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# Temporal Stability of Repeated Assessments of Problematic Internet Use Among Adolescents: A Prospective Cohort Study

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## 1. Introduction

The growth of Internet usage has been phenomenal in the last decade. According to the latest statistics on worldwide usage of the Internet, there has been a 4-times increase in the number of users.<sup>1</sup> In terms of regional distributions by geographic locations, Asia is the area with the highest number of Internet users in the world in 2009 with more than 764.4 millions.<sup>1</sup> With such a large population of Internet users, misuse and loss of control in the use of the Internet should not be expected rare events.

Problematic Internet use has been identified as a potential mental health issue that exhibits some signs and symptoms similar to other established addictions since the mid-90s.<sup>2-5</sup> Since then the term "Internet Addiction" has been proposed and different opinions have been put forward as to whether problematic Internet use should be considered as a psychiatric disorder or a mental illness similar to other well established addictive disorders.<sup>6-11</sup> Until now, "Internet Addiction" is not included as a disorder in the latest version of the Diagnostic and Statistical Manual of Mental Disorders-IV Text Revision (DSM-IV-TR) as well as in the International Classification of Diseases-10 (ICD-10).<sup>12-13</sup>

The major contention of whether the problematic use of the Internet should be considered as an addiction in the conventional sense, such as in the case of substance dependent disorder, is how well Internet addiction can fulfil the validation criteria as a psychiatric disorder.<sup>14</sup> Robins and Guze, who first proposed a set of formal criteria for establishing the validity of psychiatric diagnoses, suggested five criteria.<sup>15</sup> These include: a clear clinical description of the disorder; evidence from laboratory studies; exclusion of other disorders; follow-up studies; and family studies.<sup>15</sup> In terms of the first criterion, a volume of work by many researchers has provided an informative debate.<sup>6-11</sup> Evidence from laboratory studies implies the possibility of bio-markers and validated psychiatric and psychological assessments. Recent studies using imaging techniques have provided some results for supporting differences in brain activities between problematic and normal Internet users.<sup>16-18</sup> Studies on the co-morbidities of problematic Internet use have been paving the way for the establishment of a clear picture for differential diagnoses of "Internet Addiction".<sup>19</sup> Follow-up studies, as suggested by George, reflect the ability of demonstrating temporal

stability of the diagnosis and family studies suggest the possibility of a genetic basis for the disorder.<sup>14</sup> These criteria are most difficult to satisfy and there is a lack of evidence in the area of problematic Internet use. To be able to demonstrate the temporal stability of a diagnosis of "Internet Addiction", distinct clinical profiles of symptoms are to be maintained overtime and not evolved into a different disorder. In order to demonstrate the temporal stability of a diagnosis of "Internet Addiction", cohort studies with repeated assessments using a validated instrument are necessary. So far, no such report has been identified in the literature.

The primary aim of this study is to bridge the knowledge gap in providing information on the temporal stability in the assessment of problematic Internet use, or the lack of it, across different time points among a cohort of young people recruited in a prospective longitudinal study. Individuals who were identified as problematic Internet users repeatedly across all time points were considered as "temporal stable" cases.

## 2. Materials and methods

This prospective cohort study was conducted in Guangzhou city of the Guangdong Province in Southeast China in July 2008. Guangzhou is the capital city of the Guangdong Province which is the most populous province in China. It was estimated that the population size of the city was nearly 10 million in 2006. Institute ethics approval for the study was granted by the Department of Psychological Education of Elementary and Secondary Schools of the Province Administration.

The methodologies of the baseline phase of the study were described in previous reports.<sup>20</sup> In brief, the sample was generated from the total student population of adolescents who attended high schools within the region and were registered with the Guangzhou city secondary school registry. A stratified random sampling method with stratification according to the proportion of students in metropolitan and rural areas was used for sample generation. The sample consisted of adolescents aged between 13 and 18 years.

The cohort study was conducted on campus at different schools with baseline data collected via a health survey carried out within the same week. Selected students from different schools were recruited with informed consent, either granted by students' parents or students themselves depending on their ages, to participate in the survey. Students were invited to fill in a self-reported questionnaire designed specifically for the study. The cohort was then followed for 9 months with resurvey conducted on problematic Internet use at 3 months and 9 months after the baseline survey.

Problematic use of the Internet was assessed by the Internet Addiction Test (IAT) also known as the Young's Internet Addiction Scale (YIAS) designed by Young.<sup>21</sup> The IAT is a 20 item self-reported scale based on the DSM-IV diagnostic criteria for pathological gambling. It includes questions that reflect typical behaviours of addiction. An example question is: "How often do you feel depressed, moody, or nervous when you are off-line, which goes away once you are back on-line?" Respondents were asked to indicate the propensity of their responses on a Likert scale ranging from 1 (rarely) to 5 (always). Total scores were calculated with possible scores ranging from a minimum of 20 to a maximum of 100. The severity of addiction was then classified according to the suggested cut-off scores with 20-49 points as "normal", 50-79 points as "moderate", and 80-100 points as "severe".<sup>21</sup> As only a few students scored 80 points or higher in this study, the exposure variable was dichotomised into two categories: "Severe/moderate" and "normal" for ease of data analysis.

Other information collected in the baseline survey included demographics, metropolitan or rural schools, location of family residence, whether the respondent was a single child, and parental education levels. Psychosocial information was also collected on drinking status, depression, and satisfaction with family relationships. Depression was assessed using the Zung Self-rating Depression Scale (SDS) and family relationships were assessed using the Family satisfaction subscale of the Multidimensional Student's Life Satisfaction Scale (MSLSS) at baseline.<sup>22-23</sup>

Data were analysed using the Stata V10.0 statistical software program.<sup>24</sup> As this study was descriptive in nature, variables were summarised with frequencies and percentages. Temporal stability in the assessment of problematic Internet users, or the lack of it, was reported as estimated proportions of problematic users identified across different points in time. The 95% confidence intervals for these estimated proportions were also calculated. Comparisons of the mean IAT scores between the "temporal stable" and "temporal unstable" cases at baseline, 3 month and 9 month follow-ups were conducted using independent Student's t-tests.

### 3. Results

A total of 1618 students were recruited and responded to the baseline survey providing usable information. Of these 1293 students responded to the follow-up questionnaires at the 3 and 9 month follow-ups. This represented a follow-up rate of 79.9%. Comparisons between the respondents and non-respondents indicated no statistically significant differences in terms of age, sex, and whether attending city or rural schools. The characteristics and outcome measures of the respondents were summarised in Table 1. Slightly less than half of the sample were aged below 15 years (n=619, 47.9%) with a mean age of 15.0 years (s.d.=1.8). There were slightly more females (n=722, 55.8%) than males, and about half were studying in a city school (n=650, 50.3%). In terms of demographics, the majority of the families resided in the city (n=923, 71.4%) and slightly more than half were the only child in the family (n=735, 57.1%). The majority of their parents attained at least a level of secondary education, with about 15% of fathers and 11% of mothers receiving post secondary education levels including university and post graduate education. One hundred and seventy one (13.2%) students scored moderate to severe on the Zung's Depression Scale and about 10 percent (n=132) of respondents reported drinking 3-4 times within a month prior to the baseline survey. More than a quarter of students indicated that they were very dissatisfied with their family relationships (n=280, 21.7%) at baseline.

In terms of assessment for problematic Internet use, 11.1% (n=143) of the sample could be classified as having a high risk of problematic Internet use at baseline, 8.3% (n=107) at the 3 month follow-up, and 5.6% (n=72) at the 9 month follow-up.

Table 2 and 3 summarised the number of students assessed to be problematic Internet users across different time points throughout the entire follow-up period. As shown, only 25 students were classified as problematic Internet users at all three time points at baseline, 3 months, and 9 months. These represented less than 2% (1.9%, 95% C.I.=1.3%-3.8%) of the entire cohort, and 17.5% (95% C.I.=11.6%-24.7%) of the 143 assessed as problematic Internet users at baseline. Only 32 students (2.5%, 95% C.I.=1.7%-3.5%) were classified as problematic Internet users consecutively at baseline and at 3 months follow-up, and 13 students (1.0%,

<b>Variables</b>	<b>Frequency (%)</b>
<b>Problematic use of the Internet at baseline</b>	
Moderate/Severe	143 (11.1)
Normal	1250 (88.9)
<b>Problematic use of the Internet at 3 months follow-up</b>	
Moderate/Severe	107 (8.3)
Normal	1186 (91.7)
<b>Problematic use of the Internet at 9 months follow-up</b>	
Moderate/Severe	72 (5.6)
Normal	1221 (94.4)
<b>Demographics</b>	
Age group	
<15 yrs	619 (47.9)
≥15 yrs	674 (52.1)
Sex	
Male	571 (44.2)
Female	722 (55.8)
City school	
Yes	650 (50.3)
No	643 (49.7)
Family located at	
Rural	182 (14.1)
Semi-rural	188 (14.5)
City	923 (71.4)
Single child	
Yes	735 (57.1)
No	552 (42.9)
Father's education level	
Lower than senior high school	433 (34.8)
Senior high/technical	616 (49.5)
University of higher	196 (15.7)
Mother's education level	
Lower than senior high school	570 (44.5)
Senior high/technical	565 (44.1)
University of higher	146 (11.4)
<b>Depression symptom</b>	
Moderate/severe	171 (13.2)
Normal	1121 (86.8)
<b>Dissatisfaction with family relationship</b>	
Very dissatisfied	280 (21.7)
Others	1013 (78.3)
<b>Drinking in the last month</b>	
3-4 times	132 (10.3)
1-2 times or none	1153 (89.7)

Table 1. Frequency distributions of problematic Internet use across time, demographics, and other variables of adolescents in the study sample (N=1293)

		3 months resurvey				
		Yes		No		
Baseline survey	9 months resurvey		9 months resurvey		Total	
	Yes	No	Yes	No		
Yes	<b>25</b>	32	19	67	143	
No	13	37	15	1085	1150	
Total	38	69	34	1152		
Grand Total	107		1186		1293	

Table 2. Proportions of problematic Internet user identified by different times of survey

Problematic Internet user identified at different time points	Frequency	Percentage (95% C.I.)
Normal user across all surveys	1085	83.8 (81.6-85.7)
Identified only at baseline	67	5.2 (4.0-6.5)
Identified only at 3 months resurvey	37	2.9 (2.0-3.9)
Identified only at 9 months resurvey	15	1.2 (0.7-1.9)
Identified at baseline and 3 months resurveys	32	2.5 (1.7-3.5)
Identified at baseline and 9 months resurveys	19	1.5 (0.9-2.3)
Identified at 3 months and 9 months resurveys	13	1.0 (0.5-1.7)
Identified at all 3 surveys	25	1.9 (1.3-2.8)

Table 3. Frequency and percentages (95% C.I.) of problem Internet users by time categories (N=1293)

95% C.I.=0.5%-1.7%) at 3 month as well as at 9 month follow-up. Comparisons of the mean IAT scores between “temporal stable” and “temporal unstable” cases indicated significant differences between groups across all three time points with the “temporal stable” group scoring higher by 18.0 (95% C.I.=12.5-23.4), 15.9 (95% C.I.=10.4-21.4), and 20.7 (95% C.I.=14.8-26.6) at baseline, 3 month and 9 month follow-up respectively.

#### 4. Discussion

This study aims to examine the assessment profile of problematic Internet usage across time in a cohort of young people in Southeast China. The main reason for the study is to provide information on temporal stability in the assessment of problematic Internet usage in response to one of the requirements of Robins and Guze’s criteria for the validity of a psychiatric diagnosis for “Internet Addiction”. The results of the study indicated that of the 143 students identified as problematic Internet users at baseline, only 25 (17%) were re-identified as problematic users in the two follow-up surveys. If a criterion that a larger proportion of individuals assessed to be problematic Internet users were re-identified repeatedly at all three time points indicated temporal stability, then the results of the study did not provide strong evidence for temporal stability in the assessment of problematic Internet use. In terms of the temporal stability of the diagnosis, to the knowledge of the authors this is the first attempt of the diagnostic validity of “Internet Addiction” as a potential psychiatric disorder. Due to the lack of a similar study on the same topic, a comparison of results would be difficult.

There could be three possible interpretations of the results. First, is that temporal stability in the assessment of problematic Internet use is difficult to achieve, as it has been noted in other established psychiatric disorders.<sup>14</sup> This may be due to transient characteristics of problematic Internet use. Results from a longitudinal study on risk factors for "Internet Addiction" among adolescents suggested that mood state, particularly depression, is predictive of Internet use.<sup>26</sup> Since mood state in adolescents is highly sensitive to circumstantial as well as their internal physical conditions, mood fluctuations occur frequently. The transient characteristics of problematic Internet use may just be a behavioural manifestation of their mood changes. The second interpretation of the results is that the lack of temporal stability in the assessment of problematic Internet use is because of a lack of validity and reliability of the assessment instrument. One major criticism on the proposal of a clinical diagnosis of "Internet Addiction" is that the psychometric properties of most assessment instruments designed for measuring "Internet Addiction" as a psychological construct are unsupported by rigorous examinations.<sup>27</sup> Of the few reports on the validation of the IAT published in the international literature, factor structural and convergent validity were the main focus.<sup>28,29</sup> However, no information on test-retest reliability was provided, thus the temporal validity of the construct that the IAT is designed to assess is unknown. The results of this study suggest a general lack of temporal validity. Third, temporal stability can only be achieved for those who are at very high risk of problematic usage, but not for users with moderate risk. Results of this study render some support to the notion that "temporal stable" cases scored significantly higher on the IAT than "temporal unstable" cases consistently across time. The possible explanation of the results obtained from the study could be anyone one, or a combination, of the above interpretations.

As in all studies, there are strengths and weaknesses in this study. This is a population-based study that includes a random sample of students. No significant differences have been found between respondents and non-respondents suggesting a representative sample. A potential limitation has been identified in this study. Information on problematic Internet use is collected via self-reporting. Hence this will constitute a report bias in the outcome variable. To improve the study quality, in future studies informants should be used in conjunction with information collected from respondents.

In conclusion, it is important to have a general consensus on the definition of "Internet Addiction" within the psychiatric and psychological community in order to design and develop an appropriate assessing instrument that is based on well-framed theoretical models and is supported by empirical data. Once the appropriate instrument has been adopted, the temporal stability in the assessment is also an important aspect in establishing a proper clinical diagnosis for a psychiatric disorder. In the area of problematic Internet use, given the vast growing population of Internet users, there is an urgent need for researchers and clinicians to develop a general consensus on the issue as well as to work towards a proper evidence-based diagnosis and potential treatment strategies for the problem.

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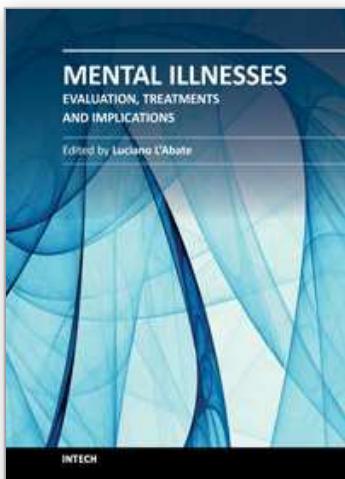
## 6. Declaration

All authors ensure that there is no conflict of interest of any kind that involved in the production of this manuscript nor is the study associated with any commercial bodies. No competing financial interests exist.

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## Mental Illnesses - Evaluation, Treatments and Implications

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In the book "Mental Illnesses - Evaluation, Treatments and Implications" attention is focused on background factors underlying mental illness. It is crucial that mental illness be evaluated thoroughly if we want to understand its nature, predict its long-term outcome, and treat it with specific rather than generic treatment, such as pharmacotherapy for instance. Additionally, community-wide and cognitive-behavioral approaches need to be combined to decrease the severity of symptoms of mental illness. Unfortunately, those who should profit the most by combination of treatments, often times refuse treatment or show poor adherence to treatment maintenance. Most importantly, what are the implications of the above for the mental health community? Mental illness cannot be treated with one single form of treatment. Combined individual, community, and socially-oriented treatments, including recent distance-writing technologies will hopefully allow a more integrated approach to decrease mental illness world-wide.

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