Comparison of the Behavior Rating Inventory of Executive Function in a Japanese Sample and the Original American Sample

Yoko Okamura[1], Michiyo Ehara[2], Yuka Nakajima[2], Emiko Otsuka[2], Masami Akaishi[2] and Katsunori Yoshinaga[2]

Abstract: Executive dysfunction (ED) frequently occurs in children with traumatic brain injury, but it is difficult to diagnose in its early stages or in childhood. The Behavior Rating Inventory of Executive Function (BRIEF) published in the USA is a widely used measure of ED in children. In Japan, there are few tools for the comprehensive assessment of child ED, and the Japanese translation of the BRIEF may be helpful in this regard. However, very limited data are available on use of the Japanese translation. Method: This study compared BRIEF data obtained for a Japanese translation sample with those of the original sample. The Parent Form sample in Japanese was completed by 329 parents for 136 boys and 193 girls aged 6–18 years. The Teacher Form sample was completed by 323 teachers for 128 boys and 195 girls. Independent t-tests were used to compare the findings for the Japanese sample with the normative sample for each of the scales. Results: A series of t-tests revealed that most of the Japanese sample had a significantly lower score than the normative sample on the Global Executive Composite scale. We found significant differences in BRIEF scores between the original and Japanese samples. Conclusions: There could be several reasons for the differences between samples, including the cultural aspect that Japanese people tend to have less positive self-evaluations. Our findings suggest that the BRIEF should be standardized by adjusting for the cultural context.

Keywords: Executive dysfunction; BRIEF; cross-cultural difference, Child, Japanese sample

Introduction

Executive dysfunction (ED) frequently occurs in children with traumatic brain injury, but it is difficult to make a diagnosis of ED in its early stages or in childhood. The Behavior Rating Inventory of Executive Function (BRIEF) published in the USA (Gioia, Isquith, Guy, & Kenworthy, 2000) is widely used to measure ED in children. The Parent and Teacher Forms of the BRIEF each contain 86 items that measure different aspects of executive function. ED in children is assessed by the Global Executive Composite (GEC), which is divided into two indexes. One is the Behavioral Regulation Index (BRI), consisting of three clinical scales that are Inhibit, Shift, and Emotional Control. The other is the Metacognition Index (MI), consisting of five clinical scales that are Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor. A beneficial feature of the BRIEF is that it provides multiple perspectives, including specific normative data based on age and gender. Separate normative tables for parent and teacher forms provide T scores, percentiles, and 90% confidence intervals for four developmental age groups by gender of the child. Theoretically and statistically derived scales measure different aspects of a child's or adolescent's executive behaviour.

In Japan, there are few tools for the comprehensive assessment of child ED and the Japanese translation of the BRIEF may help fulfill this purpose. However, very limited data are available on the psychometric properties of the Japanese translation. This study aimed to provide information on the internal consistency and factor structure of the original BRIEF and the Japanese translation of BRIEF data obtained for a Japanese sample. We also analyzed the differences between the original BRIEF and the Japanese translation of BRIEF data to confirm that we can use the same T score of original data.

Received November 25, 2021 ; Accepted December 9, 2021

1 Department of Psychology, Senshu University, Kanagawa, Japan
2 Chiba Rehabilitation Center, Chiba, Japan

Materials and Methods

Measures

The Japanese versions of the Parent and Teacher Forms of the BRIEF were assessed for this study. It was translated into Japanese by PAR Psychological Assessment Resources, Inc. We used it with some correction of words by specialists of the department of paediatrics including a paediatrician and three clinical psychologists in Chiba rehabilitation centre after obtaining formal permission.

Participants

In total, 362 students enrolled in a public primary school, three public junior high schools, and two public senior high schools in Kanto area in Japan were recruited for this study. Participants received 1,000 yen as a reward for participation in this study. Participants who were aged under six years in kindergarten were not included in this survey because of differences with the education system in the USA, even though the normative sample in the USA was collected in children aged from 5 to 18 years.

Procedure

Participants' parents and homeroom teachers were asked to complete the Parent and Teacher Forms of the BRIEF translated into Japanese. The questionnaires were collected directly a few days later. Of these participants, three hundred twenty-nine parents (90.90%) completed the Parent Form and three hundred twenty-three teachers (89.20%) completed the Teacher Form. Details of the entire sample are presented in Table 1. A retest was performed after two weeks with 54 of these respondents.

Analyses

Analysis of variance (ANOVA) was used to test whether differences in age and gender were the same as in the original data (Gioia et al., 2000). The reliability and the validity of these data were assessed. To assess reliability, the internal consistency, test-retest reliability, and the coefficient of agreement among the evaluators were examined. The construct validity was assessed using factor analyses. Additionally, independent t-tests were used to compare the findings for the Japanese sample with the normative sample (Gioia et al., 2000) for each of the scales, but The data of 6-7years group in Japanese sample is compared to 5-7 years group of Original sample. Analyses were conducted using IBM SPSS Statistics 21.

Table 1. Number of participants.

	Parent Form		Teacher Form	
Age group	Boys	Girls	Boys	Girls
6 - 7 years	29	21	25	23
8 -10 years	43	41	44	39
11-13 years	39	41	39	40
14-18 years	55	60	50	63
Total	166	163	158	165
	329		323	

This study received ethical approval from the Chiba Rehabilitation Center where the study was undertaken (Approved by the Bioethics Review Committee of Chiba Rehabilitation Center on April 30, 2008).

Results

Age and gender differnces in BRIEF scours

The mean and standard deviation (SD) of the BRI, MI, and GEC are shown in Table 2.

ANOVA was conducted to examine the age and gender differences for the Parent and Teacher Forms. For the Parent Form, there were main effects for age, F (3, 321) = 5.75, $p<.01$, and gender, F (1, 321) = 14.76, $p<.01$. Mean scores for boys were greater than for girls, and both boys' and girls' scores decreased with increasing age. A significant interaction between age and gender was found for the GEC scale, F (3, 321) = 4.10, $p<.01$. A Bonferroni multiple comparison test was conducted to compare each group. The results are shown in Figure 1. For the Teacher Form, there were main effects for age, F (3, 315) = 12.95, $p<.01$, and gender, F (1, 315) = 20.52, $p<.01$. Mean scores for boys were greater than for girls, and both boys' and girls' scores decreased with increasing age. A significant interaction between age and gender was found for the GEC scale, F (3, 315) = 3.68, $p<.01$. A Bonferroni multiple comparison test was conducted to compare each

Table 2. Means and standard deviations on the BRIEF for the Japanese sample.

			BRI		MI		GEC	
	Age group	N	M	SD	M	SD	M	SD
Parent Form								
Boys	6－7 years	29	40.45	10.54	75.97	16.66	116.41	25.54
	8－10 years	43	33.86	5.82	66.42	16.26	100.28	21.30
	11–13 years	39	31.87	4.47	59.46	10.54	91.33	13.83
	14–18 years	55	32.05	5.65	65.49	19.33	97.55	23.66
	Total	166	33.95	7.22	66.14	17.03	100.09	22.82
Girls	6－7 years	21	33.90	4.39	61.76	11.43	95.67	14.64
	8－10 years	41	33.15	5.71	58.56	11.20	91.71	15.93
	11–13 years	41	33.29	6.11	61.54	15.83	94.83	20.89
	14–18 years	60	32.43	4.79	56.38	11.36	88.82	15.41
	Total	163	33.02	5.32	58.92	12.70	91.94	17.05
Total	6－7 years	50	37.70	9.05	70.00	16.19	107.70	23.82
	8－10 years	84	33.51	5.74	62.58	14.48	96.10	19.24
	11–13 years	80	32.60	5.39	60.53	13.47	93.13	17.78
	14–18 years	115	32.25	5.20	60.74	16.27	92.99	20.18
	Total	329	33.49	6.36	62.57	15.44	96.05	20.55
Teacher Form								
Boys	6－7 years	25	37.72	12.50	65.80	23.94	103.52	35.46
	8－10 years	44	33.75	7.60	54.30	11.02	88.05	17.69
	11–13 years	39	31.59	4.18	48.72	7.28	80.31	10.42
	14–18 years	50	31.08	4.43	49.82	9.15	80.90	11.98
	Total	158	33.00	7.44	53.32	13.93	86.32	20.38
Girls	6－7 years	23	33.13	5.35	52.52	11.51	85.65	15.59
	8－10 years	39	31.00	2.79	47.62	5.09	78.62	7.26
	11–13 years	40	30.73	3.70	48.13	9.92	78.85	13.13
	14–18 years	63	30.75	2.63	46.90	5.11	77.65	7.14
	Total	165	31.13	3.49	48.15	7.77	79.28	10.58
Total	6－7 years	48	35.52	9.92	59.44	19.99	94.96	28.94
	8－10 years	83	32.46	5.98	51.16	9.32	83.61	14.52
	11–13 years	79	31.15	3.94	48.42	8.67	79.57	11.82
	14–18 years	113	30.89	3.52	48.19	7.30	79.09	9.68
	Total	323	32.05	5.84	50.68	11.49	82.73	16.49

Note. BRIEF = Behavior Rating Inventory of Executive Function; BRI = Behavioral Regulation Index; MI = Metacognition Index; GEC = Global Executive Composite; SD = standard deviation

group. The results are shown in Figure 1.

The validity and reliability of the Japanese translation of BRIEF data

For the parents, Cronbach's α coefficient for each index were 0.75 for BRI, 0.92 for MI, and 0.92 for GEC, whereas for the teachers, they were 0.81 for BRI, 0.93 for MI, and 0.93 for GEC. The test-retest correlations were 0.92 for BRI, 0.92 for MI, and 0.93 for GEC for the parents, and were 0.89 for BRI, 0.93 for MI, and 0.93 for GEC for the teachers. All of these were significant ($p < 0.01$). Regarding the coefficient of agreement among evaluators, correlation coefficients between the parents and teachers were 0.48 for BRI, 0.41 for MI, and 0.46 for GEC, indicating significant correlations ($p < 0.01$).

Factor analyses of the data sets for the Parent and Teacher Forms were conducted to test the construct validity of this assessment. For the Parent Form, a

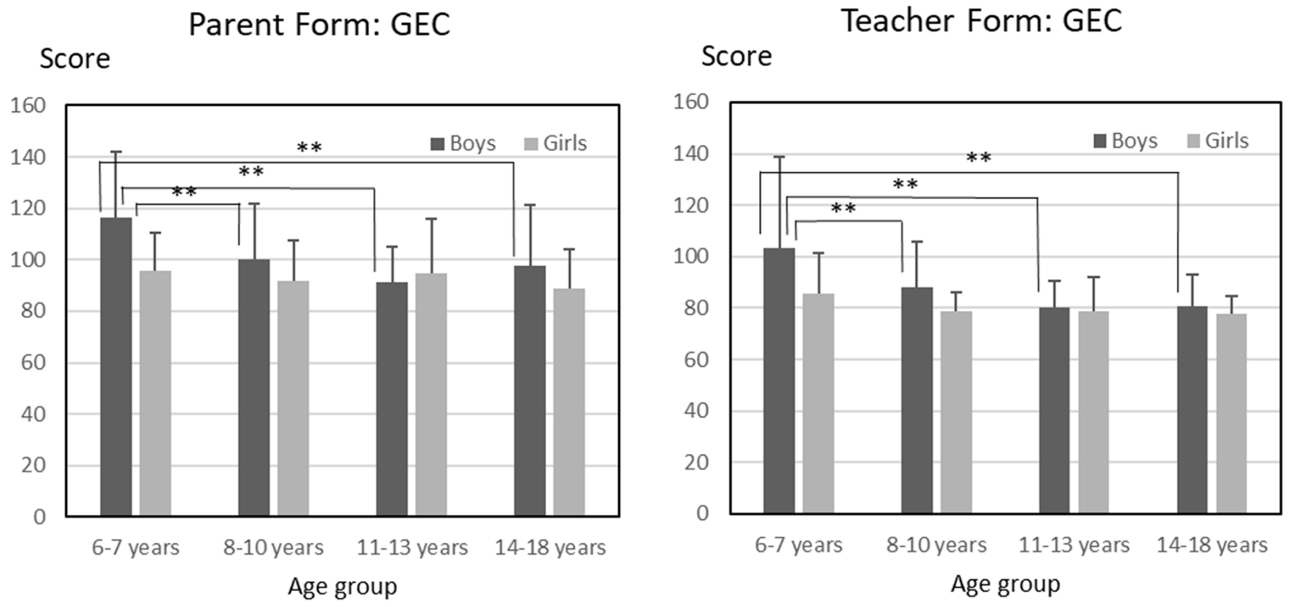

Figure 1. Differences in age and gender between parent and teachers forms.

GEC = Global Executive Composite; $^{*}p < .05$, $^{**}p < .01$.

Table 3. Factor loadings of the items on the parent form.

Scale	Factors	
	BRI	MI
Emotion control	**1.00**	−0.01
Inhibit	**0.61**	0.41
Shift	**0.54**	0.29
Plan/organize	0.50	**0.80**
Working memory	0.53	**0.71**
Monitor	0.59	**0.69**
Initiate	0.51	**0.61**
Organization of materials	0.42	**0.60**
Variance explained	37.45	69.75

Note. BRI = Behavioral Regulation Index; MI = Metacognition Index

Table 4. Factor loadings of the items on the teacher form.

Scale	Factors	
	BRI	MI
Working memory	**0.93**	−0.04
Plan/organize	**0.92**	−0.06
Initiate	**0.91**	−0.01
Monitor	**0.71**	0.26
Organization of materials	**0.70**	0.06
Emotion control	−0.12	**1.05**
Inhibit	0.17	**0.60**
Shift	0.46	**0.47**
Variance explained	66.62	75.26

Note. BRI = Behavioral Regulation Index; MI = Metacognition Index

two-factor model accounted for 69.75% of the variance in the generalized least squares method. Table 3 presents the factor loadings for this solution. The first factor was defined by the Emotion Control, Inhibit, and Shift scales; the second factor was defined by the Plan/Organize, Working Memory, Monitor, Initiate, and Organization of Materials scales. For the Teacher Form, a two-factor model accounted for 75.26% in the generalized least squares method. Table 4 presents the factor loadings for this solution. The first factor was defined by the Working Memory, Plan/Organize, Initiate, Monitor, and Organization of Materials scales; the second factor was defined by the Emotion Control, Inhibit, and Shift scales. In summary, factor analyses of the Parent and Teacher Forms consistently supported a two-factor model, which was the same as in the original assessment.

Comparison of the Japanese and original samples

A series of t-tests revealed that the Japanese sample had a significantly lower score than the original sample on the GEC scale, except for the Parent Form rating for boys aged 6-7 years (t = 0.02, n.s.), the Teacher Form rating for boys aged 6-7 years (t = 0.01, n.s.),

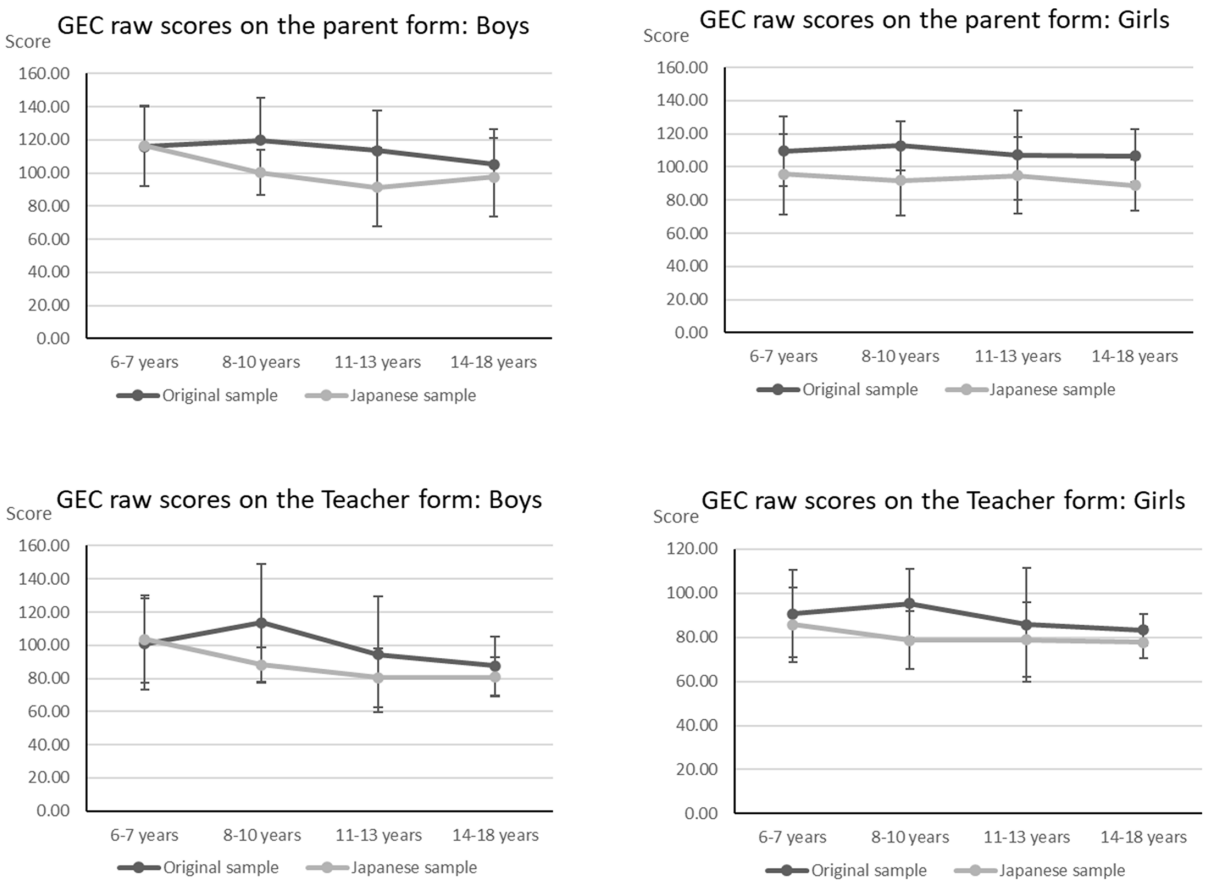

Figure 2. Means and SDs of GEC raw scores

GEC = Global Executive Composite

and the Teacher Form rating for girls aged 6–7 years (t = 0.19, n.s.) (see Figure 2).

Discussion

The present study shows that the Japanese translation of the BRIEF demonstrated adequate reliability and validity, which was the same as in the original BRIEF. The results of this study imply that it is possible to use the Japanese translation of the BRIEF to measure executive dysfunction in children in Japan. It is important that we showed the same factor structure for the major as original sample. In this study we proved The Japanese translation of the BRIEF was available for the major of executive function for Japanese children as American children though the data of this study was limited population. The next step we need is developing this study to gather randomized samples on demographics.

However, there are differences between the Japanese sample and the original American sample. The reasons for these differences could include cultural variations in response style and in Japanese executive function itself. Lower Japanese GEC scores than in their American counterparts may indicate that Japanese people tend to prefer to use the midpoint of the rating scale. The BRIEF is a questionnaire in which parents or teachers estimate a child's executive function using three points: 1 corresponding to *Never*, 2 corresponding to *Sometimes*, and 3 corresponding to *Often* (Gioia et al., 2000). Japanese people were more likely than those in other countries, including Americans, to use the midpoint of the scale (Chen, Lee, & Stevenson, 1995; Heine, Kitayama, & Lehman, 2001; Stening, & Everett, 1984). In the context of Japanese culture, *Never* may be used to indicate the midpoint in this questionnaire. It may appear that Japanese people are more likely to think that "my son/daughter's behavior is never a problem" than Americans. Thus, Japanese tend to provide lower ratings than Americans.

Furthermore, Emotional Control in students aged

6–7 years was rated lower than in American students. One reason for this is that, in terms of virtue, it may be important for Japanese children to control their emotions from a very young age, as Chen et al. (1995) showed. Another reason concerns differences in development of executive function itself in Japanese children. Japanese children grow up learning that they should behave politely. They may learn this from a younger age than American children and may behave less impulsively even though they are quite young.

Finally, the BRIEF is standardized and validated to convert raw scores to T scores (Gioia et al., 2000). It is clear that there are cross-cultural differences between the Japanese and the original sample. Therefore, T scores of the BRIEF translated into Japanese should be adapted to the Japanese population. If these cultural differences are not adjusted for, most cases of executive dysfunction in Japanese children will not be diagnosed. Adaptation of the BRIEF into Japanese should consider the benefits to and welfare of Japanese children.

Conclusion

We found significant differences in the BRIEF between the Japanese and the original samples. There could be several reasons for these differences, including the cultural aspect that Japanese people tend to provide lower ratings than Americans. Our findings therefore suggest that the BRIEF needs to be adapted to Japanese children.

This study has several limitations. First, the participants in this study were not representative of Japanese children because the sample was gathered from a limited number of schools in the Kanto area in Japan, even though the manual of the BRIEF (Gioia et al., 2000) stated that the goal of the sampling procedure of standardization was to approximate the population of the United States according to key demographic variables: gender, socioeconomic status, age, ethnicity, and geographical population. The next study we need is to though the Japanese sample of this study show the same factor structure for the major as the American sample.

However, according to Beaton, Bombardier, Guillemin, and Ferraz (2000), there are guidelines for the process of cross-cultural adaptation of measures. The process include six stages: 'initial translation', 'synthesis of the translation', 'back translation', 'expert committee', 'test of the prefinal version', and 'submission of documentation to the developers or coordinating committee for appraisal of the adaptation process'. Our study covered part of the fifth stage: 'test of the prefinal version'. Beaton et al. (2000) also recommended pretesting, which requires data from 30 to 40 people completing the questionnaire to probe into how respondents understand the items, as the fifth stage of adaptation. It is certain that our research is adequate to probe the necessity of adaptation in Japanese children.

Second, we did not have any clinical samples in this research. The ability of the BRIEF to discriminate among clinical samples was reported by Gioia et al. (2000). The BRIEF is very useful in assessing the clinical executive function of children with ADHD (Colomer, Berenguer, Roselló, Baixauli, & Miranda, 2017; Keenan, Clark, Holubkov, Cox, & Ewing-Cobbs, 2018; Miranda, Berenguer, Roselló, Baixauli, & Colomer, 2017; Qian et al., 2017), autism spectrum disorder (Høyland et al., 2017; Miranda et al., 2017; Torske, Nærland, Øie, Stenberg, & Andreassen, 2017), and traumatic brain injury (Dollman, Figaji, & Schrieff-Elson, 2017; Ganesalingam et al., 2011; Keenan et al., 2018; Kurowski et al., 2018; Potter et al., 2011; Vander Linden et al., 2018). Our future goal is to provide a useful way of assessing child ED. Therefore, it will be necessary to explore the validity of the BRIEF in a variety of Japanese clinical samples in the next step of this research.

An implication of this study is that we showed the validity and reliability of the Japanese translation of the BRIEF. The BRIEF could be an important tool to assess child ED. It would be a useful aid in performing interventions for child ED. Another significant implication is that it suggests the necessity of cultural adaptation for neuropsychological assessments. Most multicultural assessments that are published only add a translation into another language. This might be just an initial translation, considering that there are six stages in the process of cross-cultural adaptation of measures (Beaton et al., 2000). A tool that one wishes

to use in another country and another language requires not only adaptation for translation but also cultural adaptation (Beaton et al., 2000). Not only the BRIEF, but all neuropsychological assessments should be considered for cultural adaptation in the future.

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