying liability of experiencing a life event into additive genetic (A), common environmental (C) and unique environmental effects (E). Based on the principle of parsimony, the best-fitting model was chosen (Neale & Cardon, 1992). The presence of sex-specific genetic effects was tested by constraining the genetic correlation between twins of opposite sex at .5. Then, differences in the degree of impact of A, C and E was tested by constraining the estimates for men and women to be equal. Next, A and C were dropped from the model to test their significance by likelihood ratio tests.

Results

Table 1 shows the results for the analyses of the differences in exposure to life events between MZ twins, DZ twins and their siblings, stratified according to sex and age. In women around 27 years of age, the Pearson χ^2 showed a significant difference between the three groups of MZ twins, DZ twins and sisters regarding the presence of a spouse or involvement in a romantic relationship. Additional analyses, in which the MZ twins were compared to the other two groups and the DZ twins were compared to the singletons, showed that female MZ twins were less likely to have a relationship than their sisters ($p < .005$). A p value of less than .05 was found for the comparisons of MZ twins to DZ twins and of DZ twins to their sisters. The significant difference between the three groups of women of around 27 years of age with respect to serious illness of a significant other was due to a lower prevalence in female MZ twins as compared to their sisters ($p < .01$). Except for these two effects, there are no differences in prevalences of life events between MZ twins, DZ twins and siblings.

The prevalences of reported life events suggested sex differences, which we formally tested. Compared to women, men in the youngest two age groups were more likely to have experienced a robbery ($p < .01$ and $p < .05$) or a violent assault ($p < .001$ and $p < .05$), whereas men in the youngest and oldest age groups were more likely to have experienced a traffic accident ($p < .005$ and $p < .05$). Women in all age groups reported more sexual assaults ($p < .001$ at all ages) than men. Furthermore, women in the oldest age group more often reported a serious illness or death of a significant other ($p < .005$ for both life events). Women in the youngest two age groups reported more often to be involved in a romantic relationship ($p < .001$ in both age groups).

Next, OR and tetrachoric correlations were calculated for each sex by zygosity group (Table 2). In Appendix A, the number and percentages of concordant exposed, and discordant and concordant not exposed twin pairs are given for the five groups. All life events appeared to be influenced by familial factors with the exception of traffic accidents in women. Therefore, further analyses on the family resemblance of traffic accidents were performed in male twins only. In men, OR and correlations could not be calculated for the violent and sexual assaults life events because of the absence of concordant pairs. Consequently, these life events were not included in further analyses. The comparisons of concordance rates between MZ male pairs (MZM) and DZ male pairs (DZM) as well as MZ female pairs (MZF) and DZ female pairs (DZF) pairs using a χ^2 test showed no significant differences. As significant sex differences were observed in prevalence rates for life events, data from MZF and MZM (or DZF and DZM) twin pairs could not be pooled to test for the differences in concordance rates in larger groups.

Therefore, we turned to model-fitting in Mx which made it possible to test for the presence of sex differences in familial resemblances while using a threshold model with sex-specific thresholds to allow for sex-specific prevalences. We first tested if there was evidence that the genetic correlation between opposite- sex twin pairs was different from .5. Results showed that the genetic correlation could be constrained to .5 for all life events, indicating no qualitative sex differences in genetic influences. The test for quantitative sex differences in the influences of genes and environment showed that the estimates of A, C and E were not significantly different between men and women either. The final series of models tested the AE and CE model against the full ACE (i.e., additive genetic, common environmental and unique environmental influences) model. For involvement in a relationship familial resemblance was best explained by genetic factors. For life events that involved illness and death of a significant other, familial resemblance was best explained by common environment. For the other life events it was not possible to decide whether familial resemblance was due to genetic or common environmental effects. However, as expected, removing both A and C from the model led to a large increase in χ^2. Table 3 shows the differences in χ^2 between the ACE model and the AE, CE and E model after constraining the genetic correlation in the DZ twins of opposite sex to .5 and the estimates of men and women to be equal. The lower half of Table 3 gives the estimates of A, C and E

Table 1

Total *N*, Mean Age and *N* Participants (%) who Experienced a Life-Event in MZ Twins, DZ Twins and Singleton Siblings Stratified According to Age and Sex

			N	Mean age/*SD*	Spouse	Illness — self	Illness — significant other	Death — significant other	Divorce	Accident	Robbery	Violent assault	Sexual assault
Age 21 yrs	M	MZ	237	21.8/1.5	96 (40.7)	21 (9.6)	73 (32.6)	154 (65.8)	48 (21.4)	39 (17.4)	47 (20.9)	19 (8.5)	0 (0.0)
		DZ	287	22.1/1.5	128 (44.6)	34 (12.5)	87 (32.5)	188 (66.4)	55 (20.1)	51 (18.6)	59 (21.4)	24 (8.8)	0 (0.0)
		Sibs	104	21.8/1.7	48 (46.2)	18 (18.4)	32 (33.0)	71 (69.6)	18 (18.8)	19 (19.8)	18 (18.4)	11 (11.2)	1 (1.0)
	F	MZ	510	21.9/1.7	312 (61.5)	47 (9.8)	184 (38.0)	328 (66.8)	105 (21.6)	59 (12.2)	68 (14.0)	12 (2.5)	27 (5.6)
		DZ	525	22.2/1.6	299 (57.4)	53 (10.5)	182 (36.0)	356 (69.8)	139 (27.3)	60 (11.8)	86 (16.9)	23 (4.5)	36 (7.0)
		Sibs	165	21.9/1.9	105 (63.6)	26 (16.7)	59 (38.3)	108 (67.5)	39 (25.2)	25 (16.1)	23 (14.7)	5 (3.2)	6 (3.8)
Age 27 yrs	M	MZ	199	27.2/1.7	122 (61.6)	30 (15.7)	79 (41.1)	136 (69.4)	61 (31.0)	41 (21.2)	40 (20.5)	18 (9.4)	2 (1.0)
		DZ	268	27.3/1.6	175 (65.8)	47 (19.0)	97 (39.4)	184 (72.7)	83 (32.5)	48 (19.0)	47 (18.6)	17 (6.8)	2 (0.8)
		Sibs	161	27.5/1.8	102 (65.0)	21 (13.5)	65 (41.9)	101 (64.3)	43 (27.2)	34 (21.5)	34 (21.7)	11 (7.1)	1 (0.6)
	F	MZ	448	27.8/1.8	325 (72.9)*	57 (13.2)	159 (36.5)#	282 (64.1)	147 (33.6)	87 (20.0)	115 (26.2)	21 (4.8)	37 (8.5)
		DZ	485	28.0/1.9	379 (78.5)*	79 (16.9)	203 (42.7)#	315 (66.5)	156 (32.8)	81 (17.1)	113 (23.8)	23 (4.8)	43 (9.0)
		Sibs	267	28.3/2.1	224 (84.8)*	41 (16.0)	121 (47.3)#	187 (70.8)	73 (28.0)	40 (15.5)	55 (21.2)	14 (5.4)	32 (12.3)
Age 43 yrs	M	MZ	172	43.9/10.1	156 (90.7)	31 (19.0)	78 (48.8)	105 (62.9)	36 (22.2)	36 (22.2)	51 (30.9)	8 (4.9)	2 (1.2)
		DZ	203	43.7/11.1	171 (84.2)	48 (26.2)	77 (43.3)	110 (59.5)	42 (23.1)	35 (19.2)	53 (29.6)	11 (6.1)	3 (1.7)
		Sibs	252	42.1/11.4	216 (85.7)	45 (20.0)	95 (42.0)	147 (64.5)	50 (22.3)	49 (22.1)	59 (26.9)	12 (5.5)	4 (1.8)
	F	MZ	520	44.9/10.6	438 (84.6)	104 (22.7)	262 (56.5)	330 (68.8)	133 (28.6)	72 (15.6)	135 (28.6)	27 (5.9)	43 (9.3)
		DZ	322	44.3/9.8	282 (88.1)	65 (22.6)	142 (50.2)	201 (67.7)	70 (24.3)	50 (17.5)	75 (26.1)	17 (6.0)	24 (8.4)
		Sibs	358	41.4/9.2	318 (89.1)	67 (20.2)	167 (51.5)	246 (71.9)	87 (26.5)	52 (16.2)	85 (25.7)	9 (2.8)	27 (8.3)

Note: F: Female, M: Male, *SD*: standard deviation.

* $p < .005$ for χ^2 test of differences between MZ, DZ and siblings.

\# $p < .05$ for χ^2 test of differences between MZ, DZ and siblings.

Table 2

Odds Ratios (95% confidence interval) for MZ and DZ Complete Twin Pairs and Tetrachoric Correlations (95% Confidence Interval) Based on Data from Complete and Incomplete Pairs (below bold line)

	Spouse	Illness — self	Illness — significant other	Death — significant other	Divorce	Accident	Robbery	Violent assault	Sexual assault
MZM	8.0 (4.4–14.7)	2.7 (1.1–7.0)	2.4 (1.3–4.3)	3.2 (1.8–5.7)	1.6 (.8–3.3)	5.8 (2.7–12.6)	2.2 (1.0–4.7)	4.8 (1.2–20.3)	*
DZM	2.9 (1.3–6.3)	.8 (.2–4.0)	3.2 (1.4–7.8)	2.5 (1.0–5.8)	1.9 (.6–5.7)	2.3 (.8–7.2)	1.9 (.7–5.4)	*	**
MZF	4.2 (2.8–6.2)	2.8 (1.6–5.0)	2.9 (2.0–4.1)	5.3 (3.6–7.8)	2.7 (1.8–4.1)	1.6 (.8–2.9)	2.3 (1.5–3.6)	8.7 (2.9–26.6)	9.9 (4.6–21.4)
DZF	2.2 (1.2–3.9)	2.7 (1.2–5.9)	2.4 (1.4–4.1)	3.6 (2.0–6.5)	1.1 (.6–2.2)	1.3 (.5–3.4)	2.4 (1.2–4.8)	14.7 (3.0–71.5)	2.4 (.3–20.9)
DOS	2.8 (1.6–4.8)	1.5 (.6–4.0)	2.8 (1.7–4.8)	3.6 (2.1–6.4)	1.6 (.9–3.0)	1.0 (.4–2.2)	1.5 (.7–3.0)	2.7 (.3–25.0)	*
MZM	.68 (.53–.80)	.32 (.01–.58)	.33 (.12–.52)	.41 (.21–.59)	.16 (–.10–.40)	.54 (.31–.72)	.27 (.01–.51)	.40 (–.02–.72)	*
DZM	.38 (.10–.61)	–.10 (–.50–.33)	.43 (.13–.67)	.32 (.01–.59)	.25 (–.15–.58)	.27 (–.10–.60)	.21 (–.15–.54)	*	**
MZF	.49 (.37–.60)	.33 (.15–.50)	.39 (.26–.51)	.57 (.45–.67)	.35 (.21–.48)	.14 (–.06–.33)	.28 (.13–.43)	.52 (.22–.74)	.60 (.45–.73)
DZF	.27 (.07–.46)	.31 (.05–.54)	.33 (.13–.51)	.45 (.25–.62)	.04 (–.19–.26)	.08 (–.22–.37)	.30 (.06–.51)	.62 (.21–.87)	.39 (–.13–.71)
DOS	.37 (.18–.53)	.14 (–.17–.42)	.39 (.20–.56)	.45 (.26–.61)	.18 (–.05–.39)	–.03 (–.28–.22)	.13 (–.12–.36)	.18 (–.37–.65)	*

Note: MZM: monozygotic male pairs; DZM: dizygotic male pairs; MZF: monozygotic female pairs; DZF: dizygotic female pairs; DOS: dizygotic twin pairs of opposite sex.

*No concordant exposed pairs.

**No exposed participants.

in the best-fitting model. When it was not possible to decide whether familial resemblance was due to genetic or common environmental effects, the estimates of A and E in the absence of C and the estimate of C and E in the absence of A are given.

Discussion

With two exceptions, there are no significant differences between MZ twins, DZ twins and singletons regarding the prevalence of experienced life events, not even for the life events suggested to bear an increased risk for twins, that is a divorce and serious illness of self. Only in women aged around 27 years, singletons were more likely to have a spouse or be involved in a romantic relationship and to have someone in their network suffering from a serious illness. Whether these findings are just due to coincidence or reflect real differences needs further exploration.

The overall absence of differences between twins and singletons with respect to relationship and divorce rates are in agreement with earlier literature (Foy et al., 2001; Pearlman, 1990). This indicates that the hypothesis that twins have more problems in relationships with others (Clark & Dickman, 1984; Zazzo, 1976) can be rejected. Moreover, serious illness of self does not seem to be more prevalent in twins. Most studies so far have not found any twin singleton differences at the level of specific diseases either (Andrew et al., 2001; de Geus et al., 2001; Kyvik, 2000). Given the absence of twin singleton differences, a twin population can be used to study environmental risk factors of psychiatric disorders, as these findings can be generalized to the general population.

OR and tetrachoric correlations suggested familial resemblance for all life events, except traffic accidents in women. Exposure to a violent or sexual assault was not further analyzed because of the absence of concordant male pairs. Variance components analyses suggested that genetic influences explain 57% of the variation in having a spouse or a relationship. Common environmental effects explain around 30% of the variation in illness and death of a significant other. No distinction could be made between genetic and common environmental effects with respect to the other life events. However, for most events, results pointed more in the direction of genetic than common environmental effects. These findings are in agreement with earlier research. In the Minnesota Twin Registry, the heritability was estimated to be 0.70 for the propensity to marry (Johnson et al., 2004). Furthermore, two studies performed in the Virginia Twin Register indicated that life events that are supposed to partly result from a respondent's own behavior are probably genetically influenced (Bolinskey et al., 2004; Kendler et al., 1993). This implies that an association between an environmental risk factor and a psychiatric disorder, even in longitudinal research, might be due to genetic influences shared by the risk factor and the disorder. This may be formally tested in bivariate twin models and in models that include gene–environment interaction and correlation (Purcell, 2002), but also needs to be considered in other studies on environmental risk factors.

In the former (Bolinskey et al., 2004; Kendler et al., 1993) and in our own study, the prevalence of some life events was very low, which may have contributed to the problem of distinguishing genetic from common environmental effects. A longitudinal study in which twins are asked on several occasions about experienced life events seems useful to study familial influences on exposure to life events. The rate of

Table 3

χ^2 for the Test of Significance of Additive Genetic (A) and Common Environmental Effects (C). Parameter Estimates of the Percentage of Variance Explained by Additive Genetic, Common and Unique Environmental Effects (E) in the Best Fitting Model

	Spouse	Illness — self	Illness — significant other	Death — significant other	Divorce	Accident in men	Robbery
χ^2 drop A*	8.531	1.419	.001	1.637	3.185	1.684	.420
χ^2 drop C*	.740	.049	7.215	6.027	.000	.001	.808
χ^2 drop A and C#	128.255	20.297	73.913	128.989	24.013	20.811	24.060
A/C**	.57/–	.33/.27	–/.37	–/.48	.29/.23	.55/.47	.30/.25
E**	.43	.67/.73	.63	.52	.71/.77	.45/.53	.70/.75

Note: *Critical value of χ^2: 3.841 at $p = .05$ with 1 degree of freedom.

#Critical value of χ^2: 5.991 at $p = .05$ with 2 degrees of freedom.

**When it was not possible to decide whether familial resemblance was due to genetic or common environmental effects, the estimates of A and E in the absence of C and the estimate of C and E in the absence of A are given.

reported events will increase when the data collected at several occasions are analyzed simultaneously.

OR and tetrachoric correlations gave the same results regarding the presence of familial influences. Comparisons of concordance rates of life events did not reveal significant differences between MZ and DZ twins suggesting no genetic effects. However, these analyses were performed in men and women separately since the prevalences of some of these experienced life events were significantly different. In the model-fitting analyses, thresholds could be estimated separately for each sex, while testing whether the estimates of variance components A, C and E could be constrained to be equal in men and women. As this was allowed for almost all life events, the power to detect genetic effects was greater in the model-fitting analyses than in the comparisons of the concordance rates.

Although it was not a primary aim of our study, we found some clear sex differences on the reported experienced life events. Not surprisingly, men younger than 30 years of age more often experience an accident, robbery or violent assault and women are more often victim of a sexual assault. Older women more frequently report illness and death of a significant other. An explanation could be that women are more sensitive to the needs of others and more frequently take care of ill people. Women in the two youngest age groups more often have a spouse or are involved in a romantic relationship than men. This is in accordance with marriage rates of men and women in this age group in the Netherlands (CBS, 2000). Women apparently have a relationship with a man who is approximately 5 years older. An interesting issue to examine in future is whether these differences in exposure to some environmental factors also imply that the impact of these factors on the development of psychiatric disorders is different in men and women.

To summarize, the results suggest that there are no differences in prevalences of exposure to life events between MZ twins, DZ twins and singletons. The exposure to life events was influenced by familial factors. For presence of a spouse, familial resemblance was due to genetic effects. For most other life events, no distinction could be made between genetic and common environmental effects.

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Appendix A

N (%) Concordant and Discordant Monozygotic and Dizygotic Twin Pairs for Events

		Spouse	Illness — self	Illness — significant other	Death — significant other	Divorce	Accident	Robbery	Violent assault	Sexual assault
MZM	Con yes	99 (44.6)	8 (4.0)	41 (20.3)	105 (48.6)	15 (7.1)	18 (8.7)	14 (6.7)	3 (1.5)	0 (0.0)
	Disc	57 (25.7)	42 (20.9)	76 (37.6)	72 (33.3)	70 (33.3)	43 (20.8)	59 (28.2)	22 (10.7)	2 (1.0)
	Con no	66 (29.7)	151 (75.1)	85 (42.1)	39 (18.1)	125 (59.5)	146 (70.4)	136 (65.1)	181 (87.9)	203 (99.0)
DZM	Con yes	51 (42.9)	2 (2.0)	20 (20.6)	55 (51.4)	6 (5.8)	6 (5.8)	7 (6.9)	0 (0.0)	0 (0.0)
	Disc	43 (36.1)	28 (28.6)	33 (34.0)	37 (34.6)	30 (28.8)	27 (26.3)	31 (30.4)	11 (10.9)	0 (0.0)
	Con no	25 (21.0)	68 (69.4)	44 (45.4)	15 (14.0)	68 (65.4)	70 (68.0)	64 (62.7)	90 (89.1)	99 (100.0)
MZF	Con yes	334 (57.8)	23 (4.6)	129 (25.0)	275 (51.6)	61 (11.8)	16 (3.1)	43 (8.2)	5 (1.0)	14 (2.7)
	Disc	162 (28.0)	110 (21.8)	189 (36.7)	150 (28.1)	163 (31.5)	124 (24.2)	157 (29.8)	33 (6.5)	51 (9.8)
	Con no	82 (14.2)	372 (73.7)	197 (38.3)	108 (20.3)	294 (56.8)	373 (72.7)	326 (62.0)	470 (92.5)	453 (87.5)
DZF	Con yes	140 (53.6)	12 (5.1)	49 (20.9)	134 (55.4)	18 (7.5)	6 (2.5)	17 (7.1)	3 (1.3)	1 (0.4)
	Disc	90 (34.4)	55 (23.4)	89 (38.1)	73 (30.2)	92 (38.4)	57 (24.1)	67 (27.8)	14 (5.9)	19 (8.0)
	Con no	31 (11.9)	168 (71.5)	96 (41.0)	35 (14.5)	130 (54.2)	174 (73.4)	157 (65.1)	221 (92.9)	217 (91.6)
DOS	Con yes	129 (47.8)	6 (2.4)	50 (20.5)	131 (51.6)	21 (8.3)	8 (3.1)	13 (5.1)	1 (0.4)	0 (0.0)
	Disc	97 (35.9)	55 (22.2)	87 (35.6)	80 (31.5)	87 (34.2)	77 (30.2)	77 (30.4)	25 (10.0)	22 (8.7)
	Con no	44 (16.3)	187 (75.4)	107 (43.9)	43 (16.9)	146 (57.5)	170 (66.7)	163 (64.4)	224 (89.6)	230 (91.3)

Note: Con: concordant; Disc: discordant; MZM: monozygotic male pairs, DZM: dizygotic male pairs, MZF: monozygotic female pairs; DZF: dizygotic female pairs; DOS: dizygotic twin pairs of opposite sex.