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ORIGINAL RESEARCH

Prevalence of bipolar spectrum disorder in Korean college students according to the K-MDQ

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Background: The purpose of this study was to assess the prevalence of bipolar spectrum disorder (BSD) in the general Korean population.

Methods: A sample of college students (n = 1026) was stratified to reflect geographical differences accurately in Korean college students. The Korean version of the Mood Disorder Questionnaire (K-MDQ) was administered and an epidemiological survey carried out between November 2006 and February 2007. BSD was defined as a score of at least seven K-MDQ symptoms that co-occurred and resulted in minimal or more functional impairment.

Results: The prevalence of BSD was 18.6% (95% confidence interval [CI] 16.2–21.0) in total, being 19.8% (95% CI 16.3–23.2) in men and 17.5% (95% CI 14.2–20.8) in women. The prevalence of BSD was more common in rural dwellers than in urban dwellers ($P = 0.008$, chi-square test). Univariate and multivariate regression models showed that rural residence was a significant factor associated with BSD. There were significant relationships between BSD and gender, age, and socioeconomic status.

Conclusion: The prevalence of BSD found in the present study is higher than that reported by other epidemiological studies in Korea and in international studies.

Keywords: general population, bipolar disorder, epidemiological study, Mood Disorder Questionnaire

Introduction

Recent international studies have reported that the lifetime prevalence of bipolar spectrum disorder (BSD) ranges from 2.4% to 6.4%.[1–3] However, few studies have investigated the prevalence of BSD in Korea. The prevalence of bipolar I disorder in Korea has been found to range from 0.16% to 0.44%,[4–6] which is significantly lower than that reported in Western countries.

People diagnosed with bipolar II disorder and bipolar disorder not otherwise specified suffer significant psychosocial disabilities.[7–9] The subsyndromal symptoms of hypomania have a negative impact on social functioning, ability to work, and quality of life.[10–12] Therefore, it is necessary to estimate the prevalence of BSD.

Diagnostic tools such as the *Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV, SCID)*[13] are useful for accurately diagnosing psychiatric disorders. However, these approaches are time-consuming and may be difficult to implement in clinical practice. In contrast, screening instruments with appropriate sensitivity and specificity, such as the Mood Disorder Questionnaire (MDQ) and the Bipolar Spectrum Diagnostic Scale, are easy to implement and can be used by untrained physicians, and so are widely used to detect BSD. The Korean version of the Mood Disorder Questionnaire (K-MDQ)[14] has been

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standardized, and its sensitivity and specificity for diagnosing bipolar disorder have been reported to be satisfactory.

The MDQ has much lower sensitivity and a lower positive predictive value when conducted in the general population.[15–17] To overcome these flaws, it is necessary to modify MDQ criterion 3. The broader definition of MDQ criterion 3 can improve the sensitivity of the MDQ by more than 30% and reduce its specificity by less than 10%.[16,18] Chung et al reported a sensitivity of 0.50 and a specificity of 0.90 in the general population when reducing impairment threshold to minimal functional impairment.[16] Therefore, we defined MDQ positivity as a score of at least seven MDQ symptoms that co-occurred and resulted in minimal or more functional impairment. The aim of the present study was to estimate the prevalence of BSD using the K-MDQ in Korean college students, who are at the typical age for onset of bipolar disorder.

Materials and methods

Sampling

We used stratified cluster sampling based on the regional distribution of college students published by the National Bureau of Statistics. The students were selected by region, gender, and academic year from four regions (Seoul metropolitan area, Chungcheong region, Gyeongsang region, and Honam region). The study included 1026 students, 511 of whom were male and 515 of whom were female.

Survey

We selected 10 research assistants to assist 10 researchers across the country. The researchers met twice to standardize the K-MDQ screening test. The researchers then conducted two 30-minute sessions to train the research assistants to administer the K-MDQ surveys using the manual to ensure that the research assistants fully understood the study. We selected 10 universities for inclusion based on data collected by the National Bureau of Statistics in 2005 to ensure that the sample accurately reflected geographical differences in the Korean population. Given the seasonal variation in mood disorders, our study was conducted during the winter season. The institutional review board approved the study protocol.

Investigation tools

Psychosocial demographics

Demographic data on gender, age, academic year, household socioeconomic status, and setting were collected using multiple-choice questions.

Korean version of the MDQ

The MDQ[15,19] consists of three parts, including 13 questions to assess the presence of symptoms and behaviors related to mania or hypomania (criterion 1), a question to determine whether two or more symptoms have been experienced at the same time (criterion 2), and a question to determine the extent to which symptoms have caused functional impairment on a scale ranging from "no problems" to "serious problems" (criterion 3).

Hirschfeld et al[19] defined MDQ positivity as a score of at least seven for symptoms that co-occurred and resulted in moderate or severe functional impairment. However, some authors have suggested that the impairment threshold be modified or eliminated in order to improve the sensitivity of the MDQ.[20–22] Therefore, in this study, we broadened the threshold for functional impairment to include minimal or more functional impairment.

Data analysis

We estimated the prevalence of BSD according to sociodemographic variables. Chi-square tests were used to compare the prevalence of BSD according to each variable. Given that elimination or modification of MDQ criterion 3 would improve the sensitivity and specificity of this instrument for detecting BSD,[20–22] we also analyzed cases that met criteria 1 and 2 of the MDQ. To identify the factors associated with BSD, we performed a multiple logistic regression analysis using sociodemographic factors as independent variables and BSD as dependent variables. The Statistical Package for the Social Sciences for Windows version 12 (SPSS, Inc, Chicago, IL, USA) was used to perform the statistical tests, and P values < 0.05 were deemed to be statistically significant.

Results

Demographic characteristics

Of the 1026 subjects who participated in the survey, 511 were men (49.8%) and 515 (50.2%) were women; 315 were freshmen (30.7%), 356 were sophomores (34.8%), 250 were juniors (24.4%), and 103 were seniors (10.1%). More than half (59.2%) of the participants were considered to be middle class, and 69.1% lived in an urban area (Table 1).

Prevalence of BSD according to sociodemographics

The prevalence of BSD in men, women, and the total sample was 19.8% (95% confidence interval [CI] 16.3–23.2), 17.5% (95% CI 14.2–20.8), and 18.6%

Table 1 Sociodemographic characteristics of the study population

Variable	Total (n = 1026)
	n (%)
Gender	
Male	511 (49.8)
Female	515 (50.2)
Academic year	
Freshman	315 (30.7)
Sophomore	356 (34.8)
Junior	250 (24.4)
Senior	103 (10.1)
Household SES	
High	147 (15.3)
Middle	568 (59.2)
Low	247 (25.5)
Setting	
Urban	705 (69.1)
Rural	315 (30.9)

Abbreviation: SES, socioeconomic status.

(95% CI 16.2–21.0), respectively. The prevalence of BSD was higher in the rural setting than in urban areas ($P = 0.008$, chi-square test). However, no statistically significant differences were found according to gender, academic year, or household socioeconomic status (Table 2).

Factors associated with BSD in univariate regression

We estimated the odds ratios and 95% CI to identify factors associated with BSD using univariate logistic regression.

Table 2 Prevalence of bipolar spectrum disorder according to sociodemographic characteristics

	Total			*P* value*
	n	%	95% CI	
Gender				NS
Male	101	19.8	16.3–23.2	
Female	90	17.5	14.2–20.8	
Academic year				NS
Freshman	55	17.4	13.3–21.7	
Sophomore	67	18.8	14.8–22.9	
Junior	48	19.2	14.3–24.1	
Senior	20	19.4	11.8–27.1	
Household SES				NS
High	21	14.3	8.6–19.9	
Middle	105	18.5	15.3–21.7	
Low	48	19.4	14.5–24.4	
Setting				0.008
Urban	117	16.6	13.8–19.3	
Rural	74	23.5	18.8–28.2	
Total	191	18.6	16.2–21.0	

Note: *Chi-square test was applied.
Abbreviations: NS, not significant; CI, confidence interval; SES, socioeconomic status.

In the MDQ-positive cases, a rural setting was associated with a relatively higher risk for BSD than the urban setting (adjusted odds ratio 1.57, 95% CI 1.12–2.20, $P < 0.05$). This result was the same in the cases that satisfied criteria 1 and 2 of the MDQ (Table 3).

Factors associated with BSD in multiple logistic regression

When BSD was the dependent variable, the rural setting was positively associated with BSD (odds ratio 1.52, 95% CI 1.08–2.15, $P < 0.05$). When cases satisfying criteria 1 and 2 of the MDQ was the dependent variable, the result was the same, albeit not statistically significant (odds ratio 1.32, 95% CI 0.99–1.76, $P = 0.06$; Table 4).

Discussion

In this study, the prevalence of BSD in college students was 18.6%. Other research using the MDQ in college students revealed a prevalence of 4% in freshmen at Oxford University in the United Kingdom and a prevalence of 1.7% in freshmen at Stanford University in the United States.[23] However, this difference was not meaningful because our results were obtained using a broadened definition of MDQ criterion 3 to overcome the lower sensitivity of MDQ in the general population. If a Hirschfeld cutoff of MDQ was applied to our study, the 2.3% rate of MDQ positivity was similar to that in the two aforementioned studies. The rate of MDQ positivity applying a Hirschfeld's cutoff for MDQ in the general population has ranged from 2.0% to 17.7%.[16–18,24] However, it is not possible to compare our results directly with those from other nations because the definition of MDQ positivity was not uniform, although our result for the rate of MDQ positivity was higher than that in other reports.

The high rate of MDQ positivity in our study can be accounted for by the high rate of positive responses to symptom items on the MDQ, which ranged from 11.9% to 76.2%. The rate of positive responses to symptom items on the MDQ in the general population has been reported to range from 7.1% to 55.6%.[15,16,24] Hirschfeld et al and Chung et al reported that the rate of MDQ positivity was 3.7% and 4.4%, respectively, and the rate of positive responses to symptom items on the MDQ ranged from 7.3% to 36.0% and from 7.1% to 37.2%, respectively.[15,16] Similar to our results, Mangelli et al found that rates of MDQ positivity and positive responses to symptom items on the MDQ were 17.7% and ranged from 17.5% to 55.6%, respectively.[24] The Cronbach's alpha coefficient of the K-MDQ items

Table 3 Factors associated with bipolar spectrum disorder in univariate logistic regression

	MDQ criteria 1 + 2				MDQ positive			
	C-OR*	95% CI*	A-OR*	95% CI*	C-OR*	95% CI*	A-OR*	95% CI*
Gender								
Male	1.00				1.00			
Female	0.75	0.54–1.03			0.86	0.63–1.18		
Academic year								
Freshman	1.00		1.00		1.00		1.00	
Sophomore	0.74	0.46–1.18	0.77	0.39–1.51	0.88	0.50–1.55	0.76	0.34–1.73
Junior	0.76	0.48–1.20	0.94	0.54–1.63	0.96	0.55–1.68	1.21	0.61–2.38
Senior	1.08	0.67–1.73	1.32	0.78–2.25	0.99	0.55–1.76	1.30	0.68–2.49
Household SES								
High	1.00		1.00		1.00		1.00	
Middle	0.66	0.35–1.25	0.66	0.35–1.26	0.51	0.24–1.08	0.49	0.23–1.05
Low	0.79	0.45–1.37	0.74	0.42–1.30	0.70	0.37–1.29	0.66	0.35–1.23
Setting								
Urban	1.00		1.00		1.00		1.00	
Rural	1.37*	1.04–1.81	1.38*	1.04–1.83	1.56*	1.12–2.16	1.57*	1.12–2.20

Note: *$P < 0.05$ is considered statistically significant.
Abbreviations: MDQ, Mood Disorder Questionnaire; MDQ positive, as a score ≥7 K-MDQ symptoms that co-occurred and resulted in a minimal or more functional impairment; C-OR, crude odds ratio; A-OR, adjusted odds ratio (adjusted by gender and age); CI, confidence interval; SES, socioeconomic status.

in our study was good at 0.75. Therefore, the difference in the rates of positive response to symptom items on the MDQ obtained in our study versus that in others may have resulted from cultural differences and in the sample used. For instance, subjects in our sample were younger than those in other studies. Younger adults gave more frequent responses to symptom items on the MDQ.[15,16,25] The rate of positive responses to symptom items on the MDQ in high-school students was as high as our results, also.[26] Miller et al[27] reported that false-positive MDQ screening was associated with substance abuse. The high prevalence of substance abuse[28,29] among Koreans may be a reason for the high rate of MDQ positivity in this study.

We conducted a logistic regression analysis to examine the relationship between BSD or cases that met criteria 1 and 2 of the MDQ and socioeconomic variables. A rural setting was positively related to BSD and cases that met criteria 1 and 2 of the MDQ, but no significant relationship was evident between BSD and gender, age, or economic status. There is no gender difference in the prevalence of bipolar disorder,[30,31] but the relationship between BSD and urban or rural setting is unclear.[32–35]

Table 4 Factors associated with bipolar spectrum disorder in multivariate logistic regression

	MDQ criteria 1 + 2			MDQ positivity		
	OR*	95% CI*	Significance*	OR	95% CI	Significance*
Gender						
Male	1.00			1.00		
Female	0.77	0.56–1.07	NS	0.88	0.60–1.30	NS
Academic year						
Freshman	1.00			1.00		
Sophomore	0.80	0.40–1.56	NS	0.79	0.34–1.81	NS
Junior	0.92	0.53–1.61	NS	1.23	0.62–2.43	NS
Senior	1.33	0.78–2.26	NS	1.34	0.70–2.59	NS
Household SES						
High	1.00			1.00		
Middle	0.65	0.34–1.24	NS	0.50	0.23–1.06	NS
Low	0.71	0.40–1.24	NS	0.62	0.33–1.18	NS
Setting						
Urban	1.00			1.00		
Rural	1.32	0.99–1.76	0.06	1.52	1.08–2.15	0.02*

Note: *$P < 0.05$ considered statistically significant.
Abbreviations: MDQ, Mood Disorder Questionnaire; MDQ positivity, score of ≥7 K-MDQ symptoms that co-occurred and resulted in a minimal or more functional impairment; OR, odds ratio; CI, confidence interval; NS, not significant; SES, socioeconomic status.

The MDQ has been administered in various settings and using different criteria to detect bipolar disorder, but some considerations should be given to proper screening in the general population. In the general population, the sensitivity and positive predictive value of the MDQ has been reported to be only 25% and 50%, respectively.[15–18] However, when reducing the impairment threshold to minimal functional impairment, the MDQ may be a possible tool to screen for BSD in the general population, because the sensitivity increases up to 50% while the specificity still exceeds 90%.[16] Therefore, the MDQ can be a useful and high specificity tool for ruling out BSD, and may be a helpful tool for screening for BSD when reducing impairment threshold to minimal functional impairment. The best method for diagnosing BSD in the general population is screening, first ruling out the disorder using the MDQ and then applying confirmatory tools, such as SCID, to improve the diagnostic accuracy.

The present study has some limitations. First, the sample size was relatively small. Second, we did not confirm BSD using diagnostic tools such as SCID, so we could not calculate the sensitivity and specificity of the K-MDQ among college students. Third, the present study did not distinguish among the subtypes of bipolar disorder. Given that the epidemiological characteristics and sensitivity of tools differ according to subtype,[31,36] it is reasonable to make comparisons with each case divided into subtype. Fourth, because the samples did not represent all age groups, some results such as the rate of positive responses to symptom items on the MDQ showed differences when compared with other community studies. However, the present study is the first to estimate the prevalence of BSD in Korean college students and to identify variables associated with BSD.

Conclusion

The prevalence of BSD found in the present study was higher than that reported by other Korean epidemiological studies and international studies. Univariate and multiple logistic regression showed that rural setting was a significant factor associated with BSD. Although there were some shortcomings for screening BSD using the MDQ in the general population, such as college students, the MDQ can be a useful option to find BSD when using a modified threshold of the MDQ criterion.

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Disclosure

The authors report no conflicts of interest in this work.

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