

A Genetic Epidemiologic Study of Social Support in a Chinese Sample

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Accumulated evidence suggests that social support is influenced by genetic and environmental factors. However, there are little data that examine this issue from Asian samples. We reported results from a preliminary study that examined familial effects on social support in a Chinese adult twin sample. We administered a 10-item social support instrument that measures three dimensions of social support (i.e., objective support, subjective support, and utilization of support) developed for the Chinese population. Two hundred forty-two same-sex twin pairs, where both members of the pair completed the personal interview, were included in the final analysis. Structural equation modeling was used to estimate additive genetic (A), shared environmental (C), and nonshared environmental (E) effects on each dimension of social support. Familial factors (A+C) explained 56.63% [95% CI = 45.48–65.72%] and 42.42% [95% CI = 29.93–53.25%] of the total phenotypic variances of subjective support and utilization of support, respectively. For the objective support, genetic effects did not exist, but common environmental effect explained 37.56% [95% CI = 26.17–48.28%] of the total phenotypic variances. Neither gender nor age effects were seen on any dimension of social support. Except for objective support, genetic factors probably influence variation in subjective support and utilization of support. Shared environmental factors may influence all dimensions of social support.

Social support may be seen as the emotional, instrumental, and financial aid that is obtained from one's social network (Berkman, 1984). It is now well established that social support plays an important role in human health and also has protective effects for chronic diseases such as coronary heart disease (Anderson et al., 1996; Rosengren et al., 2004), hypertension (Gerin et al., 1992), coronary atherosclerosis (Wang et al., 2005), stroke (Morris et al., 1993), general level of functional ability (Seeman et al., 1995), mental illnesses including generalized social phobia (Torgrud et al., 2004),

and depression (Kim & Shin, 2004; Koizumi et al., 2004). In recent years, with the relationship between social support and health status being well documented, increasing attention has been paid to factors underlying social support.

Twin studies have explored the genetic and shared (common to the twin pair) environmental contributions to the level of social support (Agrawal et al., 2002; Bergeman et al., 1990; Kendler et al., 1997; Kessler et al., 1992; Raynor et al., 2002), and have found heritability estimates ranging from 0 to 75 per cent, and significant shared environmental effects. Three previous twin studies suggest gender and age differences may exist in the sources of social support (Agrawal et al., 2002; Coventry et al., 2004; Kendler et al., 2005). These studies reported social support being related significantly to genetic influences, but the heritability estimates vary between samples. Probable causes include differences in the races sampled, sample size, measurement instruments, data preparation, statistical methods used, and so on.

Since approximately 5 per cent of human genetic variation can be observed only when comparing two groups of people from different races (Ossorio & Duster, 2005) and all countries have their own cultural backgrounds, genetic epidemiologic analysis of social support in different races is necessary. Currently, genetic and environmental influences on social support have only been reported in samples obtained from Western countries. There are no similar studies within Asian populations. In this analysis we used epidemiologic data from a Chinese twin sample to examine the contribution of genes and environment on social support.

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Materials and Methods

Subjects

The study sample was selected from the Qingdao Twin Registry, which was established in 2000. Details of this registry have been published previously (Yang et al., 2002). The registry has recruited 4374 twin pairs through local preventive medicine offices and media advertisements, including 1525 pairs aged from 20 to 60 years. This twin sample is younger (mean = 35.2 years, $SD = 8.6$ years) and has more males (59%) than the general population of the Qingdao metropolitan area.

A detailed phenotypic study, using volunteers from the Qingdao Twin Registry had, by the end of 2001, enrolled a total of 510 twin pairs, aged 21 to 61 and with assigned zygosity (Lu et al., 2003). In August 2004, this same twin cohort, now aged 24 to 64 ($N = 490$ pairs) was invited to participate in our social support survey. Both members of 277 twin pairs and one member of 32 twin pairs (whose sibling did not respond) responded positively, and were included in the survey. The individual and pairwise response rates were 59.80% and 56.53%, respectively. An additional 47 dizygotic (DZ) pairs completed the survey through media promotion. The final sample comprised 242 same-sex twin pairs and 82 opposite-sex twin pairs. The 242 same-sex twin pairs included 70 monozygotic (MZ) male pairs, 100 MZ female pairs, 28 DZ male pairs, and 44 DZ female pairs. The participants ranged from 23 to 67 years old (mean $\pm SD = 39.3 \pm 8.6$; male: female = 42.9%: 57.1%). We did not find significant differences ($p > .05$) in age distribution or sex composition between participating twins and non-participating twins whose zygosity had been determined.

Zygosity Determination

Zygosity was determined as follows (Lu et al., 2003). First, 97 opposite sex pairs were classified as DZ twins. Second, blood type of same sex twin pairs was tested. All blood samples were tested in a clinical laboratory at the Sixth People's Hospital in Qingdao. Forty-seven twins with different ABO blood types were classified as DZ twins. Third, the zygosity of the remaining 361 twin pairs was determined using an AmpF1STR Profiler Plus™ PCR kit purchased from PE Co., USA. This kit contains nine STR markers (D3S1358, vWA, FGA, D8S1179, D21S11, D18S51, D5S818, D13S317 and D7S820). One sexual labeling site (Amelogenin) was also amplified for the 361 subjects. The probability of misclassification of zygosity based on these biomarkers can be controlled within $p < .01$ (Lu et al., 2003).

Measures

Social support was measured using a previously developed questionnaire (Xiao, 1994). This 10-item instrument evaluates three dimensions of social support including (1) objective support (three items), referring to received support from direct material aid

and social network; (2) subjective support (four items), referring to emotional and perceived support; (3) utilization of support (three items), referring to one's use of social network. A 4-point scale (from 'never' to 'a lot') was used to measure responses for all items except 5, 6, and 7. The scale for each dimension was obtained by summing over the scores of the nested items. The overall score for social support was calculated by summing the individual scores over the 10 items. The test-retest correlation was .92 for the overall score and .89 and .94 for the dimensions over the two month interval. All dimensions, especially subjective support and utilization of support, were negatively correlated with the scale of Symptom Checklist (Xiao, 1994). The 10-item inventory for social support is thus rendered a valid and reliable instrument.

All twins were invited to complete the survey at local preventive medicine offices near their homes. Specially trained interviewers explained the questionnaire before the participants completed the inventory on their own. Written informed consent was obtained from each participant prior to the interviews. The study protocol was approved by the Institutional Review Boards at the Center for Disease Control and Prevention at Qingdao, as well as the Peking University School of Public Health.

Statistical Analysis

Linear modeling was used to examine age and sex effects on each dimension of social support. Covariance matrices were computed separately for MZ and DZ twins, as implemented in the SAS procedure (SAS Institute Inc., 1999). A genetic psychological model was fitted to the covariance matrices using Mx (Neale et al., 1999; Neale, 2004), given the assumptions of no gene-environment interactions, no assortative mating, and equal environment for MZ and DZ twins. We tested the last assumption by assessing frequency of contact between twin members in each pair. We did not find evidence that MZ twins contacted each other more frequently than DZ twins (Pearson chi-square = 6.56, degrees of freedom = 3, $p = .09$). On average, MZ twins share 100% of their genes and DZ twins share 50% of their genes. We assumed genetic correlation to be unity between MZ twins and .5 between DZ twins. Structural equation modeling was used to decompose the total phenotypic variance of social support into additive genetic, shared environmental, and non-shared environmental origins. The maximum likelihood method was used to estimate additive genetic (A), shared environmental (C), and non-shared environmental (E) variance parameters. The likelihood-ratio chi-squared test was used to evaluate the fit of the nested reduced models against the full model (ACE), by fixing one or other of these parameters to zero. Akaike's Information Criterion (AIC) was also used to assess the adequacy of model fitting (Martin et al., 1997).

Table 1
General Descriptive Statistics of Twins for Three Social Support Measures

Measures	\bar{x}	<i>SD</i>	Minimum	Maximum	Skewness	Kurtosis
Objective support	9.66	3.12	2	19	0.27	-0.24
Subjective support	25.82	4.45	12	32	-0.57	-0.27
Utilizing of support	7.75	2.01	3	12	0.07	-0.4
Total score	43.23	7.06	21	62	-0.23	0.11

Note: \bar{x} : mean score
SD: standard deviation

To test age effects, we compared the ACE model with the ACES model where the additional quantitative age effect was included (Neale, 1999). To test the sex effect, we compared the model permitting different estimates for males and females with the model assuming a null sex effect (in this comparison only, we included the 82 opposite-sex twin pairs).

Result

Table 1 and Table 2 present descriptive statistics for each dimension of social support. There was no significant difference between MZ and DZ twins in terms of mean scores for all dimensions of social support ($P > .05$, two-tailed Student's *t* test). Linear model analysis found that neither age nor sex was a significant factor for all other dimensions of social support, except for utilization of support (data not shown). Thus, age and sex-adjusted covariance matrices were also used for genetic analysis of utilization of support.

Table 3 shows intrapair correlations for MZ and DZ twins. All correlations were significant or highly significant ($P < .05$ or $.01$, two-tailed test). For objective support, the intrapair correlations were similar for MZ and DZ twins (.38 vs. .37), suggesting the presence of shared environmental effects, but lack of genetic effects. For the other two dimensions, the intrapair correlation between MZ twins was higher than between DZ twins, implicating probable genetic effects for the two social support traits.

We tested whether the variance parameters for utilization of support are gender specific by comparing the model permitting difference values in males and females with the model assuming equal values for

both gender groups. The chi-square test did not reveal significant differences between the two models ($\chi^2 = 3.84$, $df = 3$, $p < .05$). Thus, we chose the latter model. Comparing the ACE (without age effect) model and ACES model for utilization of support, a Chi-square test did not reveal significant differences between the two models ($\chi^2 = 1.08$, $df = 4$, p value $< .05$). The ACE model best fitted the data.

Univariate twin analyses were used to estimate genetic and environmental influences for each of the three measures separately. Table 4 gives the fit statistics, variance estimates and their 95% CI for three genetic models. For objective support, compared to the full ACE model, the CE model gave a perfect fit ($\chi^2 = 0.00$, $df = 1$, $p = 1.00$). This result suggests that genetic factors may explain little of the phenotypic variation of objective support. For the other two dimensions of social support, AE and CE models gave a similar fit. Dropping from the full ACE model, neither A nor C brought a significantly increased chi-square ($df = 1$). This result might imply that the origins (additive genetic and common environmental) of familial effects were present, but were not well distinguished. Therefore, the ACE model gave acceptable fit to the data and significant familial effects were estimated. For objective support, genetic effects did not exist, but common environmental effects explained 37.56% (95% CI = 26.17%–48.28%) of the total phenotypic variances. Familial factors explained 56.63% (95% CI = 45.48%–65.72%) and 42.42% (95% CI = 29.93%–53.25%) of the total phenotypic variances of subjective support and utilization of support, respectively.

Table 2
Means and Standard Deviations of Three Social Support Measures by Zygosity and Sex

Measure	Monozygotic twins				Dizygotic twins					
	Male–Male (<i>N</i> = 140 sibs)		Female–Female (<i>N</i> = 200 sibs)		Female–Female (<i>N</i> = 56 sibs)		Female–Female (<i>N</i> = 88 sibs)		Male–Female (<i>N</i> = 164 sibs)	
	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>	\bar{x}	<i>SD</i>
Objective support	9.51	3.26	9.74	3.18	10.16	2.97	9.61	3.04	9.56	3.02
Subjective support	26.06	4.49	25.80	4.41	24.46	5.17	26.98	4.27	25.48	4.14
Utilizing of support	7.47	1.94	8.18	2.08	7.21	1.86	7.80	1.88	7.62	2.03

Note: \bar{x} : mean scores
SD: standard deviation

Table 3
Intrapair Correlation Coefficients of Twins for Each Dimension of Social Support

Measures	Intrapair correlation			
	MZ (170 pairs)	P value	DZ (72 pairs)	P value
Objective support	.38	< .01	.37	< .01
Subjective support	.55	< .01	.44	< .01
Utilizing of support	.44	< .01	.26	.03
Utilizing support adjusted ^a	.41	< .01	.24	.03

Note: ^a residuals after removing out the effects of gender and age

Discussion

The current study was the first large-scale attempt to genetically dissect psychological characteristics within the Chinese population. The results showed that variation in subjective support and variation in utilization of support were influenced by familial factors as measured by a Chinese social support questionnaire. With the exception of objective support, genetic factors are likely to influence variation in subjective support and utilization of support. Shared environmental factors may influence all dimensions of social support.

Previous studies have found some evidence of significant genetic and shared environmental effects on social support. Kessler et al. (1992) found significant genetic effects on five of the eight measures (i.e. perceived spouse support, perceived relative support, perceived friend support, confidant, frequency of

interaction with relatives, frequency of interaction with friends, frequency of church attendance, and frequency of club attendance) with heritability estimates ranging from 28% to 52%. The variance decompositions of significant common environmental effects on the five measures ranged from 18% to 44%. Bergeman et al. (1990) reported that genetic effects accounted for 30% of the total variance of perceived adequacy of the social support network among 424 Swedish twin pairs, but heritability accounted for little of the quantity of social relationships.

Common environmental effects accounted for 0 and 37% of the total phenotypic variances of perceived support and quantity of relationships, respectively. Kendler et al. (1997) examined genetic and environmental effects on six dimensions of social support (friend support, relative support, friend problem, relative problem, confidant, and social integration) in a population-based study of 854 female twins (mean age of 34.6 years, and ranging from 22 to 59 years), and found the six dimensions were moderately stable overtime, with heritability estimates ranging from 43% to 75%. However, common environmental factors contributed to twin resemblance only for relative problems and relative support. Raynor et al. (2002) reported a significant dominant genetic effect, in addition to additive effects (59%), on perceived support. Thus, it appears likely that genetic and shared environment play a major role in the variation of social support.

We sought to examine gender differences in utilization of support by studying MZ same sex and DZ

Table 4
Variance Estimates, 95% Confidence Intervals, and Model Fit Statistics for Three Dimensions of Social Support

Trait	Model	Variance component (%)				Model fit			
		Genetic	Shared environment	Nonshared environment	Familial	χ^2	df	P	AIC
Objective support	ACE	0.00 [0.00, 43.71]	37.55 [0.00, 47.85]	62.45 [51.42, 73.83]	—	4.80	3	.19	-1.21
	CE	—	37.55 [26.17, 47.89]	62.45 [52.11, 73.83]	37.55 [26.17, 47.89]	4.80	4	.31	-3.21
Subjective Support	ACE	30.07 [0.00, 64.06]	26.55 [0.00, 56.48]	43.38 [34.28, 54.52]	56.63 [45.48, 65.72]	1.09	3	.78	-4.91
	AE	57.86 [47.60, 66.40]	—	42.14 [33.60, 52.40]	—	2.99	4	.56	-5.01
	CE	—	51.59 [41.69, 60.28]	48.41 [39.72, 58.31]	—	3.79	4	.44	-4.21
Utilizing support	ACE	27.57 [00.00, 53.12]	14.85 [00.00, 47.50]	57.58 [46.75, 70.07]	42.42 [29.93, 53.25]	2.53	3	.47	-3.47
	AE	43.08 [31.10, 53.59]	—	56.92 [46.41, 68.90]	—	2.89	4	.58	-5.11
	CE	—	39.10 [27.86, 49.28]	60.90 [50.72, 72.14]	—	3.81	4	.43	-4.19

Note: χ^2 : Likelihood ratio chi-square test
df: degrees of freedom
P: p value
AIC: Akaike's Information Criterion.

same and opposite sex twins. Although women had higher mean levels for utilization of support, we found no evidence to suggest qualitative gender differences. Genetic factors influencing social support are not different between sexes. The previous literature on sex differences in social support is inconsistent, oscillating between no sex differences to greater support in women (Coventry, 2004; Agrawal, 2002).

Our study did not find any significant genetic influence on any dimension of social support. The different conclusions of researchers may be caused by differences in race, national culture, sample size, questionnaire, statistical method, and so on. The current research did not observe age effects on any dimension of social support. This finding adds to limited research that suggests social support is a moderately stable trait (Bergeman et al., 2001).

To the best of our knowledge, the present study is the first report to provide evidence of familial effects on social support in a Chinese sample. We appropriately ran the models separately for males and females, and then equated these parameters without a significant decrease in model fit. Joint male/female models were used thereafter. However, several important limitations of this study should be recognized. First, our sample is a convenient volunteer twin sample, and is not representative of the general population. Thus, our findings may not be generalized to the total Chinese population. Second, the present study lacked sufficient power to differentiate between genetic and shared environmental influences on social support. Third, the social support instrument used in this study was designed for a Chinese population. We did not examine the same dimensions as those reported in other studies, which makes it difficult to compare our findings with others.

Despite these limitations, the findings of this preliminary study may lay a foundation for future studies, and should help professionals develop appropriate support programs to prevent disease in China.

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APPENDIX A
Social Support Scale

1. How many intimate friends do you have to support and help you? (Choose only one response.)
 - (1) None (2) One or two (3) Three to five (4) Six or more
2. Whom have you lived with this year? (Choose only one response)
 - (1) Far from family and lived alone
 - (2) Moved around and lived with stranger most time
 - (3) Lived with classmates, colleagues and friends.
 - (4) Lived with your family members
3. How is the relationship between you and your neighbors? (Choose only one response)
 - (1) A nodding acquaintance and no cares about each other
 - (2) May care a little when you were in trouble
 - (3) Some neighbors care about you
 - (4) Most neighbors care about you
4. How is the relationship between you and your colleagues? (Choose only one response)
 - (1) A nodding acquaintance and no care about each other
 - (2) May care a little when you were in trouble
 - (3) Some colleagues care about you
 - (4) Most colleagues care about you
5. How much do the following kinfolk support and care for you?
 - (1) Spouse (Lover)
 - (a) Not at all (b) A little (c) Quite a bit (d) A lot
 - (2) Parents
 - (a) Not at all (b) A little (c) Quite a bit (d) A lot
 - (3) Children
 - (a) Not at all (b) A little (c) Quite a bit (d) A lot
 - (4) Brothers and sisters
 - (a) Not at all (b) A little (c) Quite a bit (d) A lot
 - (5) Others (Such as sister-in-law)
 - (a) Not at all (b) A little (c) Quite a bit (d) A lot
6. When you are in an extremely difficult situation, who can you count on to provide you with financial and instrumental aid?
 - (1) No-one
 - (2) Following sources (Note: you can choose more than one answer):
 - a. Spouse
 - b. Other nuclear family members (parents and siblings)
 - c. Other kinfolk
 - d. Neighbors
 - e. Colleagues
 - f. Unit in which you work
 - g. Official or semi-official organizations, such as political parties, trade unions and other organizations, and so on
 - h. Nongovernment organizations such as religious and public organizations, and so on.
 - i. others (please indicate).

continued over

APPENDIX A (CONTINUED)

Social Support Scale

7. When you are in an extremely difficult situation, who can you count on to provide you with emotional aid?
- (1) None.
 - (2) Following sources: (Note: you can choose more than one answer.)
 - a. Spouse
 - b. Other nuclear family members (parents and siblings)
 - c. Other kinfolk
 - d. Neighbors
 - e. Colleagues
 - f. Unit in which you work
 - g. An official or semi-official organization, such as political parties, trade unions and other organizations, and so on
 - h. Nongovernment organizations such as religious and public organizations, and so on
 - i. Others (please indicate).
8. How do you console yourself when you get in trouble? (Choose only one response.)
- (1) Never tell others
 - (2) Only tell one or two very close friends
 - (3) Tell friends when they ask
 - (4) Tell friends, family and organization(s) for help.
9. How do you seek help when you get in trouble? (Choose only one response.)
- (1) Only depend on myself, do not accept others' help
 - (2) Seldom seek help
 - (3) Seek help some times
 - (4) Often seek help from my friends, family and organization(s).
10. How often do you participate in activities organized by groups (such as political party or league organizations, religious organizations, trade unions, students' unions, etc.)? (Choose only one response.)
- (1) Never take part in
 - (2) Take part in occasionally
 - (3) Often take part in
 - (4) Take part in actively.