

## Reliability and Validity of a Parent-Assessed Impulsiveness Scale for Chinese Children

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### Abstract

**Objective:** The aim of this study was to investigate the reliability and validity of a version of the Barratt Impulsiveness Scale assessed by children's parents.

**Methods:** The test-retest reliability, split-half reliability, and homogeneity reliability were tested. Construct validity (including internal consistency and factor structure) and criterion validity were tested. The criterion validity examined the correlation with hyperactivity and impulsive factors of the CBCL and Conners' scales and the score differences between the control and the diagnosed groups were compared.

**Results:** The test-retest reliability was 0.825. The split-half correlation coefficient was 0.722. The internal factors consistency  $\alpha$  coefficient of the scale was 0.387 for attention, 0.641 for motion, 0.643 for non-plan, and the total score was 0.794. The score was related with Conners' hyperactivity and impulsivity factors and CBCL's corresponding factors. This assessed scale included six factors. The scores of the comparison group were significantly higher than those of the control group.

**Conclusions:** The reliability and validity of the Impulsiveness Scale assessed by parents were ideal and consistent with psychometric requirements.

**Keywords:** Children; Impulsivity; Norm, Reliability; Validity

### Introduction

Impulsiveness is defined as a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individuals or to others [1,2]. The question of whether a person is capable of modulating their cognition and behavior to fit the demands of a given environment is integral to almost any conceivable situations. Because of this, there is widespread interest in understanding the role of impulsiveness among healthy populations in activities ranging from employment behaviors, such as error-prone to educational performance, often blurts out an answer before a question has been completed [3]. Impulsiveness plays an important role in normal behavior, as well as in pathological ones [4]. Impulsivity is a trait disposition associated with the vulnerability to suicidal behavior across psychiatric diagnoses [5], such as cocaine abuse [6], mania [7], personality disorders [4], and substance use disorders [8]. Two types of impulsivity are distinguished. Dysfunctional impulsivity is the tendency to act with less forethought than most people of equal ability when this tendency is a source of difficulty; most previous work on impulsivity appears to have focused on this trait. Functional impulsivity, in contrast, is the tendency to act with relatively little forethought when such a style is optimal [9]. Impulsivity is important manifestation of diseases, including neurodevelopmental disorders (attention-deficit/hyperactivity disorder), disruptive, impulse-control, and conduct disorders. Population surveys suggest that ADHD occurs in most cultures in about 5% of children [10]. Impulse is closely

related to juvenile violent crime; impulsive behavior is a common personality characteristic of various juvenile offenders [11]. Children's impulses often affect cognitive function and interpersonal development, which require early intervention. Given its relevance to both healthy and harmful behaviors, therefore, accurate assessment of impulsivity in children is of significant clinical importance for both prevention and treatment and repeated assessment may be necessary.

The Barratt Impulsiveness Scale (BIS) is arguably the most commonly administered self-report measure specifically designed for the assessment of impulsiveness in both research and clinical settings [12]. The BIS, currently in its 11th revision [13], is a 30-item self-report instrument designed to assess the personality/behavioral construct of impulsiveness. This year (2014) will mark the 55th anniversary of the Barratt Impulsiveness Scale [14]. Cheng applied the traditional Chinese version of the BIS-11 for opioid-dependent participants in Taiwan and established a modified Chinese version of the Barratt Impulsiveness Scale [15]. However, there is no impulsiveness scale suitable for children in China, so the BIS-11 was translated into Chinese in order to study children's impulsive behavior. The earlier study found that children tend to self-evaluate according to the "good" standards of the society, while the results have greater differences if evaluated by researchers and parents. The items were appropriately modified to suit parents assessing children. We suppose that the scale has better reliability and can effectively distinguish different degrees of impulsiveness. The study aims to examine reliability and validity of the scale, and provides the tool to estimate child impulsiveness in Chinese.

## Materials and Methods

### This study performed following explanatory research

Scale and modified content: The Barratt Impulsiveness Scale (BIS) was developed by Barratt in 1959 to evaluate impulsive characteristics and is the most common self-rating scale of impulsive features. In the past 50 years, the BIS have been amended a dozen times. The latest version was BIS-11 revised by Patton et al. in 1995 [13]. The scale consisted of 30 items and scored on a 1-4 point range: 1, rarely/never; 2, occasionally; 3, often; 4, almost always/always. Twelve items were reverse scored. The scale consisted of three second-order factors: attentional, motor, and non-planning. High scores represented no focused attention, hyperactivity, and lack of planning. Its reliability and validity were good. It was an effective assessment tool to evaluate impulsive features. It has been translated into 11 languages including Chinese [12]. Orozco-Cabal developed 15 items for the BIS-15S [16]. Hartann also used it with German adolescents [17].

In order to assess Chinese children's behavioral characteristics, we discussed each item in expert group (including corresponding author), and some items were modified, such as number 14: "I often change jobs" was changed to "I often do one thing while not finishing another". Item 20 ("I often change my shelter") was changed to "I prefer not to stay in one place too long". Preliminary tests found that children's understanding and self-evaluation capacity were limited, so first person expression was changed to third person expression, so that children could be assessed by their parents.

The Child Behavior Checklist (CBCL) is among the most widely used parent-report measures of youth emotional and behavioral problems in both clinical and research settings [18]. The Su Revised Norms of CBCL in Hunan Province found that the correlation between the new version and the previous version were high. The validity of the new version was better than the previous one. The authors argued that the new version was simpler and more convenient for using the same subscales across age and sex groups [19], as assessed by the parents.

Conners Parent Symptom Questionnaire (PSQ) is a behavior assessment scale for parent-assessed children prepared by Conners, which has mainly been used to assess children with ADHD. The scale can be used for clinical diagnosis and research and as a screening tool for epidemiological investigations. The scale is widely used in foreign countries and both the reliability and validity are better than other Scales. Su established Chinese urban of Conners PSQ and tested its reliability and validity, finding that the reliability and validity were good [20]. The assessment was performed by the parents.

### Subjects

Each class of grade 1-6 from a primary school in Changsha, China, and two classes from each grade of grade 7-11 from a junior and high school were selected as the study subjects. A total of 721 cases were selected. All selected children were asked to complete a self-rating scale in class. A total of 541 valid questionnaires were returned including 262 males and 279 females. A PSQ scale was taken home for parents by the students and returned the next day. Of the 721 original cases, 663 valid questionnaires were returned including 324 males and 339 females. In the same period, 49 patients diagnosed with attention deficit hyperactivity disorder, oppositional defiant disorder, conduct disorder, anxiety disorder, tic disorders, and other disorders by DSM-4 diagnostic criteria were collected from the child psychology clinic of

the Mental Health Institute of Central South University as the comparison group. The forms were completed by family members and children. This study was conducted in accordance with the declaration of Helsinki. This study was conducted with approval from the Ethics Committee of Central South University. Written informed consent was obtained from all participants.

### Age and gender distribution of BIS scores

The control group was divided into four groups consisting of boys and girls aged 7-12 and 13-18 years old. The distribution of scores in each group was compared by t test.

### Reliability tests

Split-half reliability: The questionnaire items from the control group (324 males and 339 females) were divided into parity half by item numbers. The correlation between the two halves was calculated and the Spearman-Brown correction formula was performed. The items in each factor were encoded in the questionnaire and numbered. The items of each factor were divided into parity half. The correlations between the two halves of each factor were correlated with the same method.

Test-retest reliability: One class of 56 students was evaluated for a second time after a one-month interval. The Pearson correlation coefficient between the two assessment results was calculated.

Internal consistency factor: Cronbach's  $\alpha$  coefficient of items, subscales, and total scores were calculated.

Consistency of factor scores and total scores: The Pearson correlation coefficient between the factor scores and total scores were computed.

Consistency between raters: The Pearson correlation coefficient between between the self-rating scales of young people aged 13 to 18 and their parents' rating scales were calculated.

### Validity

Construct validity was calculated by: 1) internal consistency (Pearson correlation coefficient between among factors, between the factor scores, and the total score) and 2) factor analysis (principal component analysis by the greatest variance orthogonal rotation method). Criterion validity was studied in three ways. 1) Parents in the control group also completed the hyperactivity and impulsive factor items of the PSQ and the Pearson correlation coefficient between factor scores and the BIS were calculated. 2) Parents in the comparison group completed the Achenbach Child Behavior Checklist (CBCL) and the Pearson correlation coefficient with the BIS were calculated. The BIS scores of the control and comparison groups were compared to examine the role of BIS identification for children with DSM-4 diagnoses by t test.

### Statistical analysis

All data were performed using SPSS for Windows 12.0 on the computer.

## Results

### Age and gender distribution of BIS scores

The control group was divided into four groups consisting of boys and girls aged 7-12 and 13-18 years old. The distribution of scores in each group was compared. For each subscale and total score, the 7-12-year-old boys were the highest and girls aged 13-18 were the lowest. Males scored higher than females. The 7-12-year-old group was higher than the 13-18-year-olds ( $P < 0.001$ ).

### Reliability

Split-half reliability: The total score was 0.722, with 0.568 for the attentional factor, 0.612 for the motor factor, and 0.595 for the non-planning factor.

Retest reliability: The parents of 56 children in the fourth grade at the school were selected and retested a month later in order to assess the stability of the scale (Table 1). The test-retest correlation of subscales and total scores after a month was significant ( $P < 0.01$ ).

	Attention	Motion	Plan	Total score
A month later	0.457**	0.705**	0.612**	0.825**

**Table 1:** Test-retest reliability ( $r$ ). Note: \*\* $P < 0.01$ .

Internal consistency: Cronbach's  $\alpha$  coefficient reflected internal consistency. The  $\alpha$  coefficients of the PSQ scales and each subscale

were 0.387 for the attentional factor, 0.641 for the motor factor, 0.643 for the non-planning factor. The total coefficient was 0.794.

Consistency of factor scores and total scores ( $r$ ): The correlation analysis with the total score found 0.811 for attention, 0.794 for motion, and 0.875 for non-plan ( $P < 0.01$ ) factors.

### Validity

Factor analysis: The principal component analysis was performed for the children's BIS on the control and comparison groups by the greatest variance project orthogonal rotation method. A total of six-root eigenvalue  $\geq$  factor 1 was selected. The total explained variance was 49.87%, including items 1, 5, 6, 7, 10, 11, 19, 22 and 30 as the first factor for mainly loading planning, items 2, 9, 14, 15, 16, 20, and 27 were taken as the second factor for mainly loading movement, items 4, 13, 17, 18, and 24 were taken as the third factor for mainly loading attention (the first three factors were similar to the original scale). Items 8, 25, and 21 were also extracted as the fourth factor for the main load for shopping impulsivity. Items 3, 23, and 26 were taken as the fifth factors for the main loading hyperactivity. Items 28 and 29 were taken as the sixth factor for the main loading multiple words.

The Pearson correlation coefficients of the CBCL total score and subscales were shown in Table 2. The attentional factor was negatively correlated with resistance problems (withdrawal, somatic complaints, anxiety, and depression) and thinking problems. Motor and non-planning factors were related with external resistance issues (disciplinary problems, aggressive behavior) and attention problems.

	Attention factor	Motion factor	Non-plan factor	Total score of the scale
Activities	.323*	.193	.205	.262
Social situation	.454**	.165	.036	.261
School information	-.068	-.166	-.365*	-.263
Social competence	.439**	.150	-.001	.216
Flinch	-.312*	-.219	-.160	-.356*
Somatic complaints	-.443**	.074	-.103	-.191
Anxiety and Depression	-.509**	-.215	-.426**	-.496**
Social issues	-.121	.006	.078	-.025
Thinking problems	-.397**	-.036	-.051	-.236
Attention problems	.145	.461**	.508**	.420**
Disciplinary problems	.225	.529**	.515**	.478**
Aggressive behaviors	.171	.541**	.455**	.447**
Resistance problem	-.525**	-.164	-.318*	-.443**
External resistance problem	.168	.513**	.423**	.416**
Total score of behavior problems	-.193	.334*	.193	.085

**Table 2:** Pearson correlation coefficient of BIS and CBCL subscale scores. Note: \* $P < 0.05$ ; \*\* $P < 0.01$ .

The correlation between BIS and Conners' hyperactivity and impulsivity factors was 0.477 for the total score, 0.335 for the attentional factor, 0.442 for the motor factor, and 0.390 for the non-planning factor ( $P < 0.01$ ).

### Identification role of abnormal children

The scores in the control and comparison groups were compared. The results were shown in Table 3. The score of the comparison group was higher than that of the control group. The difference was highly significant.

	Research (n=663)	Group	Abnormal (n=49)	group	t	P
Attention	19.34±3.56		21.98±5.35		4.67	.000
Motion	21.39±4.39		24.68±4.91		5.07	.000
Plan	28.97±4.94		33.73±5.46		6.45	.000
Total score	70.00±10.21		80.18±12.70		6.60	.000

**Table 3:** Comparisons of BIS score of the parent Rating Scale in the research and abnormal groups ( $\bar{x} \pm s$ ).

### Consistency among raters

The Pearson correlation coefficient between the self-ratings of 312 young people aged 13-18 years old and their parents' ratings was 0.457 for the attentional factor, 0.593 for the motor factor, and 0.564 for the non-planning factor. The total score of the scale was 0.644 ( $P < 0.01$ ).

### Discussion

Children's self-assessments were difficult to perform by themselves [21]. Parents' assessments through the CBCL [19] and Conners PSQ [20] are typically used for children. The revision of the BIS also adopted parental assessment. The results of the present study indicated that Chinese parents' ratings of the children's Impulsiveness Scale had sufficient reliability and validity. The split-half reliability was 0.722, test-retest reliability was 0.825, and the  $\alpha$  coefficient of the full scale was 0.794. The internal consistency of the factors in parents' ratings was close to 0.82 reported by Patton et al. The test-retest reliability and internal consistency  $\alpha$  coefficient of the attention factor were lower than that of the other factors. The causes were analyzed. The item cores of the attention factor were frequently reverse scored; for example, "he is a thoughtful man," "he likes to consider complex issues," and other items. This may be related to insufficient observation from Chinese parents of children from this point, or not using items like this to describe children. The internal consistency of the total scale was acceptable with Cronbach's alpha being 0.794. The subscales had somewhat lower internal consistencies although Cronbach's  $\alpha$  for the subscales ranged between 0.4 and 0.6. However, that might result from fewer items. Chinese parents' assessments on the children's Impulsiveness Scale were hence concluded to have sufficient internal consistency reliability.

Impulsiveness of the children was impacted by age and gender. In school children, the total and subscale scores of the boys were higher than that of the girls and 7-12-year-olds scored higher than 13-18-year-olds. The results were negatively correlated with age and BIS-11 total score reported by Someya et al. [22] and consistent with men being more impulsive than women reported by Spinella [23]. It is also associated with high impulsivity of boys, the increased self-control of the children with age, and the development law of decreased impulsivity. The BIS total scores of parent-assessed children in the study sample averaged 70.00±10.21, which was higher than the self-

assessment scores of American students (63.82±10.17) ( $P < 0.01$ ) [13]. This may be relevant to younger students in China and cultural differences.

A total of six characteristic root extract value  $\geq$  factor 1 was selected by principal component analysis of the BIS for children in the control and comparison groups with the greatest variance orthogonal rotation method. The common explained variance was 49.87%, including three factors similar to the original scale. BIS subscales were related to the total score. The correlation coefficient was 0.764-0.872. In terms of criterion validity, Achenbach Child Behavior Checklist (CBCL) is a commonly used international parental child behavior rating scale. Conners PSQ are a parent-completed child behavior rating scale, mainly to assess children with ADHD. The scale is widely used in foreign countries. The national norm reliability and validity of the two scales were good [13,14]. From the correlation analysis between the BIS and the total score of CBCL and PSQ hyperactivity and impulsivity factors, BIS subscale and total scores were positively correlated with CBCL external resistance problems, but negatively correlated with internal resistance problems. On the one hand, this may be related to the fact that impulsive children lack consideration. Inappropriate or risky behavior conflicts with the outside world happen easily, thus provoking disciplinary problems and aggressive behavior and other external resistance problems [15]. On the other hand, they have less consideration of the appropriateness of their actions and less introspection, and are thus less likely to retreat into anxiety, depression, somatic complaints, and other internal resistance problems. In addition, attention factors were positively correlated with CBCL social factors ( $r=0.454$ ), while the total score was negatively correlated with withdrawal ( $r=-0.365$ ), showing that impulsive children were prone to social issues because of lack of consideration, as well as flinch performance because of the lack of consideration not social problems. The correlation between the BIS and PSQ hyperactivity and impulsive factor scores was also good, indicating that the BIS were more consistent with impulsive behaviors in Conners' evaluation. The correlation between the self-assessment of young people aged 13-18 years old and their parental assessment was better than that of other scales, indicating a good correlation between the two.

BIS subscales and the total scores of the children in the comparison group were higher than the scores of the control group and the difference was highly significant. This is consistent with more impulsive phenomenon in children with psychiatric disorders.

### Conclusion

Our research showed that the number of items of the parent-assessed BIS scale was moderate, the content was simple, the reliability and validity was consistent with psychometric requirements, and it provided a useful tool for assessing children's impulsive behaviors. However, the study is only involved in limited sample size, and confirmatory factor analysis is not performed. Further study should be performed using larger sample sizes with confirmatory factor analysis.

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## Conflict of Interest

All authors have no conflict of interest regarding this paper.

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