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Reliability and validity of the Japanese version of the Obsessive-Compulsive Inventory-Revised (OCI-R)

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Abstract

The objective of the present study was to investigate the factor structure, and the reliability and validity of the Japanese version of the Obsessive-Compulsive Inventory-Revised (OCI-R). The participants included 214 university students enrolled at two universities in a metropolitan area. They completed the OCI-R and other related scales, and of these, 38 students answered the OCI-R again two weeks later. Based on a factor analysis, the six-factor structure, the same as the original version, was confirmed. For reliability, internal consistency and test-retest reliability were evaluated and both internal consistency and test-retest reliability were confirmed. For convergent validity, we calculated the correlation coefficient using the Japanese version of the Maudsley Obsessional-Compulsive Inventory, which measures obsessive-compulsive symptoms. For concurrent validity, we calculated the correlation coefficient using the Patient Health Questionnaire-9, which measures depressive symptoms; and the Generalized Anxiety Disorder-7, which measures anxiety symptoms. Overall, the factor structure, the reliability, and the validity of the Japanese version of the OCI-R were all confirmed in this study. In the future, we will investigate whether the same results can be obtained in clinical groups.

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Introduction

Obsessive-compulsive disorder (OCD) is characterized by a preoccupation with repeated obsessions that are unrelated to intention, as well as compulsions that are performed to relieve the discomfort and anxiety caused by the obsessive ideas. According to a survey from the World Health Organization, OCD is ranked as one of the 10 most disabling disorder (Michaud et al. 2006). The treatment methods for OCD, which have been verified to be effective, include pharmaceutical therapy with antidepressants, such as Selective Serotonin Reuptake Inhibitors, and Cognitive Behavioral Therapy, mainly exposure and response prevention that has been recognized with strong evidence on its effectiveness.

Typical Obsessive-compulsive (OC) symptoms include washing and checking; however, the severity of each of these dimensions differs among individuals. Compared to other psychiatric disorders, there have been greater advancements in the understanding of OCD, particularly on a physiological basis. For example, extensive neuroimaging studies have been actively conducted (Gilbert et al. 2008; Hirose et al. 2016; Koch et al. 2012; Yagi et al. 2016). Previous studies suggested that many areas in the brain were related to OCD; however, because symptoms vary extensively across patients, the possibility that different dimensions are related to different neural pathways has been proposed (Mataix-Cols et al. 2004). Evaluating and investigating OC symptoms based on different dimensions can help bring a greater understanding of the actual pathological condition of OCD.

The symptom checklist of the Yale-Brown Obsessive Compulsive Scale (Y-BOCS) (Goodman et al. 1989) and the Dimensional Yale-Brown Obsessive-Compulsive Scale (DY-BOCS) (Rosario-Campos et al. 2006) are available for the evaluation of OC symptoms. Also, the Obsessive-Compulsive Inventory (OCI) (Foa et al. 1998) is available for assessing the severity of the OC symptoms; however, it is different from the other scales. The OCI is a self-administered scale, and it can be used for both patients and healthy individuals, while the Y-BOCS and the DY-BOCS are interview-rating scales, developed for assessing OC symptoms among patients. In addition, compared to the Y-BOCS and the DY-BOCS, the OCI is expected to be used as a more comprehensive evaluation tool with the following advantages: it does not require interviewers to undergo special training, it can be used to assess obsessive thoughts and behaviors in the general population, and it allows for the measurement of the severity of each of the subscales of symptomatic dimensions that include Washing, Checking, Doubting, Ordering, Obsessing, Hoarding, and Neutralizing (Ishikawa et al. 2014). However, because the number of items included in each of the OCI subscales varies, it is difficult to identify which OC symptoms are the main symptoms. Therefore, Foa et al. (2002) developed the Obsessive-Compulsive

Inventory-Revised (OCI-R) by performing revisions, such as simplifying the subscale scoring and reducing duplication across the subscales. Currently, the OCI-R is the most widely used self-administered scale for OCD studies worldwide, including neuroimaging studies (Gilbert et al. 2008; Hirose et al. 2016; Koch et al. 2012; Yagi et al. 2016) Although the reliability and validity of the Japanese version of the OCI have been confirmed (Ishikawa et al. 2014), there have been no studies regarding the reliability and validity of the Japanese version of the OCI-R. The OCI-R has 18 questions, is easy for therapists to use, and places a little burden on patients compared to the OCI. Therefore, an investigation of the reliability and validity of the Japanese version of the OCI-R is needed for promoting advanced biological and clinical research of OCD in Japan. Therefore, we investigated the factor structure, and the reliability and validity of the Japanese version of the OCI-R.

Methods

Participants

A questionnaire survey was administered to 254 university students enrolled at two universities in a metropolitan area. The survey was conducted from mid-October through late October, 2016. Excluding incomplete responses, a total of 214 responses from the participants (106 men and 108 women, average age = 19.95 ± 1.21 years) were used for analysis. Of these, 38 participants (18 men and 20 women, average age = 20.18 ± .98 years) were available for follow-up and provided responses to the Japanese version of the OCI-R two weeks after the initial survey. Participation was voluntary, and no payment or course credits were offered.

Materials

Demographic Data

Data on age, sex, and faculty were obtained. We asked for the last five digits of each participant's mobile phone number to confirm the identification of participation to ensure the reliability of re-assessment.

Japanese Version of the OCI-R

The OCI-R, used for the assessment of the severity of OC symptoms, was developed by Foa et al. (2002) as a revised version of the OCI (Foa et al. 1998). There are 18 items, including "I check things more often than necessary" and "I wash my hands more often and longer than necessary." It is made up of six subscales, including Washing, Checking, Ordering, Obsessing, Hoarding, and Neutralizing. We

extracted 18 items from the Japanese version of the OCI (Ishikawa et al. 2014), which were same as the original OCI-R, and we used these 18 items as the Japanese version of the OCI-R. Translation procedure would be found in Ishikawa et al. (Ishikawa et al. 2014). Scores are calculated using a five-point scale [Not at all (0 point) to Extremely (4 points)].

Maudsley Obsessional-Compulsive Inventory (MOCI)

The MOCI (Hodgson and Rachman 1977) is a self-administered scale that measures OC symptoms. It consists of 30 yes/no questions. A total score and one for each of the four subscales (Checking, Cleaning, Slowness, and Doubting) are calculated. Yoshida et al. 1995verified the reliability and validity of the Japanese version. We used the MOCI to examine the convergent validity. On the basis of the previous study (Foa et al. 2002; Hajcak et al. 2004), we expected to find the strong positive correlation between the OCI-R and the MOCI.

Patient Health Questionnaire-9 (PHQ-9)

The Japanese version of the PHQ-9 is a simplified assessment tool related to major depressive disorder (Muramatsu et al. 2007). Responses were scored using a four-point scale [Not at all (0 point) to Nearly every day (3 points)], and a total score was calculated (0–27 points). We used the PHQ-9 to check concurrent validity. On the basis of the previous study (Foa et al. 2002; Ghassemzadeh et al. 2011; Hajcak et al. 2004), we expected to find moderate to strong positive correlation between the OCI-R and the PHQ-9.

Generalized Anxiety Disorder-7 (GAD-7)

The Japanese version of the GAD-7 is a simplified assessment tool for generalized anxiety disorder (GAD) (Muramatsu et al. 2010). Responses were scored as scored using a four-point scale [Not at all (0 point) to Nearly every day (3 points)], and a total score was calculated (0–21 points). We used the GAD-7 to check concurrent validity. On the basis of the previous study (Sica et al. 2009; Woo et al. 2010), we expected to find the moderate positive correlation between the OCI-R and the GAD-7.

Procedure

The questionnaires for the survey were filled out anonymously. After obtaining approval from the lecturers, the questionnaires were distributed during or after the lectures at universities and collected on the same day. Of these, 35 participants, who were confirmed to be the same individuals based on the last five digits of their mobile phone number, were followed up two weeks later for a second survey.

Statistical Analysis

SPSS (Ver. 22.0) and AMOS (Ver. 22.0) were used to perform statistical analyses. We performed confirmatory factor analysis to confirm the factor structure. We used the criteria recommended by Vandenberg and Lance (2000) (Root Mean Squared Error of Approximation [RMSEA] $\leq .08$, Tucker-Levis index [TLI] $\geq .90$, Standardized Root Mean Square Residual [SRMR] $\leq .15$, and Comparative Fit Index [CFI] $\geq .90$). For the reliability, internal consistency and test-retest reliability were investigated. For the validity, convergent validity and concurrent validity were investigated by calculating Pearson product-moment correlation coefficient. We used the Cohen's criteria criteria to determine the degree of correlation, considering $|r| \geq .50$ as strong correlation, $|r| \geq .30$ as moderate correlation, and $|r| \geq .10$ as weak correlation (Cohen 1988).

Results

Confirmatory Factor Analysis

A confirmatory factor analysis was performed using a hypothetical model with the same six factors as the original version and items corresponded to each factor. The results showed that fit index were χ^2 (120) = 248.29 ($p < .01$), RMSEA = .07, TLI = .87, SRMR = .06, and CFI = .90. Based on the relevance criteria adopted by Vandenberg & Lance (Vandenberg and Lance 2000), the values we obtained were generally within a permissible range (Fig. 1). It can, therefore, be concluded that the same six factors are valid as in the original version.

Internal Consistency

Cronbach's α coefficient was calculated to determine the internal consistency, and the overall internal consistency was high at $\alpha = .87$. The results of each of the subscales were as follows: Washing, $\alpha = .77$; Checking, $\alpha = .74$; Ordering, $\alpha = .63$; Obsessing, $\alpha = .83$; Hoarding, $\alpha = .60$; and Neutralizing, $\alpha = .49$. Although some subscales such as Ordering, Obsessing, and Hoarding showed lower values than the values reported by Foa et al. (2002), the overall values for internal consistency were favorable.

Test-Retest Reliability

The interclass correlation coefficient (ICC $_{[2, 1]}$) was calculated to exmine the test-retest reliablity. The results showed that the total ICC score was high at .86 (confidence interval [CI]: .75–.93). In the subscales, the ICC values for Checking, Obsessing, Washing, Ordering, Neutralizing, and Hoarding

Fig. 1 Result of confirmatory factor analysis of the Japanese version of the OCI-R
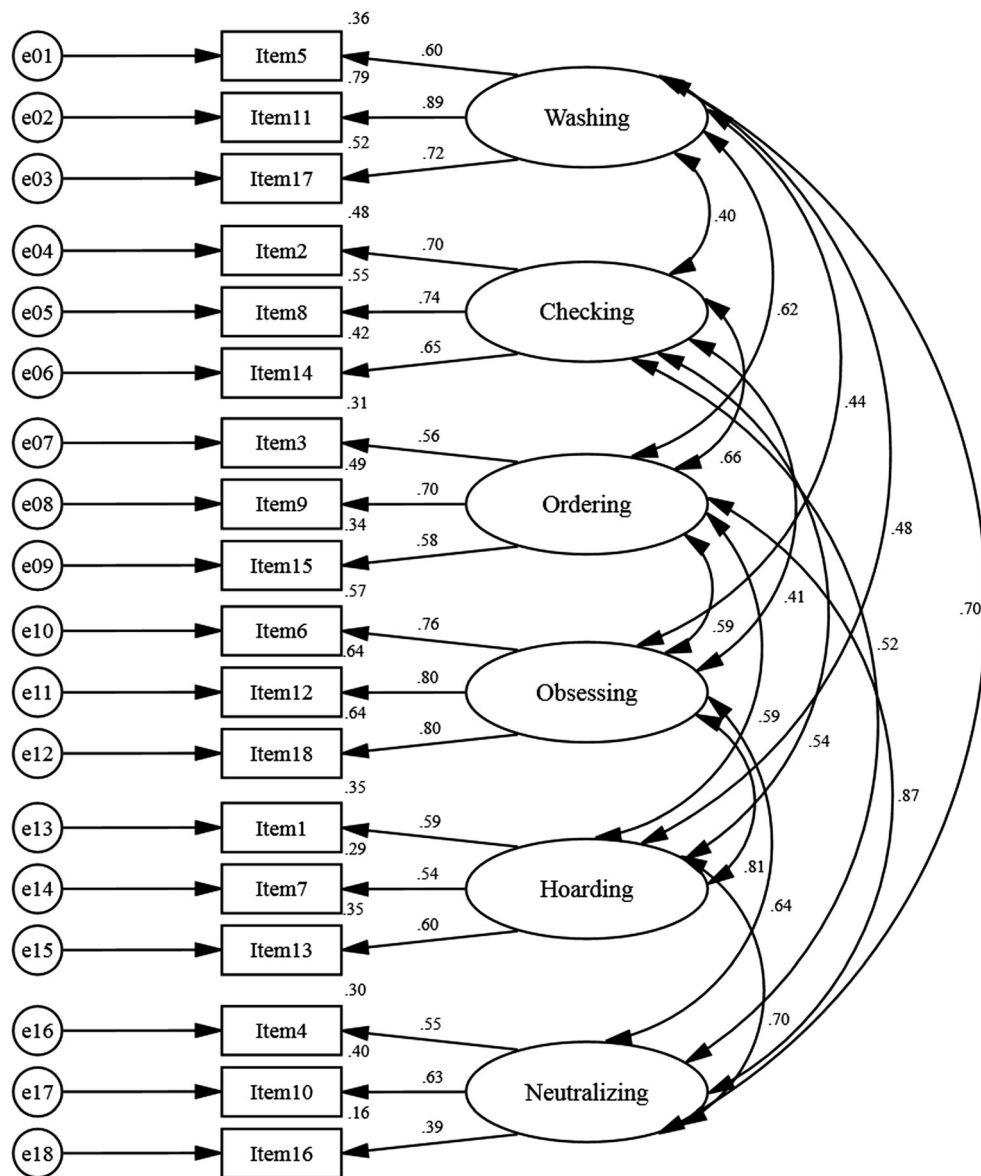
were .74 (CI: .55–.86), .86 (CI: .75–.93), .81 (CI: .66–.89), .89 (CI: .79–.94), .41 (CI: .11–.64), and .86 (CI: .74–.92), respectively. These values were generally considered favorable.

Convergent and Concurrent Validity

Regarding the convergent validity, the total score of the OCI-R showed a strong positive correlation with the total score of the MOCI ($r = .67$). In addition, as for the concurrent validity, the total score of the OCI-R was strongly positively correlated with the total score of the PHQ-9 and the total score of the GAD-7 ($r = .53$; $r = .61$). These results are shown in Table 1.

Discussion

The objective of the present study was to investigate the factor structure, and the reliability and validity of the Japanese version of the OCI-R. The Japanese version of the OCI-R was determined to have the same six-factor structure as the original version, and adequate reliability was demonstrated with favorable values for internal consistency and test-retest reliability. In agreement with the previous studies (Foa et al. 2002; Fullana et al. 2005; Hajcak et al. 2004; Woo et al. 2010), the Cronbach's α of the Neutralizing subscale was lower than that of the other subscales. Previous studies suggested that the modification of the Neutralizing subscale might be needed, because these three items in this subscale seem to be

Table 1 Correlations between the OCI-R and other measures

			Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1.	OCI-R	Total	18.87	11.00	–													
2.		Washing	2.26	2.62	.68**	–												
3.		Checking	3.69	2.73	.67**	.33**	–											
4.		Ordering	3.14	2.44	.74**	.45**	.46**	–										
5.		Obsessing	3.86	3.16	.76**	.34**	.33**	.44**	–									
6.		Hoarding	4.39	2.57	.72**	.33**	.37**	.37**	.57**	–								
7.		Neutralizing	1.54	1.96	.70**	.45**	.33**	.50**	.44**	.39**	–							
8.	MOCI	Total	9.85	4.58	.67**	.52**	.54**	.42**	.49**	.40**	.49**	–						
9.		Checking	3.02	2.02	.61**	.31**	.63**	.41**	.47**	.38**	.41**	.81**	–					
10.		Cleaning	2.74	2.04	.43**	.64**	.18*	.24**	.27**	.19**	.35**	.71**	.31**	–				
11.		Slowness	2.44	1.29	−.13	.02	.00	−.07	−.29**	−.24**	.08	.10	−.18**	.22**	–			
12.		Doubting	3.24	1.46	.56**	.25**	.45**	.34**	.46**	.50**	.36**	.75**	.61**	.28**	−.13	–		
13.	PHQ-9	Total	7.74	5.99	.53**	.23**	.23**	.33**	.59**	.48**	.34**	.42**	.42**	.18**	−.27**	.45**	–	
14.	GAD-7	Total	4.83	4.97	.61**	.28**	.40**	.36**	.68**	.49**	.32**	.54**	.55**	.24**	−.26**	.51**	.74**	–

OCI-R Japanese version of the OCI-R, *MOCI* Japanese version of the Maudsley Obsessional-Compulsive Inventory, *PHQ-9* Patient Health Questionnaire-9, *GAD-7* Generalized Anxiety Disorder-7

**$p < .01$, *$p < .05$

heterogeneous (Abramowitz and Deacon 2006; Foa et al. 2002; Fullana et al. 2005; Gönner et al. 2008; Hajcak et al. 2004; Woo et al. 2010). For example, item 4 ("I feel compelled to count while I am doing things") and item 10 ("I feel I have to repeat certain numbers") are asking about the counting coumpulsions or behaviors, while item 16 ("I feel that there are good and bad numbers") is asking about superstitious thinking, which may be more common in non-clinical samples rather than counting compulsions or behaviors. In our study, average score of item 4 and item 10 were .47 (SD = .89) and .29 (SD = 72), while average score of item 16 was .79 (SD = 1.13). In fact, item 16 showed the lowest multiple correlation coefficients ($R^2 = .08$), and Cronbach's α of the Neutralizing subscale was improved after removing item 16 ($\alpha = .51$). Therefore, replacing item 16 to more overt counting compulsions or behaviors might resolve the heterogeneity in this subscale, although it is important to note that low internal consistency of the Neutralizing subscale could be specific for non-clinical samples (Foa et al. 2002; Fullana et al. 2005).

In terms of convergent validity, correlation with the MOCI was examined. The result showed a strong positive correlation between the total scores of the Japanese version of the OCI-R and the MOCI. As the strong positive correlation was also observed between the total score of the Japanese version of the OCI and the MOCI (Ishikawa et al. 2014), it is believed that the revised version also have equivalent convergent validity. In terms of concurrent validity, the correlations between the total scores of the Japanese version of the OCI-R and the PHQ-9, and the Japanese version of the OCI-R and the GAD-7, were calculated. As a result, strong positive correlations were shown. Previous studies have also reported strong

correlations with depressive symptoms (Foa et al. 2002; Hajcak et al. 2004), suggesting a strong association with depressive episodes, which are often observed in patients with OCD. The correlation between the Japanese version of the OCI-R and the GAD-7 was relatively high. As Gönner et al. (2008) mentioned, the high correlations between negative feeling and OC symptoms would be found in the sample of patients diagnosed with comorbid OCD and depression or anxiety disorders than in the samples of patients with OCD alone. In our study, the participants were non-clinical samples, and their average score of the Japanese version of the OCI-R was not high relative to OCD patients. Therefore, we could not find distinguishing characteristics regarding OC symptom, and the correlation between OC symptoms and anxiety might be relatively high. Despite the unexpected strong correlation between OC symptoms and anxiety, we confirmed that the Japanese version of the OCI-R has adequate validity.

One of the limitations of the present study was that the analyses were performed in healthy university students instead of patients with OCD. The participants' age were between 18 and 25 years, and most of them were between 19 and 21 years. The psychometric properties of the Japanese version of the OCI-R need to be examined in various age samples in the future. In addition, further studies are needed to investigate differences in the profiles and continuity of obsessive symptoms between clinical and non-clinical groups using the Japanese version of the OCI-R. Establishing a cut-off value is expected to increase the utility of the Japanese version of the OCI-R in research and clinical settings in Japan. Finally, although this study showed important information about the cross-cultural validation of the OCI-R, our aim was not to

compare the differences of OC symptoms among different countries. Further research comparing multiple cultural group could help to identify the cultural differences in OC symptoms.

Conclusions

The Japanese version of the OCI-R has the same factor structure as the original one, and it has a good reliability and an adequate validity. Our results showed that it is a reliable and valid instrument to measure OC symptoms among Japanese population.

Authors' Contributions Study concept and design: HK and AN. Acquisition of data: HK and FO. Statistical analysis and interpretation of data: HN and AT. Drafting of the manuscript: HK. Critical revision of the manuscript: AT, YH, YS, OK, RI and AN. Study supervision: YH, FO, KA, YS, OK, RI, ES and AN. All authors read and approved the final manuscript.

Compliance with Ethical Standards

Ethical Approval   The research protocol was approved by the institutional review board of the Graduate School of Medicine, Chiba University, Japan (No.2273).

Ethics, Consent and Permissions   The purposes of the study and the ethical consideration for the participants (e.g., rights to drop out during the study; confidentiality of their information and management of data anonymously) were explained to the participants. All participants had given informed consent to be included in the study.

Conflict of Interest   The authors report no conflicts of interest in this work.

Abbreviations   *CFI*, comparative fit index; *CI*, confidence interval; *DY-BOCS*, Dimensional Yale-Brown Obsessive-Compulsive Scale; *GAD-7*, Generalized Anxiety Disorder-7; *ICC*, interclass correlation coefficient; *MOCI*, Maudsley Obsessional-Compulsive Inventory; *OC*, Obsessive-compulsive; *OCD*, Obsessive-compulsive disorder; *OCI*, Obsessive- Compulsive Inventory; *OCI-R*, Obsessive-Compulsive Inventory-Revised; *PHQ-9*, Patient Health Questionnaire-9; *RMSEA*, root mean squared error of approximation; *SD*, standard deviation; *SRMR*, standardized root mean square residual; *TLI*, Tucker-Levis index; *Y-BOCS*, Yale-Brown Obsessive Compulsive Scale (Y-BOCS)

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