• Original article •

Cross-sectional survey of prevalence and personality characteristics of college students with internet addiction in Wenzhou, China

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Background: Internet addiction can seriously affect the social functioning and studies of college students in China but measures for addressing this problem have not yet been developed or tested.

Objective: Assess the personality characteristics of college students with internet addiction.

Methods: Two self-report scales, the Tridimensional Personality Questionnaire (TPQ) and the Chen Internet Addiction Scale (CIAS), were administered to a stratified random sample of 697 college students from colleges and vocational schools in Wenzhou, China. The characteristics of 48 subjects who meet Chen's criteria for internet addiction (score of 64 or greater out of 100 on the CIAS) were compared to those of 649 subjects who did not meet criteria for internet addiction.

Results: The prevalence of internet addiction in the sample was 6.9% (95% CI=5.1-9.1%). Compared to students without internet addiction, those with internet addiction were more likely to be male, of Han ethnicity, to have a history of substance use (primarily tobacco and alcohol), and to be a student at a technical college. Students with internet addiction had higher mean (sd) scores on the novelty-seeking subscale of the TPQ [17.9 (1.2) v. 13.0 (1.6), t=16.75 p<0.001] and on the harm-avoidance subscale [17.2 (1.9) v. 14.6 (1.1), t=15.14, p<0.001] but lower scores on the reward-dependence subscale [14.6 (1.4) v. 18.3 (1.7), t=-7.64, p<0.001]. Logistic regression found that the most important independent predictors of internet addiction were Han ethnicity (OR= 5.52, 95% CI=2.00-15.32), male gender (4.40, 1.97-9.81), and substance use (1.08, 1.02-1.15). After adjustment for other variables personality measures were not significantly associated with internet addiction.

Conclusion: The prevalence of internet addiction among college students in Wenzhou is similar to that in other parts of China. Significant differences in the personality characteristics assessed by the TPQ between university students with and without internet addiction become non-significant after controlling for gender, ethnicity and substance use patterns.

1. Introduction

It is widely acknowledged that excessive internet use can be detrimental to learning, interpersonal relationships, economic status and occupational functioning. As the internet becomes increasingly accessible to the Chinese population, there is a growing concern about addiction to the internet. Reports of the prevalence of internet addiction among university students in China vary from 4.5 to 15.0%.[1-3]

Identification of personality traits that have been associated with 'addictive personality' —impulsiveness, novelty seeking, harm avoidance, psychoticism and social deviation—may be useful in the early identification and prevention of internet addiction.[4] Several different personality measures, including the Eysenck Personality Questionnaire and the Minnesota Multiphasic Personality Inventory, have been employed to assess the personality of college students with internet addiction in China.[5-7] One study in Taiwan[8] found that the Tridimensional Personality Questionnaire (TPQ) was able to predict internet addiction and alcohol abuse in adolescents. On the mainland the TPQ has been used in families with members who are alcohol dependent[9] but it has not, as yet, been used in the assessment of internet addiction.

The current study compares personality characteristics of university students in Wenzhou City with and without internet addiction using the TPQ.

2. Methods

2.1 Sample

Wenzhou is a relatively prosperous municipality with 9 million residents in Zhejiang Province on China's eastern seaboard. There are ten universities and colleges in the city that had a total of 70 230 undergraduate students in 2008. As shown in Figure 1, three universities or colleges of each type (key university, regular university, and technical college) were selected and then subjects were randomly selected from all undergraduates enrolled at each of these schools during November 2008 to January 2009. The questionnaires were administered by trained researchers in a classroom setting with about 40 students at each session. After describing the purpose of the study, the students were told that the questionnaire was anonymous, that their participation was voluntary and that they could withdraw at any time. The students were then asked to complete two self-completion instruments and a basic demographic questionnaire. On average it took students 35 minutes to complete the two instruments.

The study was approved by the Ethics Committee of the Wenzhou Min Kang Hospital.

2.2 The Tridimensional Personality Questionnaire

The Tridimensional Personality Questionnaire (TPQ) developed by Cloninger is based on his biosocial theory of personality. According to Cloninger, there are three independent dimensions of personality associated with different neurotransmitter systems: novelty-seeking (NS) (dopamine), harm-avoidance (HA) (5-hydroxytryptamine), and reward dependence (RD) (noradrenaline).[10-12] This tridimensional theory of personality describes personality characteristics at the psychological and behavioral levels, identifies different neurotransmitter systems for each personality type, and posits that the three dimensions are associated with different susceptibility genes. The tridimensional personality model can be used to assess the correlation between behavioral traits and environmental stimuli so it may be useful in the prediction of addictive behavior.

The TPQ is commonly used in studies about the personality characteristics of different populations. The Chinese translation of the questionnaire used in the current study has been shown to have good reliability and validity.[13,14] The questionnaire includes 100 true-or-false questions, which assess the three dimensions of personality (NS, HA, and RD). The component factors in each of the three dimensions and the internal consistency measures (i.e., alpha values) of the factors are shown in Table 1.

2.3 The Chen Internet Addiction Scale

The Chen Internet Addiction Scale (CIAS) developed by Chen and colleagues in Taiwan[16] assesses the core features of internet addiction. The 26 items in the scale (scored on a four-point Likert scale) are divided into five dimensions: compulsive use, withdrawal, tolerance,

Figure 1. Flowchart for the study
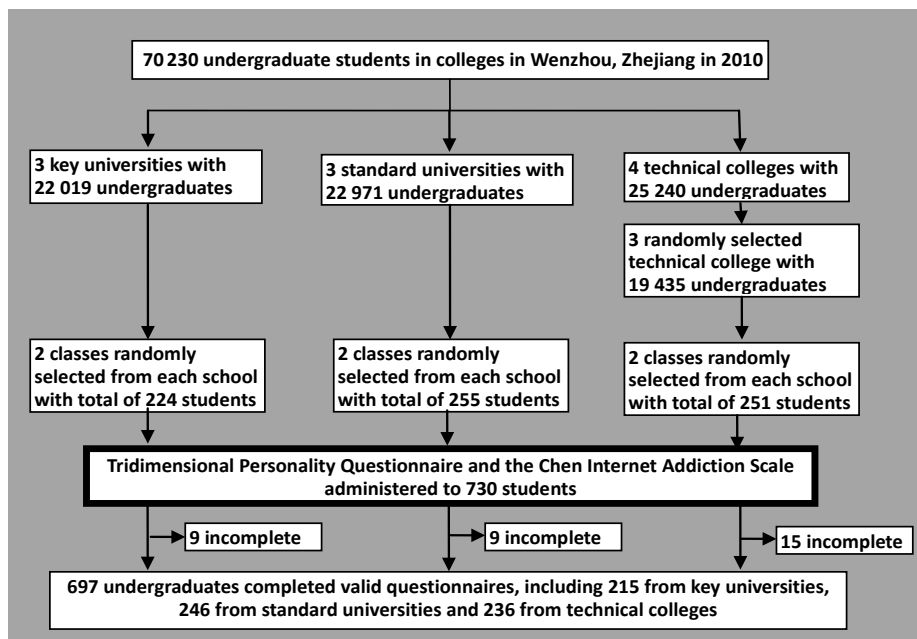
time-management problems, and interpersonal and health problems. The total score represents the severity of inappropriate internet use, with higher scores representing a more severe condition. As assessed in Taiwan,[16] the internal consistency of the total scale is excellent (alpha=0.93) and the two-week test-retest reliability is good (ICC=0.83). A study on the mainland with 933 subjects[17] also reported good internal consistency (alpha=0.94). As assessed in the current study the internal consistency (alpha) of the total CIAS score was 0.92 and internal consistency of the five dimension scores ranged from 0.75 to 0.87.

The diagnosis of 'internet addiction' employed in this study is that suggested by Chen.[16] Individuals who scored 64 or higher (out of 100) on the CIAS were considered suffering from internet addiction. This criteria for identifying persons with internet addiction has been employed in several other studies in Taiwan[17] and mainland China.[18]

2.4. Statistical analysis

All data were double-entered using Epidata 3.0 and analyzed using SPSS 15.0 software. Comparison of the demographic and personality characteristics of subjects with and without internet addiction used Chi-squared tests and t-tests. The relationship of personality and scores on the internet use scale was assessed using Pearson correlation coefficients. And the independent factors associated with the severity of internet use and the factors that predicted internet addiction were

assessed using linear and logistic regression models. There were no significant interaction effects between the variables included in the multiple regression and logistic regression analyses.

3. Results

730 students were selected and 697 (94.7%) validly completed the questionnaires, including 382 (54.8%) males and 315 (45.2%) females. The mean (sd) age of respondents was 19.9 (2.3) years and the range in ages was from 15 to 25. Among the respondents 623 (89.4%) were of Han ethnicity, 37 (5.3%) She ethnicity, 22 (3.1%) Hui ethnicity and 15 (2.1%) other ethnic groups.

3.1 Prevalence of Internet addiction among college students

The mean (sd) total CIAS score was 50.44 (11.08), the median was 50, the interquartile range was 42.0-57.5 and the full range was 30-94. Based on Chen's criteria for internet addiction (64 or higher total score in the CIAS); the prevalence of internet addiction in this sample was 6.9% (48/697)(95% CI=5.08-9.13%). Of these 48 individuals, 39 were males and 9 were females; they had a mean (sd) age of 18.7 (1.3) years, and all of them were of Han ethnicity. As shown in Table 2, compared to the 649 students who did not meet the internet addiction criteria, the 48 students with internet addiction were younger, more likely to be male, more likely to be of Han ethnicity, more likely to have used substances, and more likely to be students at technical colleges.

Table 1. Three dimensions and 12 factors in the Tridimensional Personality Questionnaire (TPQ)

Dimension	Dimension/ Factor	Number of items[a]	alpha value[b]	Description
Novelty-seeking (NS)	NS (total)	34	0.82	
	NS1	9	0.53	seeking novelty ••••• rigid
	NS2	8	0.65	impulsive
	NS3	7	0.78	unconventional•••••conservative in words and deeds
	NS4	10	0.59	unruly •••••follows the rules
Harm-avoidance (HA)	HA (total)	34	0.91	
	HA1	10	0.81	expected pessimism •••••unfettered optimism
	HA2	7	0.79	timid, hesitating
	HA3	7	0.83	shy
	HA4	10	0.80	fatiguability, low energy
Award-dependence (RD)	RD (total)	30	0.75	
	RD1	5	0.50	sentimental
	RD2	9	0.60	persevering
	RD3	11	0.81	over-attached
	RD4	5	0.49	dependent

[a]Based on previous research,[15] two items from the 100-item TPQ scale do not load on any of the factors so they are removed from the analysis.
[b]Based on the results from the data collected in the current study.

3.2 Comparison of TPQ scores between those who do and do not meet criteria for internet addiction

As shown in Table 3, there were significant differences in the personality profile of students with and without internet addiction. The total score for the novelty-seeking and harm-avoidance dimensions are significantly higher in the internet addiction group and the total score for the reward-dependence dimension is significantly lower.

3.3 Correlation analysis between TPQ scores and CIAS dimension scores

As shown in Table 4 the novelty-seeking and harm-avoidance dimensions of the TPQ were positively correlated with the total CIAS score and with the CIAS subscale scores. The reward-dependence dimension

Table 2. Comparison of demographic characteristics of college students in Wenzhou, China with and without internet addiction

Characteristic	Internet addiction group (n=48)	Control group (n=649)	statistic	p-value
Gender (n, %)				
Male	39 (81.3%)	343 (52.9%)	χ^2=14.55	<0.001
Female	9 (8.7%)	306 (47.1%)		
Age (mean, sd)	18.7 (1.3)	21.9 (1.7)	t=1.47	0.023
Han ethnicity (n, %)	48 (100.0%)	575 (88.6%)	Exact test	0.006
Tobacco, alcohol or drug use (n, %)	17 (35.4%)	118 (18.2%)	χ^2=8.50	0.004
Type of School (n, %)[a]				
Technical college	25 (52.1%)	211 (32.5%)	χ^2=9.02	0.011
General university	9 (18.8%)	237 (36.5%)		
Key university	14 (29.2%)	191(9.4%)		

[a] Using a Tukey-type multiple comparisons with arcsin transformation, technical college students were significantly more likely to have internet addiction than general university students (P<0.01), but the differences between technical college students and key university students and between general and key university students were not statistically significant.

Table 3. Comparison of mean (sd) scores of the Tridimensional Personality Questionnaire (TPQ) between college students with and without internet addiction

TPQ dimension	Factor	Internet addiction group (n=48)	Control group (n=649)	t-value	p-value
Novelty-seeking	NS (total)	17.94 (1.19)	13.00 (1.58)	16.75	<0.001
	NS1	4.33 (0.58)	3.00 (0.95)	8.00	<0.001
	NS2	4.04 (0.96)	3.55 (0.69)	2.76	0.007
	NS3	4.80 (0.52)	3.44 (0.69)	10.48	<0.001
	NS4	4.34 (0.64)	2.78 (1.15	7.98	<0.001
Harm-avoidance	HA (total)	17.20 (1.93)	14.60 (1.07)	15.14	<0.001
	HA1	4.52 (0.41)	3.67 (0.59)	9.15	<0.001
	HA2	3.83 (0.80)	3.44 (0.69)	2.38	0.190
	HA3	4.01 (0.48)	3.78 (0.37)	2.36	0.020
	HA4	4.87 (0.48)	3.76 (0.98)	11.34	<0.001
Reward-dependence	RD (total)	14.62 (1.41)	18.27 (1.73)	-7.64	<0.001
	RD1	3.36 (0.87)	4.24 (0.63)	-6.01	<0.001
	RD2	3.73 (0.67)	4.00 (0.80)	-1.69	0.094
	RD3	4.71 (1.45)	4.66 (0.47)	0.15	0.884
	RD4	3.02 (0.39)	4.33 (0.82)	-9.62	<0.001

of the TPQ is negatively correlated with the total CIAS score but positively correlated with some of the CIAS subscale scores. Given the relatively large sample size most of the correlation coefficients examined were statistically significant but only 2 of the 18 correlation coefficients assessed exceeded 0.30: the correlations between the TPQ harm-avoidance dimension and the overall and the internet addiction tolerance subscale score of the CIAS.

Comparison of the correlations of TPQ and CIAS among the 48 persons who met criteria for internet addiction and the 649 who did not meet criteria for addiction found no significant differences between the two groups in the correlation of CIAS subscale scores and the harm-avoidance and reward-dependence TPQ dimensions. But the correlation of the CIAS subscale scores with the TPQ novelty-seeking dimension was significantly stronger among persons with internet addiction than in those without internet addiction for the withdrawal syndromes subscale (r=0.480 v. 0.070, t=2.94, p=0.003), the time management problems subscale (r=0.473 v. 0.126, t=2.51, p=0.012), and the interpersonal and health problems subscale (r=0.520 v. 0.090, t=3.15, p=0.002).

3.4 Factors independently associated with internet use and internet addiction

Linear regression analysis (Table 5) using the total CIAS score as the dependent variable and gender, age, ethnicity (Han v. other), substance use (none v. any), type of school, and the three dimension scores on the TPQ as independent variables found that male gender, younger age, Han ethnicity, and tobacco or alcohol use were significant predictors of the reported severity of internet use. Thus after adjustment for all the factors considered in the model, the type of school

Table 4. Correlation of the dimension scores on the Tridimensional Personality Questionnaire (TPQ) and subscale scores of the Chen Internet Addiction Scale (CIAS) in 697college students from Wenzhou, China

CIAS/ subscale	TPQ dimension					
	Novelty-Seeking		Harm-Avoidance		Reward-Dependence	
	r	p- value	r	p- value	r	p- value
Total score	0.18	<0.001	0.31	<0.001	-0.08	0.034
Compulsive online behavior	0.14	<0.001	0.17	<0.001	0.04	0.292
Withdrawal syndromes	0.10	<0.001	0.25	<0.001	-0.03	0.429
Internet addiction tolerance	0.09	0.017	0.34	<0.001	0.20	<0.001
Time management problems	0.22	<0.001	0.21	<0.001	0.09	0.012
Interpersonal and health problems	0.15	<0.001	0.16	<0.001	0.16	<0.001

Table 5. Multiple regression results of factors associated with level of internet used in 697 undergraduates in Wenzhou, China

Variable	Beta	standard error	standardized beta	t	p
Male gender	0.97	0.17	0.21	5.68	<0.001
Age in years	-0.74	0.21	-0.13	-3.50	0.001
Han ethnicity	1.30	0.27	0.18	4.84	<0.001
Any use of tobacco, alcohol	-0.88	0.20	-0.16	-4.47	<0.001
Type of school [a]					
General university	-1.34	0.90	-0.06	-1.49	0.137
Key university	-0.19	0.92	-0.04	-0.99	0.323
TPQ subscale scores					
General university	1.16	0.75	0.05	1.54	0.124
Key university	1.66	1.22	0.05	1.36	0.174
Reward-Dependence score	0.80	0.95	0.03	0.85	0.396

TPQ= Tridimensional Personality Questionnaire
[a] Compared to students in technical colleges.
Overall R^2 for regression model: 0.228.

and the subscale scores on the TPQ dimensions were not significantly associated with reported level of inappropriate internet use.

Logistic regression analysis with internet addiction as the dependent variable and the same variables as independent variables came to a similar conclusion (Table 6). The strongest independent predictors of internet addiction (in order of importance) were Han ethnicity, male gender, and any use of tobacco, alcohol or drugs. After adjustment for these factors, type of school, age and subscale score on the TPQ were not significantly associated with the internet addiction.

Table 6. Logistic regression results of factors associated with internet addiction in 697 undergraduates in Wenzhou, China

Variable	OR (95% CI)
Male gender	4.40 (1.97-9.81)
Age in years	1.07 (0.97-1.18)
Han ethnicity	5.53 (2.00-15.32)
Any use of tobacco, alcohol or drugs	1.08 (1.02-1.15)
Type of school	
Technical college	1.0
General university	0.99 (0.75-1.30)
Key university	0.97 (0.80-1.18)
TPQ subscale scores	
Novelty-Seeking score	1.06 (0.98-1.15)
Harm-Avoidance score	1.05 (0.99-1.11)
Reward-Dependence score	0.95 (0.88-1.03)

TPQ= Tridimensional Personality Questionnaire
Overall R^2 for regression model: 0.394

4. Discussion

4.1 Major findings

The present study found a prevalence of internet addiction among college students in Wenzhou of 6.9%, which is similar to that reported in other studies in mainland China.[19]

Based on our univariate analysis, college students with internet addiction in Wenzhou are more likely than those without internet addiction to have the characteristics associated with novelty-seeking (i.e., impulsive, unconventional, unruly) and harm-avoidance (i.e., pessimistic, low energy) and less likely to have the characteristics associated with reward-dependence (i.e., sentimental, dependent). These results are similar to those reported in Taiwan[20] and to those reported for heroin addicts in Sichuan, China.[21]

In the univariate analysis we found a stronger relationship between novelty-seeking personality traits and the severity of inappropriate internet use in the internet addiction group than in the control group. Previous reports[22] suggest that novelty-seeking(NS) reflects the motivational network in the human brain and is associated with the activation of the dopamine system. Individuals with high NS scores are more likely to develop new interests and to be engaged in new activities but they are liable to overlook details and soon become distracted or bored. Internet activities, especially online games, provide a variety of virtual spaces to meet the NS needs of people with high NS scores, so these individuals are more likely to have difficulty in controlling their use of the internet. This is similar to the loss of control in persons with substance abuse problems[22] or addictive gambling problems[23] who also have high NS scores.

The harm-avoidance(HA) dimension of TPQ is supposed to reflect the brain's punishment (or behavioral inhibition) network, a system that can inhibit high-risk addictive behaviors such as alcoholism.[22] Supporting this contention, high HA scores have been found in individuals with no personal history and no family history of alcohol dependence.[24-26] But the subjects with internet addiction in the current study had high scores on the HA dimension of the TPQ, so—unlike alcohol dependence—high HA did not inhibit this type of dependent behavior. This is consistent with findings in Taiwan[8] and suggests that persons addicted to the internet may be less likely to get addicted to substances. But other studies[27] suggest that internet addiction can predict alcohol dependence. Clearly, more research will be needed to clarify the interrelationships between different types of addictive behavior.

Similar to a parallel study in Taiwan[8] we found that undergraduates with internet addiction had lower scores on the reward-dependence(RD) dimension of the TPQ. Individuals with low RD dimension scores have impaired ability to respond to verbal praise or social reinforcement[27] and they are intolerant of the unpredictable frustrations that occur in real life, so they easily become addicted to the rapid and predictable achievements in internet activities like online games.

The strong relationship of internet addiction to TPQ personality characteristics seen in the univariate analyses was not replicated in the multivariate logistic regression analysis. Similarly, when considering inappropriate internet use as a continuous measure the significant correlation of the level of internet use (i.e., the total CIAS score) with TPQ personality characteristics disappears when linear regression methods are used to adjust for other factors that can affect inappropriate internet use such as gender, ethnicity, substance use, and so forth.

4.2 Limitations

The sample selected is fairly representative of college undergraduates in Wenzhou and the main scales used in the study (TPQ and CIAS) had good internal reliability so the internal and external validity of the results are good. But college undergraduates are a unique sample with a high level of education, a very limited age range, and generally high socioeconomic status so these results cannot be generalized to other subgroups of the population.

This is a cross-sectional study so it can only identify associations between personality and internet use, it cannot identify the causal relationship between these factors. Personality characteristics are generally believed to be stable after the age of 18, but it is certainly possible that the internet addiction behavior reported by these young subjects on the CIAS preceded the personality characteristics they reported in the TPQ; thus it is uncertain whether or not the TPQ can be used to predict subsequent addictive behavior. Longitudinal studies are needed to determine this.

It is clear from the multivariate analysis that the relationship of personality traits to internet use is confounded by demographic factors. Adjustment for these factors in the univariate analysis of the correlationship of CIAS and TPQ scores (Table 4) would provide a more accurate picture of the relationship of the two scales. The multiple linear regression of the total CIAS score with the potential predictor variables (Table 5) may have obscured important relationships between the CIAS subscale scores and these predictors; additional regression analyses using each of the subscale scores as the dependent variable would be needed to identify these relationships.

4.3 Significance

The univariate results of our study are similar to those reported in other studies in Taiwan and mainland China but our multivariate results suggest that many of the univariate results are confounded by demographic and other factors that are significantly different in students with and without internet addiction. Most previous studies on the personality characteristics of students with internet addiction do not control for these potential confounders so the interpretation of their results must be considered suspect. Subsequent studies on the relationship of personality to internet addiction need to adjust for these potential confounding variables.

Conflict of interest

The authors report no conflict of interest related to this paper.

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温州大学生网络成瘾状况及其三维人格特征的横断面调查

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摘要

背景　网络成瘾严重危害大学生的学业以及社会功能，但评估和解决这一问题的措施仍有不足。

目的　探讨温州地区网络成瘾大学生的人格特征。

方法　本研究采用分层整群抽样方法，采用自评的三维人格问卷（Tridimensional Personality Questionnaire, TPQ）和陈氏网络成瘾量表（Chen Internet Addition Scale，CIAS)对温州市多所大学或职业学校的697名学生进行问卷调查。其中48名学生达到陈氏网络成瘾标准（64分及以上可确认为网络成瘾），并与649名非网络成瘾学生的人格特征进行比较。

结果　温州地区大学生网络成瘾发生率为6.9%(95% CI=5.1%~9.1%)，与非网络成瘾者相比，网络成瘾者更可能为男性、汉族、物质使用史（主要是烟草和酒精）和职业学校学生。网络成瘾者TPQ中的寻求刺激性 [17.9 (1.2)比13.0 (1.6)，t=16.75，p<0.001]、躲避伤害性[17.2 (1.9)比14.6 (1.1), t=15.14, p<0.001] 两维度分值高于对照组，奖赏依赖性[14.6 (1.4)比18.3 (1.7), t=−7.64, p<0.001] 维度分值低于对照组。Logistic回归分析发现网络成瘾最重要的独立预测因子为汉族(OR= 5.52, 95% CI=2.00~15.32)、、男性(4.40, 1.97~9.81)和物质使用(1.08, 1.02~1.15)；校正其他变量后，人格变量与网络成瘾无相关性。

结论　温州地区大学生网络成瘾发生率与国内其他地区接近。采用TPQ评定的网络成瘾大学生的人格特征与非成瘾大学生有统计学差异，但控制性别、民族和物质使用变量后，两组的人格特征无统计学差异。