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Risk Factors of Suicide Ideation in Chinese Graduate Students: CHAID Tree Analysis

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Abstract

The present study aims to identify the risk factors and develop a decision tree model of suicide ideation in Chinese graduate students. A chi-square automatic interaction detection tree analysis was conducted in a graduate students sample (*N*=1036). Measurements included University Personality Inventory (UPI), Symptom Checklist 90 (SCL-90), and Eysenck Personality Questionnaire (EPQ). Results showed that suicide incidence of Chinese graduate students was 1.15%, with males' was higher than females. Seventeen potential variables were considered and only three of them (depression, obsession, and neuroticism) were found to be risk factors of suicide ideation in Chinese graduate students, and the interactions between them constructed a decision tree model. These findings should be helpful for school and mental health providers to detect graduate students with a high possibility of suicide ideation, which will aid in planning of early suicide intervention and prevention for at risk students.

Key words: Suicide ideation; Decision tree; Graduate students

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INTRODUCTION

In China, suicide has become the first leading cause of death for people aged 15-34 (Fang & Zhang, 2012) {Fang, 2012 #1}{Fang, 2012 #1}, and the rate of suicide completion has been continued to grow in recent years (Bertolote & Fleischmann, 2002). Graduate students have increasingly been recognized as a population with high risk to attempt suicide (Li, 2009), because of their greater economic, academic, and interpersonal pressure. Considering that suicide has long-lasting effects on the family members and friends left behind, it is desirable to build a concrete standard to identify students with high risk to commit suicide.

Suicide ideation is defined as "thinking about or an unusual preoccupation with suicide", and the range of suicide ideation varies greatly from fleeting thoughts to incomplete attempts (Wilcox et al., 2010). Since suicide ideation is the first phase of suicide completion, it is prospective to identify risk factor of suicide ideation in order to conduct early suicide prevention. Among risk factors, mental health status and depression severity have been found to be related to suicide ideation in Chinese graduate students (Li, 2009). In addition, it has been reported that people with high neuroticism often reported having a high risk to have suicide ideation (Mandelli et al., 2015). Yet the effect has not been examined in Chinese graduate students.

Since suicide ideation is not the result of the action of single factor but of the interaction of various factors (Mościcki, 2001), the investigation of interactions associated with suicide ideation is a fundamental step toward identifying at risk populations, which will allow for early prevention. However, the majority of existing studies that identify risk factors and protective factors of suicide ideation were analyzed by applying logistic regression, which is unable to avoid the multiple co-linearity between predictors, and to examine the interactions between predictors as well (Conklin, 1989).

Chi-square automatic interaction detection (CHAID) is a decision tree technique, which can be used for prediction as well as classification, and detection of interaction between variables (Franses, 2006). The CHAID is an iterative process that starts the tree development by examining all predictors and then selecting the best predictors that predicts the desired classification. Like other decision trees, the advantages of CHAID are that its output is highly visual and easy to interpret. Because it uses multi-way splits by default, it needs rather large sample sizes to work effectively.

Therefore, the present study aimed to establish a decision tree model of suicide ideation in Chinese graduate students by applying CHAID tree analysis, in order to develop a series of reliable decision rules that can be used to detect graduate students with suicide ideation.

1. METHOD

1.1 Participants

A total of 1211 graduate students were selected by cluster sampling. All of the students participated in the general survey of mental health for college freshmen, with 1,036 of them were considered as valid. Of the reaming sample, 313 (30.21%) were males and 723 (69.79%) were females. All participants range in age from 22 to 35, while the mean age was 23.10.

1.2 Measurements

1.2.1 Dependent Variable: Suicide Ideation

Suicide ideation was assessed by the University personality inventory (UPI), which was developed by psychological counselors and psychiatrists of Japan University (Kajita et al., 2002). The UPI is widely used in the mental health survey for college freshmen in China. This inventory consists of two parts: The first part includes the first 60 items which indicate several aspects of mental health status, and the second part includes several open questions to explore details of the problems they perceived. Participants response to the item 25 (i.e. Have you had suicide ideations?) was considered as the dependent variable.

1.2.2 Independent Variables: General Mental Health Status, Mental and Physical Symptoms and Personality Traits

General mental health status was calculated by summing the total score of the first part of the UPI, where the higher the score, the lower the mental health levels. Internal consistency of the current data was 0.908.

Mental and physical symptoms were assessed by Symptom checklist 90 (SCL-90), which is a self report psychometric inventory and now is one of the most widely used inventory of psychological distress in clinical practice and research (Derogatis, Lipman, & Covi, 1973). The SCL-90 consists of 90 items and ten categories of psychological problems and symptoms of psychopathology: somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and a category of "additional items" that focus on sleep and diet. Internal consistency of the current data was 0.975, and the internal consistency of the subscales was range from 0.86 to 0.95.

Personality traits were assessed by Eysenck personality questionnaire (EPQ), which is a self report inventory to assess the personality traits (Eysenck & Eysenck, 1975). The EPQ includes 85 items and four factors: extraversion, psychoticism, neuroticism, and lie. Internal consistency of the current data was 0.824, and the internal consistency of the subscales was range from 0.74 to 0.79.

1.3 Data Analysis

The current study used the SPSS 17.0 to conduct data analysis. Descriptive analysis was applied to evaluate the incidence of suicide ideation. One way ANOVA was used to test the significant difference between general mental health status, physical and mental symptoms, and personality traits of participants with or without suicide ideation. CHAID tree analysis was conducted to examine the best predictors and the interactions between them of suicide ideation. Binary logistic regression was applied to confirm the discriminating factors of CHAID tree analysis, and possible predictors that were not identified in the CHAID analysis. A 2-tailed P value of less than 0.05 was considered as statistically significant.

2. RESULTS

Of all the 1,036 participants, 12 (1.15%) students reported having had suicide ideation. And the rate of suicide ideation in males (1.9%) was higher than females (0.8%). Results of one way ANOVA are shown in Table 1. Participants with suicide ideation reported significantly lower level of mental health status (P<0.001), higher level of ten physical and mental symptoms P<0.001, and higher level of three factors of personality traits (psychoticism, neuroticism, lie) (P<0.01) than those without suicide ideation.

Results of CHAID analysis for suicide ideation are illustrated in Figure 1. Depression was the primary risk factor predicting suicide ideation in Chinese graduate students (Chi-square: 43.432, P<0.001). The rate of suicide ideation was 7.3% (n=8) in the high depression group (>1.769), 1.4% (n=4) in the medium depression group (1.308-1.768), and none in the low depression group (≦1.308). The rate of suicide ideation in the medium depression group was different according to obsessive-compulsive level (Chi-square:18.299, P<0.001). Of medium depressed students with high obsessive-compulsive (>1.3), 0.7% (n=2) showed a suicide ideation, while 14.3% (n=2) of medium depressed students with

low obsessive-compulsive (≦1.3) showed a suicide ideation. For participants with medium depression and high obsessive-compulsive, the rate of suicide ideation was different according to neuroticism (Chi-square:13.230, P<0.01): 5.4% (n=2) of them with high neuroticism (>16) showed a suicide ideation and none showed a suicide ideation in the low neuroticism group (≦16).

Table 1
Results of ANOVA test

	Suicide ideation		*F*	*P*
	Yes (*n*=12)	No (*n*=1024)		
Mental health	33.16+15.15	13.54+9.16	53.366	.000
Extraversion	12.41+4.12	12.56+3.75	.019	.890
Neuroticism	17.42+5.66	8.45+5.24	34.608	.000
Psychoticism	11.25+3.19	8.37+2.15	20.796	.000
Lie	10.91+3.42	8.39+2.72	10.051	.002
Somatization	1.60+0.55	1.23+0.27	20.963	.000
Obsessive & Compulsive	2.20+1.02	1.63+0.41	20.304	.000
Interpersonal sensitivity	2.11+0.89	1.47+0.42	26.057	.000
Depression	2.25+0.89	1.34+0.36	71.413	.000
Anxiety	2.00+0.94	1.38+0.35	34.434	.000
Hostility	1.88+0.96	1.28+0.33	36.882	.000
Phobic anxiety	1.69+0.78	1.21+0.27	34.542	.000
Paranoid ideation	1.97+0.99	1.30+0.32	46.039	.000
Psychoticism	1.95+0.85	1.29+0.30	53.191	.000
Additional	2.00+0.77	1.35+0.35	39.589	.000

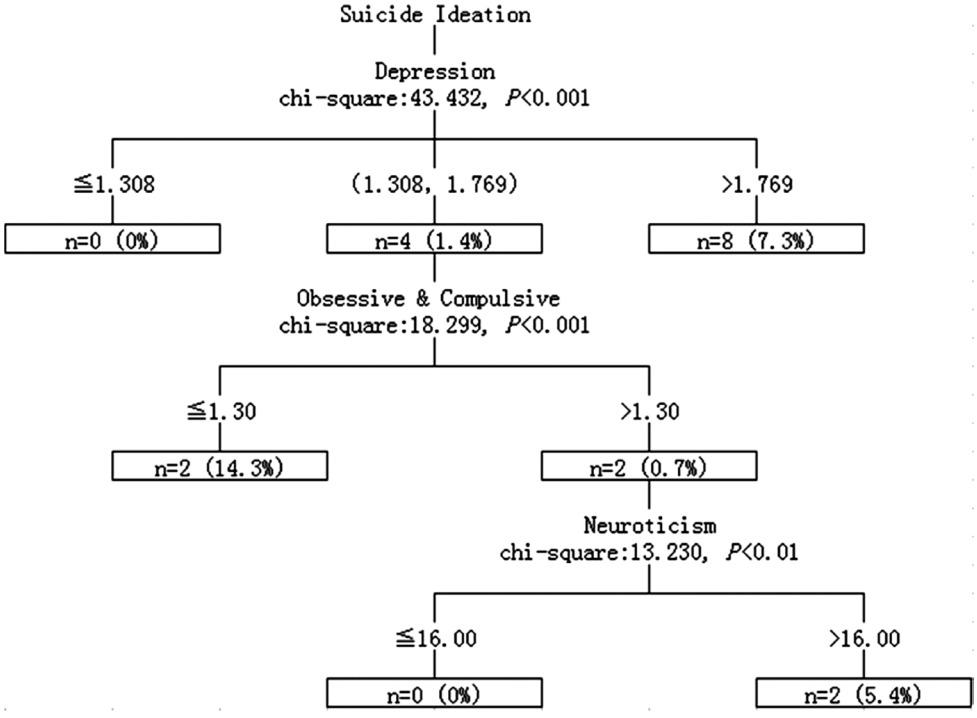

Figure 1
Decision Tree Model of Suicide Ideation in Chinese Graduate Students

Results of logistic regression analysis on the prediction of suicide ideation are shown in Table 2. Graduate students who have high neuroticism, high depression, and high Obsessive & Compulsive were more likely to have suicide ideation, which confirmed the findings of CHAID analysis. In addition, logistic regression analysis also found that mental health, psychoticism, lie, somatization, obsessive-compulsive,

interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and "additional items" had small effect on suicide ideation in Chinese graduate students.

Table 2
Results of Logistic Regression

	B	*SE*	Wals	*df*	*P*	Exp(B)
Mental health status	0.136	0.025	30.128	1	.000	1.145
Extraversion	-0.011	0.076	0.019	1	.89	0.989
Neuroticism	0.291	0.062	22.047	1	.000	1.337
Psychoticism	0.462	0.105	19.178	1	.000	1.587
Lie	0.297	0.098	9.244	1	.002	1.345
Somatization	2.543	0.636	15.981	1	.000	12.712
Obsessive & Compulsive	1.652	0.415	15.842	1	.000	5.218
Interpersonal sensitivity	1.835	0.412	19.857	1	.000	6.263
Depression	2.359	0.432	31.045	1	.000	10.585
Anxiety	2.047	0.457	20.438	1	.000	7.741
Hostility	2.037	0.433	22.173	1	.000	7.667
Phobic anxiety	2.592	0.592	19.186	1	.000	13.36
Paranoid ideation	2.234	0.487	21.072	1	.000	9.339
Psychoticism	2.542	0.506	25.201	1	.000	12.699
Additional	2.426	0.498	23.767	1	.000	11.31
Gender	0.848	0.581	2.129	1	.145	2.336
Age	0.062	0.178	.122	1	.727	1.064

DISCUSSION

The present study attempted to develop a decision tree model for the prediction of suicide ideation in Chinese graduate students by examining every possible interaction between general mental health status, mental and physical symptoms and personality traits.

Suicide ideation is the basis of suicide completion. Although it has been reported that the majority of suicide ideation has not turn to suicide attempt, studies have found that people with suicide ideation always had lower mental health status (Bromet et al., 2007). Results of the present study confirmed previous findings and further found that students with suicide ideation also had a high level of psychoticism, neuroticism, and lie.

In this study, approximately 1.15% out of a total of 1036 students reported that they had had suicide ideation, while the rate of suicide ideation was higher for males than females, which was consistent with previous findings (Ibrahim et al., 2017). This implies males may be under greater pressure and more stressful life events.

Depression has always been recognized as one of the primary risk factors predicting suicide in college students (Garlow et al., 2008). It has been reported that the majority of people reported having suicide ideation had depression symptoms (Rotenstein et al., 2016). For children and adolescents that have attempted to suicide, approximately 70% of them reported having medium depression severity and above (Pelkonen et al., 2000). This result indicates the important role of depression in the suicide prevention and intervention.

Moreover, the present study found the interaction of depression, obsessive-compulsive, and neuroticism played a more significant role in the prediction of suicide ideation than the independent effect of depression itself. Results of the current study suggested different approaches of different severity of depression are needed in order to prevent suicide ideation. Furthermore, special attention should be paid to graduate students with the medium depression and low obsessive-compulsive, and those with high depression.

In this study, gender, age, general mental health status, extraversion, psychoticism, lie, and the other 9 mental and physical symptoms were excluded in the decision tree model, despite those variables having been considered to be important predictive factors in previous studies. This implies that these excluded variables may play a less significant role in interaction with other variables for prediction of suicide ideation in Chinese suicide ideation.

The main limitation of the present study was that only several variables from the general survey of mental health were included, which limited the effects of prediction for suicide ideation. The inclusion of other psychological or physiologic variables would be helpful to build a more concrete decision tree model of suicide ideation in Chinese graduate students.

Two aspects of implications for school mental health providers should be acknowledged. First, the general survey of mental health for college freshmen should be well utilized. In China, almost every college investigated their freshmen mental health in order to conduct early intervention and prevention. However, function of these surveys is always unsatisfactory due to two main reasons:

some colleges only used single inventory to examine the general mental health status of freshmen thus unable to investigate details of specific aspects of mental health; although several colleges used inventories to investigate both their freshmen mental health and personality traits, results of these inventories are not combined to screen at risk students. Second, longitudinally psychological help should be considered for at risk students. Empirical studies have found that only minority of at risk students would report having suicide ideation, while the most of them would hide their suicide thoughts in the survey. Therefore, students with high risk to have suicide ideation should receive more attention not only from school mental health provider but also the college counselors. Specifically, it is important to improve these students' ability to cope with stressful life events, and increase the availability of support from teachers and students. On the other hand, to increase the emotion-regulation ability would be an indirect way to reduce their neuroticism since personality trait is difficult to change.

CONCLUSION

This study examined interactions for prediction of suicide ideation in Chinese graduate students and compared their effects. In addition, the decision tree model from CHAID offers a series of reliable rules to clarify Chinese graduate students with high risk to have suicide ideation. These findings also appeared to be important for school suicide prevention and intervention.

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