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Self-Report Psychiatric Symptoms in Twins and Their Nontwin Relatives: Are Twins Different?

Kenneth S. Kendler, Nicholas G. Martin, Andrew C. Heath, and Lindon J. Eaves

Departments of Psychiatry and Human Genetics, Medical College of Virginia / Virginia Commonwealth University (K.S.K., L.J.E.), Richmond, Virginia; Queensland Institute for Medical Research (N.G.M.), Queensland, Australia; and Department of Psychiatry, Washington University School of Medicine (A.C.H.), St. Louis, Missouri

While twin studies of psychiatric disorders have been conducted for over 65 years, surprisingly little is known about the comparability of psychiatric symptoms in adult twins and singletons. To address this question, we compared the means and variances of four-factor scores on the self-report Symptom Check List in twins and their relatives from the Virginia 30,000 twin-family study. The four factors were depression, panic-phobia, somatization, and insomnia. Twins had significantly higher scores on the panic-phobia factor than their relatives, by about one eighteenth of a standard deviation, and this was replicated in both subsamples. However, no consistent and significant mean differences between twins and their relatives were detected for the other three symptom factors. While some differences in variance were found between twins and their relatives, in no case were the differences replicated in both subsamples. With the possible exception of modestly elevated scores for panic-phobia, these results suggest that both the level and variability of common psychiatric symptoms reported by twins are similar to those found in the nontwin population

KEY WORDS: twins, depression, anxiety

INTRODUCTION

Twin studies have provided major insights into the role of genetic and environmental risk factors in psychiatric disorders and psychological traits for over 65 years. An implicit assumption of these studies is that, with respect to these disorders and traits, twins are representative of the general population. Despite the centrality of this assumption for twin research, this question has, in fact, been addressed only infrequently.

Twins are not typical of the singleton population with respect to obstetric complications: they have a shorter average gestation, and a substantially increased risk for low birth weight, congenital malformations, cerebral palsy, and perinatal mortality [1–3]. Language development may be delayed in twins, and there may be differences in the rearing experienced by twins and nontwins [4]. In general population adult samples, twins probably have a slight reduction in intelligence [5], although this has not been found in all studies [6].

The question of whether twins differ from singletons in their risk for psychiatric disorders has only rarely been addressed. Rutter and Redshaw [4] reviewed studies examining questionnaire measures of "maladjustment and psychopathology" in childhood and adolescence, and concluded ". . . the overall risk for socioemotional behavioral disturbance in twins is not much different from that found in singletons." We are aware of four studies that examined the rate of more severe psychopathology in adult twins. Two early studies from Germany and Sweden found no excess rates of twins in psychiatrically hospitalized patients with schizophrenia or affective illness [7]. An analysis of over 20,000 admissions to the Maudsley Hospital in London showed no excess rate for twins for any of six major diagnostic categories [8]. In what is probably the best such study, Kringlen, using the Norwegian Twin and Psychiatric Registries, found first admission rates for "functional psychosis" to be similar or slightly lower in twins than in the general population [9]. While the available evidence suggests that rates of psychopathology in adult twins do not differ substantially from those found in singletons, this evidence is largely restricted to severe disorders seen in hospitalized settings.

We recently completed a postal survey of two samples of twins and their families [10,11]. This survey contained 30 items from the widely-used Symptom Checklist (SCL) [12] designed to assess symptoms of depression and anxiety. In this report, we examine whether the mean levels and variability of symptoms of anxiety and depression systematically differ in twins and their nontwin relatives. The presence of two independent

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Address reprint requests to Dr. Kenneth S. Kendler, P.O. Box 980710, Richmond, VA 23298-0710.

samples permits us to examine the replicability of any detected differences in samples which differ in age and mode of ascertainment.

MATERIALS AND METHODS

Sample

As outlined elsewhere [10,11], data for this study were obtained from a volunteer twin sample solicited through an American Association of Retired Persons (AARP) newsletter and the Virginia Twin Registry, a population-based register, constructed from a systematic review of public birth records in the Commonwealth of Virginia. Twins obtained through either source were asked to provide names and addresses of spouses and first-degree relatives. Inclusion in the study was based only on an individual's willingness to return a mailed questionnaire covering health and lifestyle issues. The sample had a lower age limit of 18 years and no upper age limit. A second and third mailing was sent to nonrespondents who had not indicated their refusal to participate. A telephone follow-up was conducted in an attempt to obtain complete information on pairs of twins where only one twin had responded. Completed questionnaires were received from 69.8% of the twins (AARP, 75.0%; Virginia, 62.8%) and from 44.7% of the known relatives of these twins (AARP, 34.2%; Virginia, 69.2%).

Twin zygosity was determined by responses to two questions pertaining to how often the twins were confused as children due to their physical similarity. As validated against blood-typing, this method is around 95% accurate [13].

A self-report symptom inventory was obtained for each participant, using a 30-item subset of the 90-item Symptom Checklist (SCL-90) [12] included in the questionnaire. Twenty-seven of these items were chosen empirically from four SCL subscales: depression (10 items), somatization (five items), anxiety (seven items), and phobic anxiety (five items). Three items, all dealing with sleep difficulty, were chosen from the additional items available in the SCL-90.

Statistical Analysis

A factor analysis employing an oblique rotation was performed using the Statistical Analysis System [14] with the PROMAX criteria for factor rotation on the 30 SCL items. As outlined in detail elsewhere [15], four readily interpretable factors were obtained using the scree test. These factors were termed *depression* (with heaviest loadings on 10 items, including "feeling blue," "feeling worthless," "worrying too much," and "feeling hopeless"), *panic-phobia* (with heaviest loadings on eight items, including "terror spells," "suddenly scared," "avoiding frightening things," and "nervous if alone"), *somatization* (with heaviest loading on seven items, including "feeling weak," "heart pains," "faintness," and "heart pounding"), and *insomnia* (with heaviest loading on three items, including "restless sleep," "trouble falling asleep," and "awaking early"). The interfactor correlations (in the AARP and Virginia samples) were relatively high, ranging from +0.59–+0.60 between depression and panic-phobia, and +0.39–+0.42 between somatization and insomnia. The other interfactor correlations ranged from +0.46–+0.58.

Differences in mean factor scores between twins and their relatives were assessed by linear regression, using the PROREG procedure in SAS [16], controlling for age, age^2, gender, gender $\times$ age, and sample (AARP vs. Virginia). The sample size for these regressions was 29,529, of whom 14,834 were twins, and the df for the resultant t tests was 29,522 for the total sample, and 18,727 and 10,790 for the AARP and VA subsamples, respectively. Differences in variance in factor scores between twins and their relatives were assessed by the F test in SAS [16], performed on the residuals after removing the effects of the above covariates. Degrees of freedom for the combined, AARP, and Virginia samples were 14833/14694, 9,110/9,621, and 5,722/5,072, respectively. It should be noted that, as observations from members of a twin-family are not statistically independent, the degrees of freedom in these analyses are biased upward.

Given the multiple tests performed, we set our level of significance at $P < 0.01$ and decided, a priori, to regard as definitive only findings that produced a similar, statistically significant effect in both subsamples of the Virginia 30,000. To aid in interpretation, differences in means have been presented in standard deviation units, and differences in variance as percentages.

RESULTS

Differences in Means

In the combined sample, no consistent and significant difference was seen in the mean level of symptoms of depression or insomnia in the twins and their relatives (Table I). Twins reported, on average, fewer somatic symptoms in the combined sample, by 6.4% of an SD. However, while a similar finding was seen in the AARP sample, in the Virginia sample, twins had virtually the same mean level of symptoms of somatization as their relatives. Twins did report significantly higher mean levels of panic-phobia symptoms than their relatives, and this difference was seen in both subsamples. The magnitude of difference, however, 5.7% of an SD, was modest.

We also examined the mean symptom scores of all monozygotic (MZ) twins, dizygotic (DZ) same-sex (SS), and DZ opposite-sex (OS) pairs, compared to their relatives. In none of the four symptom factors was a consistent and significant effect seen across all comparisons. MZ and SS-DZ pairs all had significantly *higher* levels of panic-phobia than their relatives (by 4.4% and 7.3% of an SD, respectively), but OS-DZ twins had nonsignificantly *lower* symptom levels (by 3.0% of an SD). In no case did a twin group differ from relatives on a symptom factor by more than 9% of an SD. Furthermore, of the 12 comparisons (3 twin groups $\times$ 4 factors), six showed twins having lower, and six showed twins having higher, symptom scores than their relatives (with mean lower and higher scores of 4.8% and 3.0% of an SD, respectively).

Differences in Variance

Using the combined sample, significant differences in variance between twins and their relatives were seen

TABLE I. Differences Between Twins and Their Relatives in Means and Variances of Self-Report Symptom Factors†

	Difference in means[a]			Difference in variance[b]		
Symptom factor	Combined	AARP	VA	Combined	AARP	VA
Depression	−.026	−.038	+.036	−.045*	−.038	−.078*
Panic-phobia	+.057**	+.044*	+.087**	−.001	+.21**	−.21**
Somatization	−.064**	−.084**	+.009	−.062**	+.13**	−.29**
Insomnia	+.019	+.021	+.046	+.05**	+.13**	−.06

† For sample sizes and degrees of freedom, see text.
[a] In SD units.
[b] Expressed as percentage of variance.
* $P < .01$.
** $P < .0001$.

for symptoms of depression, somatization, and insomnia, but not panic-phobia (Table I). However, in none of the three symptom factors did these results replicate across the two subsamples. We also examined the variance of symptom scores in MZ twins, all DZ twins, and SS and OS DZ twins, as compared to their relatives. In none of the four symptom factors was a consistent and significant effect seen across all comparisons. The most consistent picture was seen for somatization, where a 4.6–12.9% reduction in variance was seen in all three twin groups, reaching statistical significance in two of them. Of the 12 comparisons, nine showed twins having less variance (with a mean reduction of 5.2%), and three showed twins having greater variance (with a mean increase of 5.4%).

DISCUSSION

Despite large sample sizes, we detected only one statistically significant difference in twins and their relatives in the means or variances of four common psychiatric symptom factors that replicated across samples. Twins appear to have higher levels of symptoms of panic-phobia. However, the magnitude of this difference, around one eighteenth of a standard deviation, was *very* modest. In accord with previous studies of self-report measures in children and adolescents [4] and studies of more severe treated psychiatric illness in adults [7–9,17] these results suggest that twins are typical of the general nontwin population in their risk for psychiatric symptoms and syndromes.

These results should be interpreted in the context of four potentially significant methodologic limitations. First, we did not systematically record whether the relatives of twins were themselves twins. Accounting for the modest familial aggregation of twins [18], over 95% of the relatives of these twins would be expected to be singletons.

Second, we compared twins to their relatives rather than to a matched sample of singletons. Relatives of twins may be atypical. For example, mothers of 5-year-old twins were shown, in one study, to have increased levels of depression ascribed to the burden of caring for two young children [19].

Third, substantial differences in cooperation rates were seen in twins and their relatives between the Virginia and AARP samples. Twins from the volunteer AARP sample participated at higher rates than the birth certificate-ascertained Virginia twins. By contrast, the much older relatives of the AARP twins were considerably less cooperative than relatives of the Virginia twins. By examining the levels of symptoms in twins whose cotwin did vs. did not also return a questionnaire, we can estimate the relationship between symptom level and cooperation. Noncooperation of a cotwin weakly predicted higher levels of all four symptom factors, with strongest effects for insomnia and somatization, and weakest for depression. If cooperation effects were important, we should see consistently higher symptom levels in the group with the highest cooperation levels, where, because of greater motivation to participate, more symptomatic individuals would return questionnaires. In particular, this would predict little difference in symptom levels in twins and relatives in the Virginia sample, where cooperation rates were similar for the two groups, but consistently higher symptom levels in twins in the AARP sample, where twins were much more cooperative than relatives. However, this pattern of results, predicted by a cooperation effect, was not observed.

Fourth, several models of social interaction between twins predict different variances between twins and singletons [13]. While our overall results are not supportive of consistent twin-singleton differences in variance for common symptoms of anxiety and depression, it is possible that the apparent trend (evident in three of the four factors) toward reduced variance in twins in the Virginia sample and increased variance in twins in the AARP sample may indicate some social interaction effects that differ between these two cohorts. Alternatively, differential cooperation rates may be responsible for these observed trends.

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