

Examining the Hypothesis of Common Factors Shared by Different Addictive Behaviors and Gender Effects on Propensity to Addiction Type

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Abstract

Background: From the two facts reported by previous research: 1) frequent co-occurrence of more than one addictive behavior, 2) childhood adversities identified as origins of different types of addictive behaviors, it is assumed that all types of addictive behaviors, regardless of substance, behavioral, or relationship, share common factors which have not yet been proven by epidemiological research. The Shorter PROMIS Questionnaire (SPQ) was previously developed to assess 16 types of addictive behaviors. Its factor structure, however, has not been fully investigated. Confirming the factor structure will enable us to hypothesize the common factor(s) shared by all, or if not all, most types of addictive behaviors. **Aims:** This study aimed at 1) examining the factor structure of the SPQ, 2) confirming the reliability of the questionnaire, and 3) examining the impacts of gender and age on each addictive behavior. **Methods:** Data obtained from 232 Japanese adults who completed all items of the SPQ were used for the analyses. After confirming the one-factor structure model for each of the 16 subscales, the validity of the one-factor structure of the SPQ was evaluated using Confirmatory Factor Analysis (CFA), by adapting 16 subscale scores as observed variables. If its validity was not confirmed, another model which showed better compatibility to the data was explored. The reliability of the SPQ as well as that of all 16 subscales was evaluated. Also, the impacts of gender and age on each subscale score were examined. **Results:** The one-factor structure for each of the 16 subscales was confirmed. The compatibility of the SPQ one-factor model was not acceptable. The best fit model was a bi-factor model in which one main factor was

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shared by all 16 subscales, and three factors were shared by some specific addictive behaviors. Male respondents were more likely than female respondents to show high scores in Alcohol, Tobacco, Gambling, Sex, and Recreational Drugs, and low scores only in Shopping. Respondents' age did not impact any of the 16 subscale scores. **Conclusion:** It was demonstrated that there are common factors shared by all different types, as well as selected types of addictive behaviors, by conducting CFAs of the SPQ. Reliability was proven for the SPQ and for all 16 subscales. Male respondents were more likely to show physically hedonic addictive behaviors.

Keywords

Addictive Behaviors, Shorter PROMIS Questionnaire, Confirmatory Factor Analysis

1. Introduction

Addiction has been one of the major challenging issues in the realm of contemporary clinical psychiatry and clinical psychology [1] [2]. Since the COVID-19 pandemic, its prevalence is further increasing [3] [4]. In the past, only substances were regarded as tools for addictive behaviors, but nowadays, a variety of behaviors, such as working and exercising, are regarded as tools or media for addictions. It is interesting to examine whether or not there are common pathologies shared by these diverse addictive behaviors, and if there are, the development of treatments addressing these core pathologies is expected. Based on these anticipations, this study will explore the common factors shared by several addictive behaviors.

Diagnostic and Statistical Manual of Mental Disorders (DSM) and International Statistical Classification of Diseases and Related Health Problems (ICD), using their own terms, have always included several substance addictions from previous versions to the current versions [5] [6]. In the category of Substance-Related and Addictive Disorders, the DSM-5 defines criteria for addictions such as alcohol, cannabis, and hallucinogens. In the ICD-11, Substance Dependence is included under Disorders due to Substance Use. As in the DSM-5, several substances such as alcohol, cannabis, and opioids, are defined as objects of addictive behaviors.

Meanwhile, unlike psychiatry, in psychology, not only substance addiction, but also behavioral addiction and relationship addiction have been included as addictive behaviors. These various addictive behaviors other than substance addiction are not fully covered in the DSM-5 and ICD-11. In the DSM-5, only Gambling Disorder is listed under Non-Substance-Related Disorders, and Internet Gaming Disorder is mentioned under Conditions for Further Study. In the ICD-11, Gambling Disorder and Gaming Disorder are both listed in Disorders due to Addictive Behaviors. Other specified disorders due to addictive be-

haviors is also a category, in which other behavioral addictions, such as shopping and working could be classified, although the types of addictive behaviors are not clearly specified in the criteria.

According to van der Hart, Nijenhuis, & Steele, addiction is one of the phenotypes of structural dissociation of personality caused by chronic continuous interpersonal traumatic experiences [7]. They also mention that borderline personality disorder and some somatoform disorders also derive from personality dissociation. Lyssenko *et al.*, by meta-analyzing previous research adopting the Dissociative Experiences Scale [8], show that disorders with significant dissociation levels are, in descending order, dissociative disorder, borderline personality disorder, conversion disorder, somatic symptom disorder, substance-related and addictive disorders, and feeding and eating disorders [9]. However, in the DSM-5 and the ICD-11, somatoform disorders, borderline personality disorders, conversion disorders, and eating disorders are classified in categories other than addiction, although they share the same pathology as the addictive disorders, *i.e.* personality splitting. Kleptomania is placed in categories other than addiction categories, although they have addictive natures when they become chronic and/or habitual. Habitual self-harming could also be conceived as addictive behavior but is listed as a symptom of borderline personality disorder. Classification manners adopted by the DSM-5 and the ICD-11 seem to categorize mental disorders just by phenomenological manifestations, and dismiss the clinically important elements, *i.e.* understanding clients' symptoms from a patient's core pathologies.

Much evidence shows that the above subcategories of addictive behavior are not distinct, but are inter-related. Many researchers report the co-occurrence of addictive behaviors both within one of three categories (substance-, behavioral-, relationship-addiction) [10] and across two or three categories [11]. More specifically, previous research has demonstrated the co-occurrence of substance addictions with other types of addictive behaviors, *e.g.* behavioral addictions like eating disorders [12] [13], and relationship addictions like domestic violence [14]. Chang *et al.* conclude that substance abuse is one of the key factors of initiation and persistence of internet addiction among the adolescents from Taiwan region [15]. These suggest common personality pathologies, including the above mentioned van der Hart *et al.*'s structural dissociation of personality [7], behind any addictive behaviors. Indeed, Goodman defines addictive behavior as a developed pattern followed by the fulfillment of the need to be released from internal discomfort, at the expense of every social activity [16], probably hypothesizing not only the same motivations of every addictive behavior, but also common personality traits of every individual with an addictive behavior(s).

In addition to this, interpersonal relationships, regardless of whether they are past or current, play paramount roles in a variety of addictive behaviors. Adverse Childhood Experiences (ACEs), childhood experiences of abuse, in particular, have been found to be risk factors of later addictive behaviors. ACEs have been regarded as crucial factors in the development of addictions with self-destructive

natures such as eating disorders [17] or self-harming behaviors [18], and addictions with aggressive natures such as perpetrators of domestic violence [19] or child abuse [20]. Schimmenti *et al.* demonstrate that internet addiction is associated with traumatic experiences, by partially being mediated by alexithymia [21]. Furthermore, as mentioned earlier, dissociation caused by ACE trauma cannot be dismissed in arguing addiction. Also, an individual's attachment style, current interpersonal relationships with parents and peers, and current family environment are also found to contribute to a variety of addictions, such as substance, gambling, internet, and Facebook addictions [22]-[26]. As such, we can see that there is a wide range of interpersonal factors related to addictive behaviors, and that substance and behavioral addictions can be the product of distorted interpersonal relationships.

Thus, it has been necessary to develop an inventory to assess a variety of addictive behaviors simultaneously for the development of future research exploring common personality pathologies and common traumatic experiences behind every addictive behavior. Not only in research, but also in clinical practice, an inventory to comprehensively assess a variety of addictive behaviors will be useful. The PROMIS Questionnaire meets this need [27]. The original version of the PROMIS Questionnaire consisted of 16 subscales with each subscale having 30 items, resulting in a 480-item questionnaire. Each of the 16 subscales can be classified under one of the aforementioned three major categories, substance-, behavioral-, and relationship-addiction. Alcohol, Tobacco, Recreational Drugs, Prescription Drugs, and Caffeine can be included in the substance addiction category. Gambling, Sex, Shopping, Food Binging, Food Starving, Work, and Exercise can be included in the behavioral addiction category. Compulsive Helping Submissive, Compulsive Helping dominant, Relationships Dominant, and Relationships Submissive can be included in the relationship addiction category. One-hundred and sixty items were selected based on factor loadings, resulting in the Shorter PROMIS Questionnaire (SPQ), which has 16 subscales as with the original PROMIS Questionnaire. Its convergent validity, discriminant validity, and internal consistency were proven [28], but its factor structure has not been determined.

In Japan, neither reliability nor validity of the Japanese version of SPQ has been proven. Furthermore, its factor structure has not been confirmed. As such, the first aim of this study is to determine the Japanese version of the SPQ factor structure, as well as to confirm its reliability.

The second aim of this study is to examine whether or not the respondents' gender and age have impacts on the level of each of the 16 addictive behaviors. It has been demonstrated that, regarding age, younger people are more likely to be addicted no matter what the addictive behavior is [29] [30]. van Deursen *et al.* attribute lower addiction prevalence among older people to their lower social stresses and higher self-regulation [30]. On the other hand, the prevalence of each addiction is uniquely influenced by gender. For example, Grant *et al.* conclude that alcohol use disorder is more common among men [29]. Smink, van

Hoeken, & van Hoek conclude that anorexia nervosa is more likely to develop among women, and compared with other eating disorders, Binge Eating Disorder is more common among men [31]. van Deursen *et al.* mention that women are more likely to have social stresses, and use smartphones for social purposes, leading them to higher risk of smartphone addiction [30]. Kandel *et al.* report that among adolescents, females are more likely to be addicted to alcohol, marijuana, and cocaine [32]. Meanwhile, among adults, males are more likely to be addicted to marijuana and cocaine, but less likely to be addicted to nicotine [32].

To summarize, this study aims at:

- 1) Using CFA to confirm the factor structure of the Japanese version of the SPQ.
- 2) Evaluating the reliability of the SPQ as well as its 16 subscales, and
- 3) Examining the impacts of age and gender on the prevalence of each addiction.

2. Methods

2.1. Procedures

Company employees, civil servants, and medical staff in Japan were solicited for the questionnaire survey of addiction, and 377 participated (188 male, 175 female, 14 gender unspecified, age range 19 - 65, mean age (SD) 40.4 (11.1)). Autonomous participation and anonymity were guaranteed. Participants were instructed to answer the Japanese version of the SPQ. The SPQ consists of 16 subscales, with each subscale having 10 items, making it a 160-item scale. The respondents were instructed to choose the number of the answer that best applied to him/her, 5 being the most and 1 being the least applicable. Thus, the total score of each subscale ranges from 10 to 50. This means that the higher the total score of each addiction subscale, the higher the severity of the addiction. This study was approved by the Institutional Review Board (IRB) of the Kitamura Institute of Mental Health Tokyo (No. 2020061901).

2.2. Statistical Analyses

Factor structure of the Japanese version of SPQ

Before examining the factor structure of the Japanese version of SPQ, the one-factor structure of each SPQ subscale will be confirmed by CFA. Then, internal consistency of each subscale will be evaluated using Cronbach's alpha. After that, validity of the SPQ one-factor structure will be examined based on our hypothesis. If the level of compatibility is not acceptable, an alternative model will be explored. Item-total correlation between the SPQ score and the score of each subscale will be examined to assess SPQ reliability. In order to see whether or not each subscale score is influenced by gender and age, the t-test and Pearson correlation will be applied, respectively. For the above statistical analyses, SPSS version 29.0 and Amos version 29.0 will be used.

Missing data was analyzed, proving missing completely at random (MCAR). Therefore, responses from 232 of the aforementioned 377 participants (117 male,

114 female, one gender unspecified, age range 19 - 65, mean age (SD) 40.1 (10.1)) who filled out all 160 SPQ items were used for the statistical analyses.

3. Results

3.1. CFA of Each Subscale

CFA was conducted to see if each PROMIS subscale has a one-factor structure. It was found that compatibility of the one-factor structure was acceptable for every subscale, as shown in **Table 1** (CFI: .979 - .997, RMSEA: .032 - .056, χ^2/df : 1.233 - 1.730).

3.2. Internal Consistency of Each Subscale

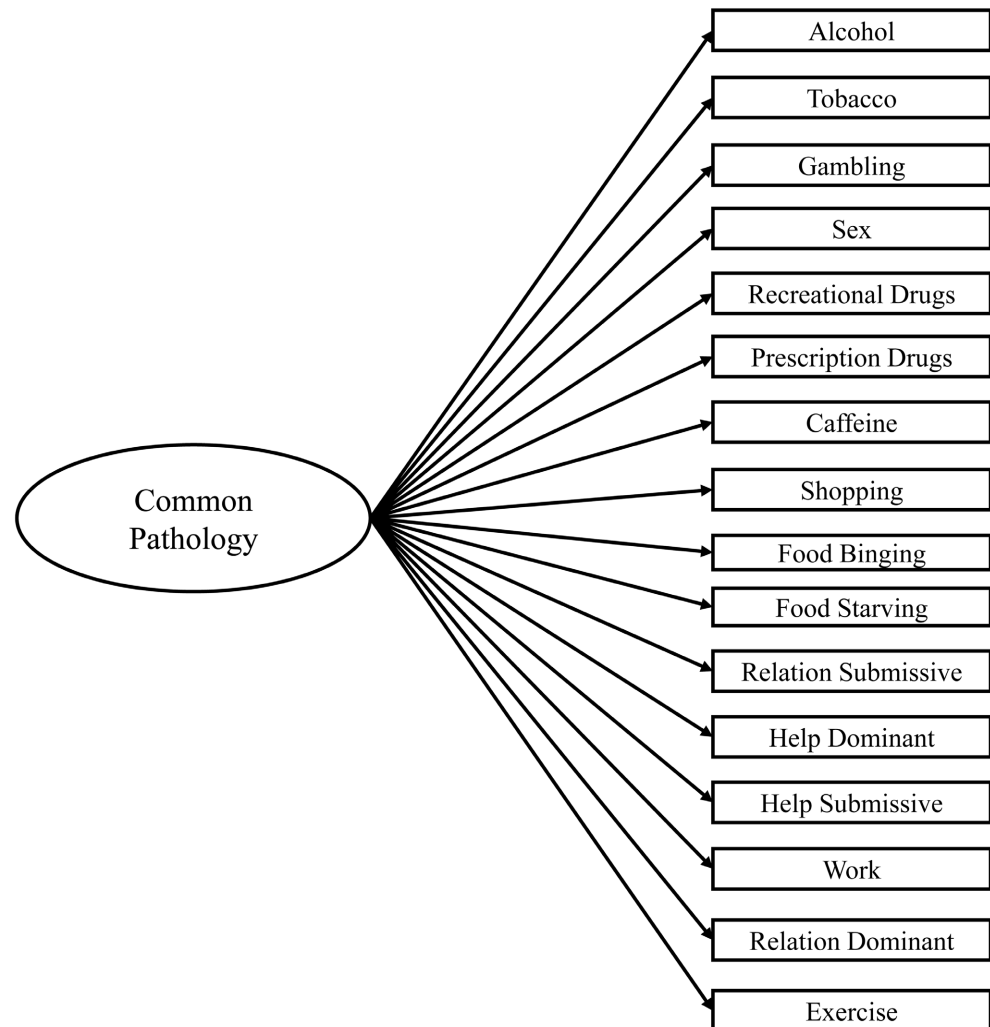
Cronbach's alpha was calculated for each of the 16 subscales. Cronbach's alpha ranged from .81 to .95 (**Table 1**), indicating good internal consistency in all 16 subscales.

3.3. CFA of Japanese Version of SPQ

CFA for the Japanese version of SPQ was conducted to see if the scale has the one-factor structure (**Figure 1**). The total scores of each of the 16 subscales were used as observed variables. Compatibility of the model is shown in **Table 2**, indicating that it is unacceptable (CFI: .895, RMSEA: .134, χ^2/df : 5.151). Therefore,

Table 1. Compatibility of one-factor model of each PROMIS subscale, internal consistency.

	CFI	RMSEA	χ^2/df	AIC	Cronbach's α
Alcohol	.991	.043	1.426	93.926	.91
Tobacco	.997	.032	1.234	90.088	.95
Gambling	.997	.032	1.233	94.657	.94
Sex	.985	.047	1.505	96.146	.87
Recreational Drugs	.992	.056	1.730	104.595	.92
Prescription Drugs	.989	.049	1.552	98.797	.90
Caffeine	.992	.044	1.451	97.379	.85
Shopping	.982	.044	1.447	91.185	.87
Food Binging	.979	.041	1.379	90.758	.81
Food Starving	.981	.041	1.381	90.188	.83
Relationships Submissive	.984	.045	1.473	94.714	.88
Compulsive Helping Dominant	.979	.045	1.470	93.580	.85
Compulsive Helping Submissive	.979	.043	1.429	91.149	.84
Work	.983	.039	1.351	89.230	.85
Relationships Dominant	.986	.049	1.544	96.319	.91
Exercise	.985	.041	1.381	90.188	.84



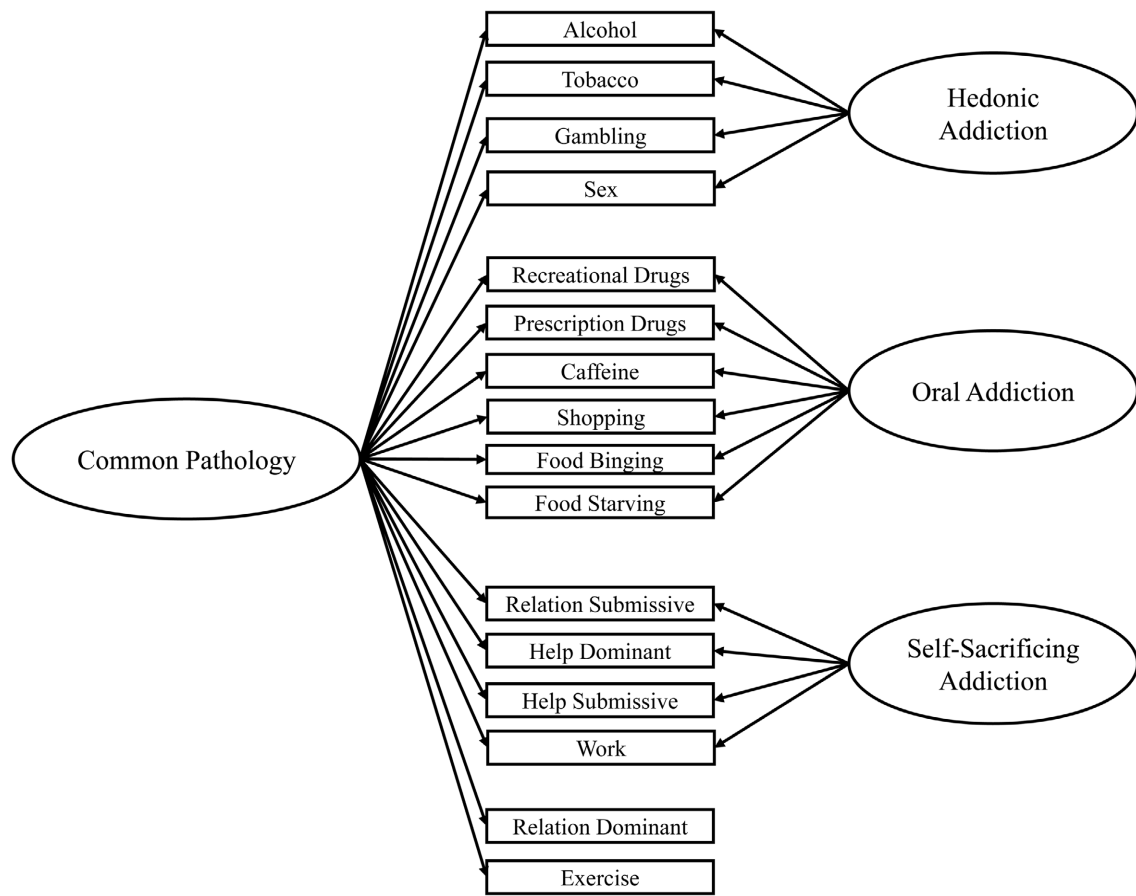
Note: Relation Submissive means Relationships Submissive, Help Dominant means Compulsive Helping Dominant, Help Submissive means Compulsive Helping Submissive, Relation Dominant means Relationships Dominant.

Figure 1. One-factor model of SPQ.

Table 2. Compatibility of one-factor model of each PROMIS subscale, internal consistency.

	CFI	RMSEA	χ^2/df	AIC
Compatibility of one-factor model	.895	.134	5.151	549.330
Compatibility of bi-factor model	.985	.055	1.710	282.556

we explored another model where compatibility is desirable or at least acceptable. After seeing the factor loading patterns on the subscales, we came to the conclusion that a bi-factor model has the best compatibility level (**Figure 2**) and its compatibility is shown in **Table 2** (CFI: .985, RMSEA: .055, χ^2/df : 1.710). As can be seen in **Figure 2**, all of the 16 subscales share a common factor, thus we gave it the name Common Pathology. Three other factors were shared by particular subscales. The first factor was shared by four subscales: Alcohol, Tobacco,



Note: Relation Submissive means Relationships Submissive, Help Dominant means Compulsive Helping Dominant, Help Submissive means Compulsive Helping Submissive, Relation Dominant means Relationships Dominant.

Figure 2. Bi-factor model of SPQ.

Gambling, and Sex. We named it Hedonic Addiction. The second factor was shared by Recreational Drugs, Prescription Drugs, Caffeine, Shopping, Food Starving, and Food Binging. We named it Oral Addiction. The third factor was shared by Relation Submissive, Help Dominant, Help Submissive, and Work. We named it Self-Sacrificing Addiction. Relation Dominant and Exercise had factor loadings on Common Pathology only.

3.4. Item-Total Correlation

As explained above, the common factor, Common Pathology was shared by all 16 subscales. We calculated the Pearson Correlation indices between each subscale total score and the SPQ total score. All the correlation indices were significantly high, ranging from .60 to .90 (Table 3). We also evaluated the internal consistency by using Cronbach's alpha as an index, proving the favorable SPQ internal consistency level (Cronbach's α : .95).

3.5. Impacts of Gender on Each Addiction

In order to evaluate the gender effect on the severity of each addiction, the t-test

was conducted to see the difference between male and female respondents in each subscale score. Male respondents were more likely than female respondents to mark higher scores in Alcohol, Tobacco, Gambling, Sex, and Recreational Drugs, and Lower Scores in Shopping (Table 3).

Table 3. Correlations between each subscale total score and PROMIS total score, impacts of gender and age.

Subscale	Pearson correlation between each subscale score and PROMIS total score	Mean/SD, t-test (male: 117/ female: 114)	Pearson Correlation Coefficient with age
Alcohol	.68	21.3 (9.2)/15.9 (7.6)*	.024
Tobacco	.60	18.2 (10.2)/12.7 (7.3)***	-.006
Gambling	.68	15.4 (7.5)/11.9 (5.2)***	.053
Sex	.72	16.8 (6.8)/12.4 (4.1)***	-.097
Recreational Drugs	.74	12.2 (5.3)/11.2 (3.4)**	.019
Prescription Drugs	.80	13.3 (5.6)/12.3 (4.7)	.043
Caffeine	.79	13.7 (5.2)/14.5 (5.2)	-.089
Shopping	.74	17.3 (6.8)/20.4 (7.9)**	-.160
Food Binging	.77	16.3 (6.1)/18.4 (6.5)	-.151
Food Starving	.90	15.6 (5.7)/15.3 (5.4)	-.086
Relationships Submissive	.88	17.8 (6.7)/16.5 (6.5)	-.069
Compulsive Helping Dominant	.86	18.8 (6.1)/18.5 (6.8)	-.106
Compulsive Helping Submissive	.86	20.2 (6.5)/19.0 (6.6)	-.054
Work	.80	20.2 (6.2)/20.0 (7.4)	-.104
Relationships Dominant	.87	16.1 (6.9)/14.3 (5.5)	-.057
Exercise	.80	18.7 (6.8)/16.1 (5.5)	-.032

* $p < .05$, ** $p < .01$, *** $p < .001$.

3.6. Impacts of Age on Each Addiction

In order to see the impacts of age on each addiction, Pearson's correlations between each subscale score and age were examined. There were no statistically significant correlations (Table 3), suggesting that age did not impact any addictive behaviors.

4. Discussion

In this study, three main results were confirmed. First, all 16 subscales of the Japanese version of SPQ have a one-factor structure. Second, the Japanese version of SPQ has a bi-factor structure. Third, the respondents' gender was identi-

fied to have unique influences on the severity of some addictions, although respondents' age did not have significant effects on any of the 16 subscale addictions. We would like to discuss these results in sequence.

The first finding that all subscales have a one-factor structure verifies the rationality to use selected subscales in each survey to assess target addictive behaviors. This will alleviate the respondents' burden as well as time required. It is also recommended to select subscales depending on the target population. For example, it is probable that sex and/or alcohol addiction are rare among adolescents, so it is better to omit the subscales of these addictive behaviors when targeting adolescents.

The second finding, that the Japanese version of SPQ has a bi-factor model, does not necessarily contradict our one-factor model hypothesis. The bi-factor model included the factor shared by all addiction behaviors. This suggests the common pathologies behind all addictive behaviors, including personality dissociation caused by childhood adversities as referred in the introduction. If so, for fundamentally treating an individual with addictive behaviors, it is preferable to focus on underlying common personality pathologies rather than to target superficial addiction tools. The result we did not premise was the existence of three factors, *i.e.*, Hedonic, Oral, and Self-Sacrificing, all of which were shared by some specific addictions. Of particular interest was that these three factors were independent from general categorization of addictive behaviors: substance, behavior, and relationship. This suggests that it is necessary to take into account the innate nature or symbolic meaning of each addictive behavior when classifying a variety of addictive behaviors, rather than just focusing on forms of these behaviors.

The third finding regarding the gender differences in the severity level of each addiction suggests that male respondents are more prone to Hedonic addiction, *i.e.*, Alcohol, Tobacco, Gambling, and Sex. In addition, male respondents showed higher scores than females in Recreational Drugs (Oral addiction). It is probable that the reason for men showing a higher level of Hedonic addiction is related to sociocultural factors. More specifically, men are less likely than women to be exposed to criticism when absorbed in the Hedonic addiction. The only addictive behavior where female respondents showed a higher severity than male respondents was Shopping (Oral addiction). Not all, but some addictive behaviors were found to be gender-dependent. This suggests the necessity to address target addictive behaviors differently between male and female patients when intervening clinically.

Finally, limitations of this study should be noted. The SPQ includes a variety of addictive behaviors, but it does not cover non-suicidal self-injury, shoplifting, and internet gaming, considered to be common addictive behaviors. In particular, these addictive behaviors are mainly observed among adolescents and young adults. The age range of this study was 19 - 65 with a mean age of 40.1, which meant adolescents were not included and only a few young adults were. Therefore, at least in this study, the above addictive behaviors did not have to be in-

cluded. In the future, particularly for targeting the young generation, the development of an inventory which covers these addictive behaviors will be necessary. However, because of the numerous tools and media enticing addictive behaviors, it is impossible to develop an inventory of all addictive behaviors. Be that as it may, this study is valuable, because it identified a common factor shared by all 16 types of addictive behavior covered by the SPQ.

5. Conclusion

This study proved a bi-factor model of the Japanese version of SPQ but did not necessarily negate the one-factor model. Gender difference was observed in the severity of some particular addictions.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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