Psychological Medicine, 2003, **33**, 927–931. © 2003 Cambridge University Press
DOI: 10.1017/S0033291703007542 Printed in the United Kingdom

BRIEF COMMUNICATION

Interpersonal dependence and major depression: aetiological inter-relationship and gender differences

V. A. SANATHARA, C. O. GARDNER, C. A. PRESCOTT AND K. S. KENDLER[1]

From the Virginia Institute for Psychiatry and Behavioral Genetics and Departments of Psychiatry and Human Genetics, Medical College of Virginia of Virginia Commonwealth University, Richmond, VA, USA

ABSTRACT

Background. Although prior research has demonstrated a strong association between interpersonal dependency (IPD) levels and risk for major depression (MD), the possible aetiological explanations of this association as well as any gender differences in the IPD–MD relationship need further clarification.

Method. Population-based twin samples ($N = 7174$) were interviewed in multiple waves to assess IPD and MD as part of a larger twin study. IPD levels were assessed using the Interpersonal Dependency Inventory while MD diagnoses were derived from the SCID. Cox proportional hazard models and multiple regression techniques were utilized.

Results. IPD was strongly associated with a risk for lifetime MD. Pre-morbid IPD scores were predictive of future onsets of MD while experiencing a MD episode was also associated with a significant rise in IPD levels. While females had higher IPD scores, IPD scores were more significantly associated with risk for lifetime MD in males. Controlling for the level of IPD substantially reduced the observed association between gender and risk for MD.

Conclusion. The strong association observed between IPD and risk for MD results largely from IPD being a risk factor for MD, but state effects of MD on IPD also contribute. IPD scores in males were more predictive of lifetime MD than for females. The higher levels of IPD in women than in men may contribute meaningfully to the sex differences in risk for MD.

INTRODUCTION

Interpersonal dependence (IPD) has been characterized as a reliance on other valued people for emotional and social support (Hirschfeld *et al.* 1977). An excess of interpersonal dependency has been associated with a vulnerability to several psychiatric disorders, most notably major depression (MD) (Borenstein, 1992). The finding that depressed individuals have higher IPD levels than non-depressed individuals has been replicated in many studies (Hirschfeld *et al.* 1983, 1984; Reich *et al.* 1987; Vielel, 1996). Though numerous studies have shown that women suffer from MD more frequently than men (Nolen-Hoeksema 1987, 1990; Bebbington, 1996), more limited evidence suggests that women have higher levels of IPD than do men (Veilel, 1996; Turner & Turner, 1999).

Three models have been proposed to explain the relationship between MD and IPD. The 'vulnerability model' proposes that high IPD levels predispose individuals to develop depression. The 'scar model' hypothesizes that the experience of major depression alters, or 'scars', an individual thereby producing a long-lasting increase in IPD level. The 'state model' suggests

[1] Address for correspondence: Professor Kenneth S. Kendler, Department of Psychiatry, PO Box 980126, Richmond, VA 23298-0126, USA.

https://doi.org/10.1017/S0033291703007542 Published online by Cambridge University Press

that IPD levels are directly influenced by current depressed mood. In the literature, some studies have supported the vulnerability model (Veilel, 1996; Shea *et al.* 1996), while others are more consistent with the scar (Veilel, 1996) or state (Hirschfeld *et al.* 1983; Rohde *et al.* 1990) hypotheses.

In this report, we examine IPD and MD in a large population-based sample of twins in an attempt to address two questions: (1) What is the magnitude of the IPD–MD relationship in women and to what extent can it be explained by the vulnerability, scar and state models?; and (2) Does the magnitude of the IPD–MD association differ in men and women?

METHOD

Sample

Our twin sample (Kendler & Prescott, 1999) derives from two inter-related projects utilizing the population-based Virginia Twin Registry – formed from a systematic review of all birth certificates in the Commonwealth of Virginia. The female–female twin pairs used in this study come from birth years 1934–1974. Twin pairs became enrolled if both members responded to a mailed questionnaire, the response rate to which was 64%. Eighty-eight per cent of our sample was first interviewed face to face in 1987–1989 and has subsequently been the subject of three additional telephone interview waves spaced at least one year apart, with completion rates ranging from 85–93%.

The male–male and male–female twin pairs, covering the birth years 1940–1974, were ascertained in a separate study beginning in 1993 in which we succeeded in interviewing by telephone 72% of those eligible (Kendler & Prescott, 1999). This sample was followed-up in a second wave of interviews completed in 83% of the sample at least 1 year after the initial interview.

Measures

In separate sections, lifetime and last year MD was assessed, with high inter-rater reliability ($\kappa = 0{\cdot}96 \pm 0{\cdot}04$), by a structured psychiatric interview based on the SCID (Spitzer & Williams, 1985; Kendler *et al.* 1992) at each interview wave. Interviewers had at least a master's degree in a mental health-related field or a bachelor's degree in such a field and 2 years of clinical experience. Each interview was reviewed by at least one senior staff member for completeness and consistency.

The Interpersonal Dependency Inventory (IDI) (Hirschfeld *et al.* 1977) was originally developed using factor analysis of a range of test items. Three subscales were derived: emotional reliance on another person, lack of self-confidence and assertion of autonomy. In a study of psychiatric patients and controls, Hirschfeld *et al.* (1977) showed that the first subscale (emotional reliance on another person (ERP)) was more strongly related to risk of illness than the other two subscales. For this study, IPD was measured using 10 items from the ERP subscale. This scale was included in a series of questions involving stress and coping in a larger twin study. Each twin was asked if they strongly agreed, agreed, disagreed, or strongly disagreed with each statement.

Statistical analysis

Female–female sample

For simplicity, we term the initial questionnaire in this sample as the t1 assessment and the four interview waves as t2 to t5, respectively. We first examined, in the entire sample, the relationship between risk for lifetime MD and current IPD, both assessed at the t2 interview. To test the vulnerability model, we eliminated from this sample all individuals who reported an episode of MD prior to the t2 interview. We then attempted to predict, from their t2 IPD scores, their risk for developing a first-onset of MD as recorded at the t3, t4, or t5 interviews. For the first two analyses, Cox proportional hazard models were used as implemented by PROC PHREG in SAS (SAS Institute, 1990). The magnitude of the relationship between IPD and MD was assessed by a hazard ratio.

IPD was also assessed by self-report questionnaire (SRQ) at the time the twins were first enrolled in the study. To test the state model, controlling for the level of IPD as assessed as the self-report questionnaire at t1, we determined whether being in a clinical state of MD at the t2 interview was associated with a significant elevation of IPD. To test the scar hypothesis, we eliminated from the sample those who reported

https://doi.org/10.1017/S0033291703007542 Published online by Cambridge University Press

a current depressive episode at t2, and examined whether, controlling for the level of IPD at t1, whether the occurrence of a depressive episode between t1 and t2 was associated with a change in IPD at t2. These analyses were completed using multiple regression techniques as operationalized by PROC MIXED in SAS (SAS Institute, 1990). Non-independence of twin pairs was dealt with by using a mixed-model with a parametrically structured covariance matrix. For all analyses, IPD was standardized so that the hazard ratio reflected the change in risk for MD associated with one SD change in IPD.

Gender differences

In our entire sample of male and female twins, we assessed the differences in IPD levels in males and females using the Sattterthwaite t test, employed because of the unequal variances in males and females. In this large sample, we also examined, using Cox proportional hazard models (Cox, 1972), the risk for lifetime MD as predicted by IPD, sex and the interaction between sex and IPD. In these analyses, we used IPD and lifetime MD as obtained at the same assessment (the first interview with the female–female pairs and the second interview with the male–male and male–female pairs).

RESULTS

The source of the IPD–MD association

We first sought to quantify the relationship between the IPD scores of female–female twins and risk for lifetime MD and to evaluate, using prospective data, the three models for the causal relationship between IPD and MD. As assessed at a single time of measurement ($N=1839$), IPD was strongly associated with a risk for lifetime MD (hazard ratio = 1·33, $\chi^2=53{\cdot}90$, $P<0{\cdot}0001$). As predicted by the vulnerability model, among those with no prior depressive episodes ($N=1328$), IPD scores significantly predicted a future onset of MD (hazard ratio = 1·38, $\chi^2=14{\cdot}77$, $P=0{\cdot}0001$). In support of the state model ($N=33$), controlling for the level of IPD at t1, being in a clinical state of MD at t2 was associated with a significant elevation of IPD ($t=3{\cdot}05$, df = 589, $P=0{\cdot}002$). However, contrary to the prediction of the scar model ($N=118$), IPD scores at t2 were not significantly elevated by a history of a depressive episode between t1 and t2 ($t=1{\cdot}70$, df = 565, $P=0{\cdot}09$). However, a trend in the expected direction was observed and it was therefore of interest to estimate the time-course of the 'scar effect'. In those with a depressive episode between t1 and t2, fitting a regression line to the change in IPD as a function of the time since recovery estimated that the episode-associated increase in IPD would be expected to return to baseline in 5·7 months after the conclusion of the episode.

Table 1. *Effect of sex, interpersonal dependence and their interaction on risk for lifetime MDD*†

Model	Independent variable(s)	Hazard ratio	χ^2	P
1	Sex	1·59	125·54	****
2	IPD	1·49	380·98	****
3	IPD Sex	1·38	59·18	****
4	IPD × Sex	0·88	8·88	**
	Sex	1·43	68·43	****
5	IPD (Male)	1·55	202·48	****
6	IPD (Female)	1·36	118·43	****

† $N=7155$ for Models 1–4; 3989 for Model 5 and 3; 166 for Model 6. For clarity, results not shown for effect of IPD in Model 3. Model 4 contains both an interaction between IPD and sex, as well as the main effects of sex and IPD (results for the latter are now shown).
** $P<0{\cdot}01$; **** $P<0{\cdot}0001$.

Gender differences

In our combined sample of 7174 twins, females had significantly higher IPD scores than did males (Satterthwaite $t=17{\cdot}37$, $P<0{\cdot}0001$). As seen in Table 1, when examined individually, both sex and IPD scores were significantly associated with lifetime MD (models 1 and 2). However, the impact of sex on the risk for MD decreased substantially when IPD scores were included in the model (model 3). Furthermore, a significant interaction was seen between IPD and sex in the prediction of MD (model 4). This interaction arose because IPD was more strongly associated with risk for MD in males (model 5) than in females (model 6).

Fig. 1 depicts the risk for lifetime MD as a function of the within-gender quartile of IPD scores for males and females. Males show a relatively linear relationship between IPD and risk for MD across the entire range of IPD scores. By contrast, in females, little difference in risk for MD is seen for those in the lower 75% of IPD scores.

https://doi.org/10.1017/S0033291703007542 Published online by Cambridge University Press

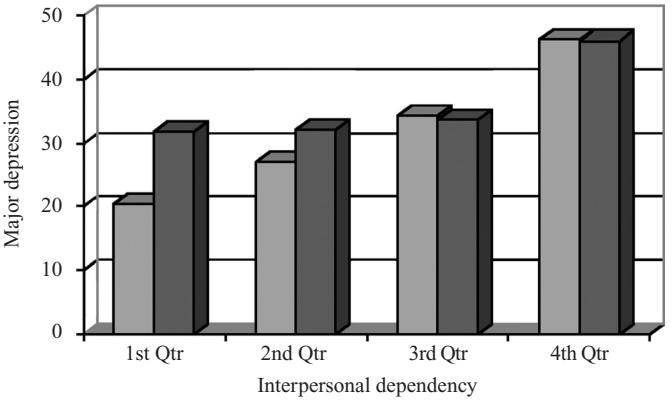


FIG. 1. Lifetime prevalence of major depression (%) as a function of the quartile of IDI score. (□, Males; ■, Females.)

DISCUSSION

IPD was strongly associated with lifetime MD in female twins. Our results, consistent with prior analyses (Veilel, 1996; Shea *et al.* 1996), also provided strong support for the vulnerability and state models, but only marginal support for the scar hypothesis. Moreover, the hazard ratio in prospectively predicting new onsets of MD from prior IPD scores was virtually identical to that seen in our cross-sectional analysis, suggesting that all or nearly all of the IPD–MD association seen in this population is due to IPD increasing risk for MD. Consequently, these analyses suggest that in any cross-sectional analysis of a population, the large bulk of the IPD–MD association stems from the vulnerability model – that high levels of IPD predispose to depressive episodes. However, we also found evidence for a robust state effect and a marginal scar effect of MD on IPD. Being in a depressive episode clearly increased levels of IPD and some of this elevation may persist beyond the end of the episode. Of note, further analyses suggested that the duration of this effect was limited and that IPD levels returned to baseline by 6 months after the depressive episode.

Consistent with prior studies (Veilel, 1996; Turner & Turner, 1999), we found that females had higher IPD levels than males. Both sex and IPD levels were significantly associated with risk for MD. When IPD levels were controlled, the effect of sex on the risk for MD was substantially decreased (from hazard ratios of 1·59 to 1·38). These results suggest that a non-trivial proportion of the gender differences in risk for MD might result from gender differences in IPD.

We also observed an interaction between sex and IPD in the prediction of MD, resulting from a stronger relationship between IPD and risk for MD in males than in females. In males, a consistent and relatively linear relationship is seen between IPD and risk for MD. In females, by contrast, the association between IPD and MD in females is 'driven' entirely by the elevated risk for MD in those with IPD levels in the upper quartile. Therefore, our analyses suggest that the sex differences in risk for MD was seen only in those with low IPD for their sex.

Limitations

Our results of this study should be examined in the context of certain key limitations. To measure IPD, we only used the 'emotional reliance on another person' subscale of the Interpersonal Dependency Inventory (Hirschfeld *et al.* 1977). Even though this subscale accurately measures a key aspect of IPD, different results may have been obtained had we used all three subscales. Also, different results may have been obtained had other IPD scales been used (Boyce *et al.* 1990). In addition, because the IPD measures were based on self-report and rates of MD were dependent on an accurate recollection of the past, these results could have been influenced by recall bias.

We could evaluate the three causal models of the IPD–MD relationship only in females. While it is plausible that the same results would

https://doi.org/10.1017/S0033291703007542 Published online by Cambridge University Press

be found in males, this need not be the case. Finally, our entire sample is limited to Caucasian twins born in Virginia. Although twins have been shown to be representative of the general population (Kendler *et al.* 1996), our findings cannot be necessarily generalized to other ethnic groups or regions.

This work was supported by NIH grants MH-40828, MH-49492 and AA-09095 and a VCU School of Medicine Summer Research Fellowship to Mr Sanathara. We acknowledge the contribution of the Virginia Twin Registry, now part of the Mid-Atlantic Twin Registry (MATR), to ascertainment of subjects for this study. The MATR, directed by Drs L. Corey and L. Murrelle, has received support from the National Institutes of Health, the Carman Trust and the W. M. Keck, John Templeton and Robert Wood Johnson Foundations.

REFERENCES

Bebbington, P. (1996). The origins of sex differences in depressive disorder: bridging the gap. *International Review of Psychiatry* **8**, 295–332.

Borenstein, R. F. (1992). The dependent personality: developmental, social, and clinical perspectives. *Psychological Bulletin* **112**, 3–23.

Boyce, P., Parker, G., Hickie, I., Wilhelm, K., Brodaty, H. & Mitchell, P. (1990). Personality differences between patients with remitted melancholic and nonmelancholic depression. *American Journal of Psychiatry* **147**, 1476–1483.

Cox, D. R. (1972). Regression models and life tables. *Journal of the Royal Statistical Society* **B34**, 187–220.

Hirschfeld, R. M. A., Klerman, G. L., Gough, H. R., Barrett, J., Korchin, S. J. & Chodoff, P. (1977). A measure of interpersonal dependency. *Journal of Personality Assessment* **41**, 610–618.

Hirschfeld, R. M. A., Klerman, G. L., Clayton, P. J. & Keller, M. B. (1983). Personality and depression. *Archives of General Psychiatry* **40**, 993–998.

Hirschfeld, R. M., Klerman, G. L., Clayton, P. J., Keller, M. B. & Andreasen, N. C. (1984). Personality and gender-related differences in depression. *Journal of Affective Disorders* **7**, 211–221.

Kendler, K. S., Neale, M. C., Kessler, R. C., Heath, A. C. & Eaves, L. J. (1992). A population-based twin study of major depression in women: the impact of varying definitions of illness. *Archives of General Psychiatry* **49**, 257–266.

Kendler, K. S., Pedersen, N. L., Farahmand, B.Y. & Persson, P.-G. (1996). The treated incidence of psychotic and affective illness in twins compared with population expectation: a study in the Swedish Twin and Psychiatric Registries. *Psychological Medicine* **26**, 1135–1144.

Kendler, K. S. & Prescott, C. A. (1999). A population-based twin study of lifetime major depression in men and women. *Archives of General Psychiatry* **56**, 39–44.

Nolen-Hoeksema, S. (1987). Sex differences in unipolar depression: evidence and theory. *Psychological Bulletin* **101**, 259–282.

Nolen-Hoeksema, S. (1990). *Sex Differences in Depression*. Stanford University Press: Palo Alto, CA.

Reich, J., Noyes, R., Hirschfeld, R. M., Coryell, W. & O'Gorman, T. (1987). State and personality in depressed and panic patients. *American Journal of Psychiatry* **144**, 181–187.

Rohde, P., Lewinsohn, P. M. & Seeley, J. R. (1990). Are people changed by the expression of having an episode of depression? A further test of the scar hypothesis. *Journal of Abnormal Psychology* **99**, 264–271.

Shea, M. T., Leon, A. C., Mueller, T. I., Solomon, D. A., Warshaw, M. G. & Keller, M. B. (1996). Does major depression result in lasting personality change? *American Journal of Psychiatry* **153**, 1404–1410.

SAS Institute (1990). *SAS/STAT User's Guide. Version 6. Fourth Edition. Volumes 1 and 2*. SAS Institute Inc.: Cary, NC.

Spitzer, R. L. & Williams, J. B. W. (1985). *Structured Clinical Interview for DSM-III-R* (*SCID*). Biometrics Research Department, New York State Psychiatric Institute: New York.

Turner, H. A. & Turner, R. J. (1999). Gender, social status, and emotional reliance. *Journal of Health and Social Behavior* **40**, 360–373.

Veilel, H. O. F. (1996). Gender differences in the role of interpersonal dependency and depression. In *Interpersonal Factors in the Origin and Course of Affective Disorders* (ed. C. Mundt, M. M. Goldstein, K. Hahlweg and P. Fiedler), pp. 168–192. Henry Ling Ltd., The Dorset Press: Dorchester.

https://doi.org/10.1017/S0033291703007542 Published online by Cambridge University Press