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Factor structure and validation of the Japanese version of the Gambling Symptom Assessment Scale (GSAS-J)

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Abstract

The Gambling Symptom Assessment Scale (GSAS) is a 12-item self-rated measure designed to assess gambling symptoms. This study was designed to translate the GSAS into Japanese and to examine the factor structure and validity of the Japanese version of the GSAS (GSAS-J) for a Japanese sample population. We examined the measurement invariance in the GSAS-J between a probable disordered and a non-disordered gambling sample. Seven hundred and seven participants (380 men, 327 women; mean age = 48.41, *SD* = 10.79) living in Japan were recruited online and included in the analyses. Confirmatory factor analysis results indicated that the GSAS-J factor structure (one-factor structure model) was appropriate for the data ($\chi^2(48) = 195.49$, $p < .05$; CFI = .927; RMSEA = .066; SRMR = .036). Results of multi-group confirmatory factor analysis indicated that the GSAS-J demonstrated strong factorial invariance between probable disordered gamblers and non-disordered gamblers. The Cronbach α coefficient was .96 for the total scale. Good concurrent validity was found for the GSAS-J in relation with other variables: the Kruskal-Wallis *H* test showed severe and extreme gamblers spent more days and much more money than those of moderate or mild gamblers, and the GSAS-J was significantly correlated with South Oaks Gambling Screen ($r = .57$), Gambling Related Cognitions Scale ($r = .71$), and Gambling Urge Scale ($r = .72$). Furthermore, *t*-test results indicated significant gender differences in GSAS-J scores. These results indicate GSAS-J is a valid measure for assessing gambling symptoms in Japanese sample populations.

Keywords: gambling, scale, confirmatory factor analysis, validity, internal consistency

Résumé

La Gambling Symptom Assessment Scale (GSAS) (échelle d'évaluation des symptômes du jeu pathologique) est une mesure d'auto-évaluation en 12 points, conçue pour évaluer les symptômes du jeu. Cette étude visait à traduire le GSAS en japonais et à examiner la structure factorielle et la validité de la version japonaise du

GSAS (GSAS-J) pour un échantillon de population japonaise. Nous avons examiné l'invariance des mesures du GSAS-J entre un échantillon de jeu problématique probable et un échantillon de jeu non problématique. Sept-cent-sept participants (380 hommes, 327 femmes; âge moyen = 48,41, *SD* = 10,79) vivant au Japon ont été recrutés en ligne et inclus dans les analyses. Les résultats de l'analyse factorielle confirmatoire ont indiqué que la structure factorielle du GSAS-J (modèle de structure à un facteur) était appropriée pour les données ($\chi^2(48) = 195{,}49$, $p < 0{,}05$; CFI = 0,927; RMSEA = 0,066; SRMR = 0,036). Les résultats de l'analyse factorielle confirmatoire multi-groupes ont indiqué que le GSAS-J démontrait une forte invariance factorielle entre les joueurs probablement pathologiques et les joueurs non pathologiques. Le coefficient de Cronbach α était de 0,96 pour l'échelle totale. Une bonne validité convergente a été trouvée pour le GSAS-J en fonction de relation avec d'autres variables: Test Kruskal-Wallis *H* – le groupe de joueurs montant de graves et à très graves symptômes du jeu a passé plus de jours et dépensé beaucoup plus d'argent que les joueurs des groupes ayant des symptômes modérés ou légers; analyses de corrélation – South Oaks Gambling Screen ($r = 0{,}57$), échelle des cognitions liées au jeu (Gambling Related Cognitions Scale) ($r = 0{,}71$) et échelle de jeu compulsif ($r = 0{,}72$). En outre, les résultats du *test de Student* indiquaient des différences significatives entre les sexes dans les scores GSAS-J. Ces résultats indiquent que le GSAS-J est une mesure valable pour évaluer les symptômes du jeu dans les échantillons de la population japonaise.

Introduction

The lifetime prevalence of gambling disorder (previously designated as pathological gambling) in people who speak English and other European languages has thus far been reported as 0.8–1.2% (Stucki & Rihs-Middel, 2007). In Japan, although no epidemiological research has been reported, non-epidemiological research for a community sample revealed that approximately 8.0% of participants were classifiable as probably maintaining a gambling disorder (Kato & Goto, 2017). Sato (2008) reported that many patients with gambling disorder in Japan received no medical care or psychological support. Moreover, the people and their families must confront gambling-related difficulties such as financial, legal, and occupational hardships. Insufficient treatment facilities exist for such patients in Japan. Therefore many of these gamblers are unable to receive treatment (Moriyama, 2008).

Furthermore, few reports have described studies of psychological treatment for gambling disorder patients in Japan. In consideration of the current situation in Japan and to support these patients in the country, a need exists for more research into gambling disorder using clinical trials and observational studies. Therefore, a valid patient-reported questionnaire must be made available to assess gambling

symptoms as a necessary preliminary step toward any study, and particularly for cross-sectional and correlative studies.

For non-clinical studies, the Gambling Symptom Assessment Scale (GSAS; Kim, Grant, Potenza, Blanco, & Hollandar, 2009) has been used recently as an outcome measure for people with gambling-related difficulties. It has also been used in clinical studies for gambling disorders. In two publicly available study protocols of a psychological treatment program for disordered gambling (Merkouris et al., 2017; Thomas et al., 2015), the GSAS was used as the primary outcome measure. The GSAS is a 12-item self-rated scale designed to assess gambling symptoms: urges, thoughts, gambling behavior, excitement, distress, and personal difficulties. The GSAS is a valid tool as it shows a significant correlation ($r = .51$) with the pathological gambling adaptation version of the Yale-Brown Obsessive-Compulsive Scale (Pallanti, DeCaria, Grant, Urpe, & Hollander, 2005) and holds internal consistency (Cronbach's $\alpha = .869$). In Japan, although measures of gambling-related variables have been developed, the concepts measured, have been limited to specific domains, such as gambling urges (Tanaka et al., 2017) and gambling related cognition (Yokomitsu, Takahashi, Kanazawa, & Sakano, 2015). Furthermore, the GSAS was developed for Koreans (Kim et al., 2005) and also applied to sexual symptoms (the Sexual Symptom Assessment Scale; Raymond, Lloyd, Miner, & Kim, 2007), suggesting that it is globally useful and adaptable to various related investigations.

Given that the use of the GSAS has been crucially important as a measure of gambling symptoms in clinical and observational studies, validating this scale is consequently important to assist researchers and clinicians in assessing gambling symptom severity and changes in those symptoms during treatment. Adaptation of a Japanese version of the GSAS (GSAS-J) has been useful in evaluating gambling disorder prevention and treatment effects. Such a tool could also be used for future research in Japan and assessment of gambling treatments. Furthermore, validation of the GSAS-J can facilitate comparative studies targeted at English-speaking or Korean-speaking populations.

Therefore, the current study examines the factor structure and validity of the GSAS-J in a sample Japanese population obtained online, and investigates measurement invariance in the GSAS-J between a probable disordered and a non-disordered gambling sample. We hypothesized that the GSAS-J had a one-factor model. To validate the GSAS-J, we used the Kruskal-Wallis H test to compare gambling behavior scores among four groups (GSAS-J mild symptom group, GSAS-J moderate symptom group, GRCS-J severe symptom group, and GRCS-J extreme symptom group). Then we calculated the Pearson's product-moment correlation coefficients between the GSAS-J and the other gambling variables. Results of an earlier study (Kim et al., 2009) suggest that we might find significant differences in gambling behaviors (number of days and amounts of money used in the prior month) among a GSAS-J mild symptom group, moderate symptom group, severe symptom group, and extreme symptom group. In addition, earlier studies suggested that individuals who had more severe gambling symptoms tended to have higher SOGS (Kim et al., 2009),

GRCS (Yokomitsu et al., 2015), and GUS (Tanaka et al., 2017) scores. We expected to find positive moderate associations between the GSAS-J and the South Oaks Gambling Screen-Modified Japanese version (SOGS-J; Saito, 1996) because the SOGS-J mainly measured gambling-related difficulties such as debt load, chasing, lying, and negative consequences. We also anticipated finding positive strong associations between the GSAS-J and the Japanese version of the Gambling Related Cognitions Scale (GRCS-J) or the Japanese version of the Gambling Urge Scale (GUS-J).

Method

This study was conducted in accordance with the COSMIN checklist (Mokkink, et al., 2010), following detailed guidelines of the preferred reporting style for the development of patient-reported outcome measures (de Vet, Terwee, Mokkink, & Knol, 2011).

Participants

One thousand Japanese residents aged 20 and older were recruited during November 10–14, 2017 through online survey panels of a major Japanese Internet survey company (Rakuten Research, Inc., Tokyo, Japan). From these recruited individuals, 268 were excluded because they had no gambling participation during the prior 12 months. Data of 707 participants with no missing values were used for final data analyses (response rate = 96.6% (707 / 732)).

Procedure

A website was created for this online study. Participants who registered with the Internet survey panels were recruited to participate in an online study presented as "behavior and cognition about gambling in daily life." Before research participation, each potential participant interested in this online advertisement was given an explanation on the web screen to support informed consent for study participation. The explanation emphasized voluntary participation in the study. Completion of the Internet survey was regarded as consent to participate in the research because the online survey was anonymous. For this study, obtaining a large sample of patients with gambling disorder at treatment facilities would be difficult because such persons do not receive medical care or psychological treatment in Japan (Sato, 2008). Therefore, an online survey was determined to be beneficial for recruiting numerous participants to ensure an adequate sample size. Earlier studies suggest that online surveys have comparable validity to traditional data sampling methods (Gosling, Vazire, Srivastava, & John, 2004).

Measures

Demographics. Participants were asked questions related to gender, age, education level, annual income, and marital status.

Gambling behavior in the previous month. Participants were requested to report the number of days they had gambled during the prior month ("How many days did you gamble in the prior month?") and the amount of money they had spent on gambling ("How much did you spend on gambling during the prior month? You need not give data about the income or expenditures related to gambling but on money that you used.")

Japanese version of the Gambling Symptom Assessment Scale (GSAS-J; see Appendix). The GSAS (Kim et al., 2009) is a 12-item self-rated scale designed for broad assessment of gambling symptoms during the prior week: urges, thoughts, gambling behavior, excitement, distress, and personal trouble. Translation for this study was conducted in accordance with the ISPOR task force (Wild et al., 2005). First, forward translation from the source language into Japanese was performed independently by two authors (KY and EK). A professional English translator who was English/Japanese bilingual blind to the original GSAS then translated the provisional GSAS-J back into English. The two English versions of the GSAS (original and back-translated versions) were reconciled by KY and EK. Discrepancies between these English versions of the GSAS were slight. Subsequently, these versions were discussed until consensus was achieved. The original author (SWK) evaluated the finalized English version of the GSAS-J and confirmed that the original meaning of each item, instruction, and response were maintained throughout the translation procedure. As with the original GSAS (Kim et al., 2009), participants responded using a 5-point Likert scale to indicate the extent to which they agreed with the values expressed in each item during the past week. Higher scores indicated severer gambling symptoms: 8–20, mild gambling symptoms; 21–30, moderate gambling symptoms; 31–40, severe gambling symptoms; 41 or more, extreme gambling symptoms (classification based on Kim et al., 2009).

The South Oaks Gambling Screen – Modified Japanese version (SOGS-J; Saito, 1996). The South Oaks Gambling Screen (SOGS; Lesieur and Blume, 1987) is a 20-item self-reported measure that assesses gambling-related difficulties: (1) debt burden, (2) chasing, (3) lying, (4) negative consequences from gambling, and (5) interpersonal trouble. The SOGS produces a score of 0–20. This study assessed gambling-related difficulties for the prior year. A score of 5 or more indicated probable disordered gamblers. Cronbach α in this study was high ($\alpha = 0.80$).

Japanese version of the Gambling Related Cognitions Scale (GRCS-J; Yokomitsu et al., 2015). The GRCS (Raylu & Oei, 2004a) assesses gambling-related cognition. The GRCS-J is a 23-item questionnaire designed to measure gambling-related cognition. As with the original GRCS, participants responded using a 7-point Likert scale to indicate the extent to which they agreed with the values expressed in each item. Higher scores indicated a higher number of cognitive distortions. The overall GRCS-J has good internal consistency ($\alpha = 0.94$) and good convergent validity (correlation coefficient with the SOGS-J: $r = .61$; Yokomitsu et al., 2015). In this study, the scale total demonstrated high internal consistency ($\alpha = 0.97$).

Japanese version of the Gambling Urge Scale (GUS-J; Tanaka et al., 2017). The GUS (Raylu & Oei, 2004b) assesses an individual's gambling urges. The GUS-J is a 6-item questionnaire designed to measure such urges. As with the original GUS, participants responded using a 7-point Likert scale to indicate the extent to which they agreed with the statements. Higher scores indicated stronger gambling urges. The GUS-J has good internal consistency ($\alpha = 0.88$) and good convergent validity (correlation coefficient with the SOGS-J: $r = .55$; Tanaka et al., 2017). Results of this study suggest that GUS-J holds high internal consistency ($\alpha = 0.94$).

Statistical Analysis

Analyses were conducted using software (IBM SPSS Statistics package 24.0; R Core Team). Descriptive statistics was presented as means and standard deviations for each variable. A confirmatory factor analysis was used to confirm the factor solutions of the GSAS-J. We hypothesized that the GSAS-J had a one-factor model. Because the GSAS-J items have a 5-point Likert structure (an ordinal, categorical scale), weighted least squares mean-variance (WLSMV) estimator was used. We used four fit indices (chi-square (χ^2)), comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR)). We used a "lavaan" package for conducting the confirmatory factory analysis. In addition, a multi-group confirmatory factor analysis was applied to ascertain the measurement invariance of the GSAS-J scores between a probable disordered ($5 \geqslant$ SOGS-J) and a non-disordered gambling sample (SOGS-J $\leqslant 4$). We constructed the following five restrictive models: where (1) all parameters were free (model 1, configural invariance); (2) loadings were invariant (model 2, metric invariance); (3) loadings and intercepts were invariant (model 3, scalar invariance); (4) loadings, intercepts, and residuals were invariant (model 4, measurement error variance invariance); and (5) loadings, intercepts, residuals, and factor means were invariant (model 5, factor variance invariance). For multi-group confirmatory factor analysis, we used a difference of less than .01 in the ΔCFI index (Cheung & Rensvold, 2002) as the adoption criterion for the model. Cronbach α was also used to assess the internal consistency of the GSAS-J. The concurrent validity of the GSAS-J was analyzed using the Kruskal-Wallis H test to compare gambling behaviors (number of days and amount of money in the prior month) among four groups (classification based on Kim et al. (2009): the GSAS-J mild, moderate, severe and extreme symptom groups), and calculated the Pearson's product-moment correlation coefficients between the GSAS-J and the other gambling variables (SOGS-J, GRCS-J, and GUS-J). Student t-tests were applied to compare gender differences in gambling symptoms. We used complete data in this study and did not impute missing values. For all tests, significance (two-tailed) was inferred for $p \leqslant .05$.

Results

Demographic characteristics and gambling symptoms

Table 1 presents demographic data. Table 2 shows participant gambling behaviors. Of the 707 participants, 53.7% ($n = 380$) were men and 46.3% ($n = 327$) were women.

Table 1
Participant demographics (n = 707)

Category	*n* (%)
Sex	
Males	380 (53.7%)
Females	327 (46.3%)
Age	
20–29	133 (14.7%)
30–39	123 (17.4%)
40–49	199 (28.1%)
50–59	232 (32.8%)
60–69	120 (17.0%)
Occupation	
Business manager/administrator	146 (16.5%)
Office worker (managerial level job)	172 (10.2%)
Office worker (clerical job)	144 (20.4%)
Office worker (technical job)	159 (18.3%)
Office worker (selling profession)	146 (16.5%)
Office worker (manufacturing/labor)	125 (13.5%)
Office worker (service job)	155 (17.8%)
Freelance profession/specialist	152 (17.4%)
Self-employed business	137 (15.2%)
Student	142 (10.3%)
Full-time homemaker	184 (11.9%)
Unemployed/retirement	168 (19.6%)
Other	117 (12.4%)
Education	
Elementary and junior high school	119 (12.7%)
High school (equivalent test)	171 (24.2%)
Two-year and career college	143 (20.2%)
Four-year college	345 (48.8%)
Graduate school	129 (14.1%)
Annual income	
< 1,000,000 JPY	124 (17.5%)
1,000,000–1,999,999	158 (18.2%)
2,000,000–2,999,999	164 (19.1%)
3,000,000–3,999,999	178 (11.0%)
4,000,000–4,999,999	180 (11.3%)
5,000,000–5,999,999	174 (10.5%)
6,000,000–6,999,999	162 (18.8%)
7,000,000–7,999,999	128 (14.0%)
8,000,000–8,999,999	144 (16.2%)
9,000,000–9,999,999	120 (12.8%)
>= 10,000,000	175 (10.6%)
Family status (multiple answers allowed)	
Living alone	170 (24.0%)
Spouse	407 (57.6%)
Mother or father	127 (18.0%)
Child	246 (34.8%)
Grandmother or grandfather	148 (11.1%)
Grandchild	145 (10.7%)
Marital status	
Married	416 (58.8%)
Divorced and/or bereaved	467 (59.5%)

Table 2
Participant gambling behavior

Gambling measure	Number of days at 1 month	Amount of money at 1 month (JPY)
Total Gambling Behaviour (N = 707)	4.24 ± 5.87 (.00, 2.00, 5.00)	53285.84 ± 238682.05 (0, 6000, 30000)
Classification by GSAS-J cut-off score		
Mild symptom (n = 435)	1.81 ± 2.88 (.00, 1.00, 3.00)	15647.59 ± 104830.91 (0, 1000, 10000)
Moderate symptom (n = 163)	5.66 ± 5.07 (2.00,14.00, 8.00)	59026.31 ± 121031.75 (10000, 30000, 50000)
Severe symptom (n = 93)	11.53 ± 8.15 (5.00, 10.00, 19.00)	196323.66 ± 564365.35 (23500, 50000, 150000)
Extreme symptom (n = 16)	13.63 ± 8.97 (6.25, 11.00, 20.00)	186687.44 ± 253744.46 (42500, 100000, 200000)
Classification by SOGS-J cut-off score		
Non-disordered gambling (n = 490)	3.22 ± 4.77 (.00, 1.00, 4.00)	42396.12 ± 265922.77 (0, 3000, 20000)
Probable disordered gambling (n = 217)	6.53 ± 7.33 (1.00, 4.00, 10.00)	77875.52 ± 158862.00 (3500, 28888, 89000)

Note. Mean ± standard deviation (25% percentile, median, 75% percentile).

The participants' mean age was 48.41 years (SD = 10.79; range = 20–69). The types of gambling in which participants were involved during the prior year were lottery 69.6% (n = 492), pachinko 49.4% (n = 492), horse racing 46.0% (n = 325), sports betting 38.5% (n = 272), pachislot 34.5% (n = 244), casinos 15.8% (n = 112), motorboat racing 15.3% (n = 108), mah-jong 14.7% (n = 104), bicycle racing 14.1% (n = 100), motorcycle racing 10.0% (n = 71), and online gambling 5.8% (n = 41). The SOGS-J scores identified 69.3% (n = 490) of participants as "non-disordered gamblers" and 30.7% (n = 217) as "probable disordered gamblers."

Moreover, the GSAS-J scores identified 61.5% (n = 435) of the participants as having "mild gambling symptoms" (GSAS-J score = 13.66 (SD = 2.50), SOGS-J score = 2.48 (SD = 1.92)), 23.1% (n = 163) as having "moderate gambling symptoms" (GSAS-J score = 25.31 (SD = 2.92), SOGS-J score = 4.08 (SD = 2.21)), 13.2% (n = 93) as having "severe gambling symptoms" (GSAS-J score = 34.78 (SD = 2.84), SOGS-J score = 6.92 (SD = 4.17)), and 2.2% (n = 16) as having "extreme gambling symptoms" (GSAS-J score = 46.69 (SD = 6.06), SOGS-J score = 10.19 (SD = 3.99). Of the total sample in each of the four categories, men represented 49.7% (n = 216), 55.8% (n = 91), 68.8% (n = 64), and 56.3% (n = 9), respectively. The gender split was even and consistent across all levels of gambling severity. Significant differences were found among the four groups for gender (χ^2 (3, n = 707) = 11.75, $p < .05$) and age (F(3, 703) = 3.155, $p < .05$; mild group -48.49 ± 10.36 years, moderate group -49.90 ± 11.60 years, severe group - 45.85 ± 10.68 years, extreme group -45.69 ± 11.88 years). Dunnett's multiple comparison test results indicated that the age of the severe group was significantly lower than that of the moderate group.

We found no significant difference among the four groups related to work category (χ^2 (36) = 31.83, p = .67), education level (χ^2 (12) = 6.48, p = .89), annual income (χ^2 (30) = 22.31, p = .84), or marital status (χ^2 (6) = 1.75, p = .94).

Examination of the GSAS-J factor structure

To assess the similarity of the GSAS-J factor structure to that of the original GSAS (Kim et al., 2009), we conducted a confirmatory factor analysis. The analysis results showed that the fit index used for this study was in the acceptable range (χ^2(48) = 195.49, $p < .05$, CFI= .927, RMSEA= .066, SRMR = .036). The path coefficients indicating the factor loading for each item were significant, 0.57–0.89 ($p < .05$). The standard error for each item was .039–.050 (Table 3).

Next, to examine the measurement invariance across a probable disordered and a non-disordered gambling sample, we applied multi-group confirmatory factor analysis to these samples. According to the model adoption criterion, Model 3 (scalar model) showed the best fit. Therefore, the GSAS-J demonstrated strong factorial invariance between probable disordered gamblers and non-disordered gamblers.

Examination of the GSAS-J internal consistency

To assess the internal consistency, we calculated Cronbach α for the overall GSAS-J scale. Cronbach α was 0.96, suggesting good internal consistency.

Examination of the GSAS-J validity

The Kruskal-Wallis *H* test and Pearson's product-moment correlation analyses were conducted to explore the concurrent validity of the GSAS-J. First, participants were separated into four groups based on their respective GSAS-J score. The four groups composed a mild symptom group (n = 435), moderate symptom group (n = 163), severe symptom group (n = 93), and extreme symptom group (n = 16). Gambling behavior differences among the four groups in the prior month were then assessed. Kruskal-Wallis *H* test results showed significant differences among the four groups: number of days, χ^2(3) = 285.58, $p < .05$; amount of money, χ^2(3) = 288.68, $p < .05$. In addition, pairwise comparisons using the Wilcoxon rank sum test revealed that severe and extreme gambling symptom group members spent more days and much more money gambling during the prior month than moderate and mild gambling symptom group members did.

We conducted correlation analyses between the GSAS-J and other gambling variables (SOGS-J, GRCS-J, and GUS-J). As expected, correlation analyses results showed that the GSAS-J score was significantly and well-correlated with the SOGS-J score (r = .57), the GRCS-J score (r = .71), and the GUS-J score (r = .72; Table 5).

Examination of gender differences for gambling symptoms in the Japanese sample

We applied t-tests to examine gender differences in the GSAS-J. The result was significant (t (705) = 3.095, $p < .05$). Our result indicated that men had more severe

Table 3
Test items, factor loadings, and Cronbach α

Item Number	GSAS - J item	GSAS original item	Factor loading	Cronbach α if item deleted*
1	この“一週間”で、ギャンブルしたいという余計な衝動に駆られた経験があったとすれば、それは平均でどのくらいの強さでしたか？	If you had unwanted urges to gamble during the past WEEK, on average, how strong were your urges?	.847	.952
2	この“一週間”のうちに、何度くらい、ギャンブルしたいという衝動に駆られましたか？	During the past WEEK, how many times did you experience urges to gamble?	.888	.951
3	この“一週間”のうちに、ギャンブルしたいという衝動で頭がいっぱいだったのは、（あわせて）何時間くらいでしたか？	During the past WEEK, how many hours (add up hours) were you preoccupied with your urges to gamble?	.818	.953
4	この “一週間” において、ギャンブルしたいという衝動をどのくらいコントロールできましたか？	During the past WEEK, how much were you able to control your urges?	.765	.953
5	この “一週間” のうちに、何度くらい、ギャンブルすることや賭け事が頭に浮かびましたか？	During the past WEEK, how often did thoughts about gambling and placing bets come up?	.845	.953
6	この “一週間” のうちに、おおよそ（あわせて）何時間くらい、ギャンブルをすることや賭け事について考えていましたか？	During the past WEEK, approximately how many hours (add up hours) did you spend thinking about gambling and thinking about placing bets?	.838	.952
7	この “一週間” のうちに、どのくらいギャンブルについての考えをコントロールできましたか？	During the past WEEK, how much were you able to control your thoughts of gambling?	.770	.953
8	この “一週間” の合計で、おおよそ何時間くらいを、ギャンブルあるいはギャンブルにつながる活動に費やしましたか？	During the past WEEK, approximately how much total time did you spend gambling or on gambling related activities?	.817	.953
9	この“一週間”の平均で、ギャンブルする直前の緊張や興奮をどの程度感じましたか？もしギャンブルしなかったとしても、したと仮定して、どのくらいの緊張や興奮を感じたであろうかを想像してお答えください。	During the past WEEK, on average, how much anticipatory tension and/or excitement did you have shortly before you engaged in gambling? If you did not actually gamble, please estimate how much tension and/or excitement you believe you would have experienced, if you had gambled.	.851	.951
10	この“一週間”の平均で、ギャンブルで勝ったことによる興奮や喜びをどの程度感じましたか？ギャンブルで勝つことはなかったとしても、あったと仮定して、どのくらいの興奮や喜びを感じたであろうかを想像してお答えください。	During the past WEEK, on average, how much excitement and pleasure did you feel when you won on your bet. If you did not actually win at gambling, please estimate how much	.792	.953

Table 3 Continued.

Item Number	GSAS - J item	GSAS original item	Factor loading	Cronbach α if item deleted*
		excitement and pleasure you would have experienced, if you had won.		
11	この“一週間”のうちに、ギャンブルを原因とした気分の落ち込み（精神的苦痛、苦悩、恥、罪悪感、困窮）を、どの程度感じましたか？	During the past WEEK, how much emotional distress (mental pain or anguish, shame, guilt, embarrassment) has your gambling caused you?	.745	.954
12	この“一週間”のうちに、ギャンブルを原因とした個人的なトラブル（人間関係、金銭的、法的、仕事、病気、健康）を、どの程度経験しましたか？	During the past WEEK, how much personal trouble (relationship, financial, legal, job, medical or health) has your gambling caused you?	.574	.958

Note. GSAS-J = the Japanese version of the Gambling Symptom Assessment Scale.
* All items Cronbach's α = .957.

Table 4
Summary of goodnesss of fit statistics for tested models in multi-group confirmatory factor analysis: Non-disordered gamblers group vs. probable disordered gamblers group

Model	χ^2	*df*	AIC	BIC	RMSEA	CFI	ΔCFI	Model comparison
Model 1	1609.87	96	13389	13772	.123	.935	-	-
Model 2	1659.09	107	13416	13749	.121	.931	.005	2 vs. 1
Model 3	1698.35	118	13433	13716	.118	.927	.004	3 vs. 2
Model 4	1082.64	130	13794	14022	.144	.880	.047	4 vs. 3
Model 5	1181.73	131	13891	14114	.151	.868	.012	5 vs. 4

Note. GSAS-J = the Japanese version of the Gambling Symptom Assessment Scale, AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, RMSEA = Root Mean Square Error of Approximation, CFI = Comparative Fit Index, model 1 = configural model, model 2 = metric model, model 3 = scalar model, model 4 = measurement error invariance model, model 5 = factor invariance model.

Table 5
Internal consistency and validity of a Japanese version of the Gambling Symptom Assessment Scale (N = 707)

	GSAS	SOGS	GRCS	GUS	Mean (*SD*)	Cronbach' α
GSAS	1.00	.57*	.71*	.72*	19.87 (19.16)	.96
SOGS		1.00	.46*	.49*	13.61 (13.04)	.80
GRCS			1.00	.70*	55.98 (28.95)	.97
GUS				1.00	12.27 (18.23)	.94

Note. GSAS = Japanese version of the Gambling Symptom Assessment Scale, SOGS = the South Oaks Gambling Screen-modified Japanese version, GRCS = Japanese version of the Gambling Related Cognitions Scale,GUS = Japanese version of the Gambling Urge Scale, *SD* = standard deviation.
* $p < .05$.

gambling symptoms than did women (men 20.85 ± 9.47, women 18.73 ± 8.65, Cohen's $d = 0.23$, 95% $CI = 0.08$–0.38).

Discussion

This study was designed to examine the factor structure and validity of the GSAS-J, which can accurately assess gambling symptoms in a Japanese sample population obtained from the Internet. We sought to examine the measurement invariance in the GSAS-J between a probable disordered and a non-disordered gambling sample. Our results demonstrated that the GSAS-J maintains a one-factor structure. Moreover, it is a valid measure for assessing gambling symptoms in Japanese. We also demonstrated that the GSAS-J indicates strong factorial invariance between probable disordered gamblers and non-disordered gamblers. These results suggest that the GSAS-J is useful by researchers and clinicians to assess gambling symptoms in Japanese speaking gamblers. We also conducted an analysis of gender differences in Japanese people, one which revealed that men in this sample had severer gambling symptoms than women.

Results of our analysis confirmed that the GSAS-J has a factor structure resembling that of the original GSAS (Kim et al., 2009). Cronbach α for the total GSAS-J scores (Cronbach $\alpha = .96$) indicated that GSAS-J holds good internal consistency with a Japanese sample. In fact, it was comparable to that of the original GSAS. We also verified the concurrent validity of the GSAS-J and found significant differences in gambling behaviors (number of days and amount of money) during the prior month among the four groups, with different degrees of severity based on the GSAS-J score. These results were consistent with results of an earlier study: gamblers with severe gambling symptoms are likely to gamble more frequently and spend greater amounts of money on gambling (Kim et al., 2009). Additionally, we examined the concurrent validities for the GSAS-J. Correlation analyses revealed that increased gambling symptoms are positively correlated with other characteristics related to disordered gambling: SOGS-J score, $r = .57$; GRCS-J score, $r = .71$; and GUS-J score, $r = .72$. These results are consistent with those reported for earlier studies (Tanaka et al., 2017; Yokomitsu et al., 2015), which found that individuals with disordered gambling are more likely to make erroneous predictions about gambling outcomes, have stronger urges to participate in gambling, and maintain greater gambling-related difficulties. The results of these correlation analyses further suggest that the construct measured by the GSAS-J is more strongly related to cognitive properties and gambling urges than to gambling-related difficulties.

In addition, a significant gender difference was found in GSAS-J scores. This result demonstrated that men had severer gambling symptoms than women in our study. A review reported by Johansson, Grant, Kim, Odlaug, & Götestam (2009) suggests male gender as a significant risk factor for gambling disorder. Earlier studies of English-speaking and Chinese-speaking gamblers indicate that men have more erroneous gambling-related cognition (Oei, Lin, & Raylu, 2007; Raylu & Oei, 2004a) and stronger gambling urges (Raylu & Oei, 2004b) than do women. Furthermore, earlier studies

in Japan have demonstrated that male gamblers exhibit more gambling-related symptoms than female gamblers do (Tanaka et al., 2017; Yokomitsu et al., 2015). Given these results, one would expect that men would have severer gambling symptoms than women in Japan.

Limitations

A potential limitation of this study was Internet sampling. Although the psychometric properties of the GSAS-J were good, it is not clear whether the results of this study can be generalized outside an online sample, such as in a clinical sample. Given that the GSAS-J would be used not only in a non-clinical sample, but also in the clinical assessment and treatment of disordered gamblers, it is necessary to assess the psychometric properties of the GSAS-J and to replicate the factor structure, reliability, and validity in a clinical sample.

Another limitation of the present study is the reliability and stability of the GSAS-J. In a clinical setting, we recommend that follow-up assessments be conducted. Future studies must be conducted to assess the test-retest reliability of the GSAS-J.

Conclusion

The results of the present study indicate that the GSAS-J is a valid measure for assessing gambling symptoms, at least in Japanese gamblers from an Internet recruiting. This scale might also be useful for future research to assess the effects of psychological treatment for individuals with gambling disorder, and the effects of prevention for non-problem and social gamblers in Japan, where systematic treatment protocols and treatment facilities have not yet been sufficiently established.

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Appendix

Gambling Symptom Assessment Scale 日本語版

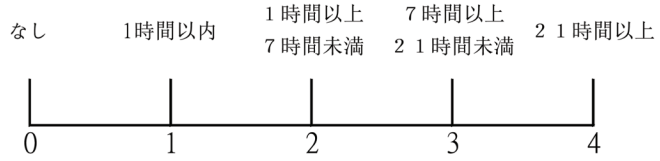
以下の質問はギャンブルに関連した症状を評価するためのものです。次の中から最もよくあてはまる数字を１つ選んでください。

質問 1. この“一週間”で、ギャンブルしたいという余計な衝動に駆られた経験があったとすれば、それは平均でどのくらいの強さでしたか？

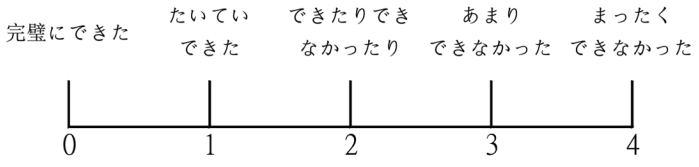
質問 2. この“一週間”のうちに、何度くらい、ギャンブルしたいという衝動に駆られましたか？

0）なし
1）1 度のみ
2）2、3 度
3）4 度以上
4）ほとんど常に

質問 3. この“一週間”のうちに、ギャンブルしたいという衝動で頭がいっぱいだったのは、（あわせて）何時間くらいでしたか？



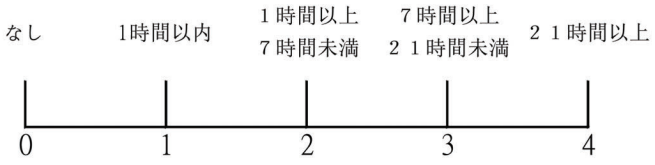
質問 4. この“一週間”において、ギャンブルしたいという衝動をどのくらいコントロールできましたか？



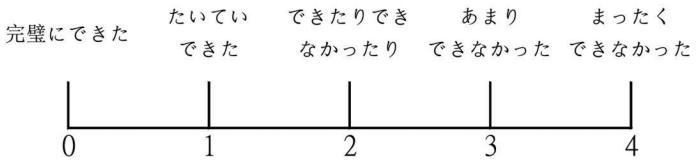
質問 5. この“一週間”のうちに、何度くらい、ギャンブルすることや賭け事が頭に浮かびましたか？

0）まったくなかった
1）1度のみ
2）2、3度
3）4度以上
4）ほとんど常に

質問 6. この“一週間”のうちに、おおよそ（あわせて）何時間くらい、ギャンブルをすることや賭け事について考えていましたか？

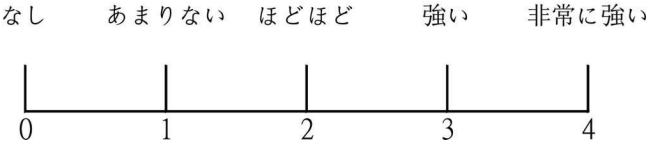


質問 7. この“一週間”のうちに、どのくらいギャンブルについての考えをコントロールできましたか？

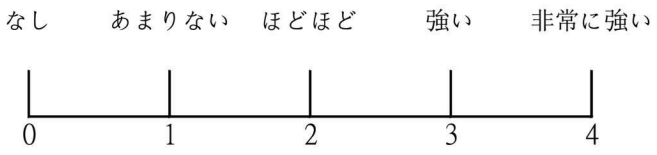


質問 8. この“一週間”の合計で、おおよそ何時間くらいを、ギャンブルあるいはギャンブルにつながる 活動に費やしましたか？

質問 9. この“一週間”の平均で、ギャンブルする直前の緊張や興奮をどの程度感じましたか？もしギャンブルしなかったとしても、したと仮定して、どのくらいの緊張や興奮を感じたであろうかを想像してお答えください。



質問 10. この“一週間”の平均で、ギャンブルで勝ったことによる興奮や喜びをどの程度感じましたか？ ギャンブルで勝つことはなかったとしても、あったと仮定して、どのくらいの興奮や喜びを感じたであろうかを想像してお答えください。



質問 11. この“一週間”のうちに、ギャンブルを原因とした気分の落ち込み（精神的苦痛、苦悩、恥、罪悪感、困窮）を、どの程度感じましたか？

質問 12. この“一週間”のうちに、ギャンブルを原因とした個人的なトラブル（人間関係、金銭的、法的、仕事、病気、健康）を、どの程度経験しましたか？