This is a post-peer-review, pre-copyedit version of an article published in Journal of Gambling Studies.
The final authenticated version is available online at: https://doi.org/10.1007/s10899-019-09887-4

Title

Craving for Gambling Predicts Income-Generating Offenses:

A Pathways Model of a Japanese Prison Population

Kenji Yokotani

Tokushima University

Katsuhiro Tamura

Niigata Juvenile Classification Home

Yusuke Kaneko

Niigata Prison

Eiichi Kamimura

Niigata University

Author Note

Kenji Yokotani is with the Graduate School of Technology, Industrial and Social Sciences, Tokushima University, Tokushima City, Japan. Katsuhiro Tamura is with the General Affairs Section, Niigata Juvenile Classification Home, Niigata City, Japan. Yusuke Kaneko is with the Department of Education, Niigata Prison, Niigata City,

Japan. Eiichi Kamimura is with Graduate School of Modern Society and Culture, Niigata University, Niigata City, Japan.

Correspondence concerning this article should be addressed to Kenji Yokotani, Tokushima University, Graduate School of Technology, Industrial and Social Sciences, 1-1, Minamijosanjimacho, Tokushima-shi, Tokushima 770-0814, Japan. Phone: 0081-88-656-7204; Fax: 0081-88-656-7204; E-mail: yokotanikenji@tokushima-u.ac.jp

Acknowledgement

We would like to express our appreciation to Dr. Tai Kurosawa for his insightful feedbacks on our early draft.

Compliance with Ethical Standards

Funding: The present study was funded by Japan Society for the Promotion of Science (19K11206).

Disclosure of potential conflicts of interest: Authors K.Y., K.T., Y.K., and E.K. declare that they have no conflict of interest.

Ethical approval: All procedures performed in our study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Craving for Gambling Predicts Income-Generating Offenses: A Pathways Model of a Japanese Prison Population

Abstract

The links between gambling and criminal offenses have been frequently reported, but the pathways from gambling to a particular offense have not. Our study applied a pathways model to predict participants' income-generating, drug-related, and violent offenses stemming from their craving for gambling. The participants were 332 male inmates in a Japanese local prison. They answered questionnaires on gambling behavior, alcohol addiction, Internet addiction, impulsivity, and psychopathy. Their official records with information on their current offense, sentence length, number of imprisonments, and length of education were also analyzed. The results show that 38.55% (n = 128) of the participants had a probable gambling disorder, a rate of problem gambling at least four times higher than that among the general Japanese population. Furthermore, their craving for gambling predicted their income-generating offenses, but not their drug-related and violent offenses. Their craving for gambling can thus be linked to their financial issues, rather than their emotional and impulsive issues. The pathways model explained the path not only from addiction/psychopathy to gambling, but also from gambling to committing an income-generating offense.

Keywords Pathways model, Japanese male prison inmates, income-generating offense, craving for gambling

Introduction

Gambling behavior is a criminogenic factor (Meyer and Stadler 1999). The severity of gambling has been found to be related to the frequency of antisocial acts among male students (Mishra et al. 2011). Problem Gambling (PG)[1] has also been linked to illegal behavior among arrested offenders (Turner et al. 2016). Several offenders reported that their gambling behaviors led to criminal activity (Turner et al. 2013). Moreover, the rate of PG among prison populations is significantly higher than among general populations in North America (Preston et al. 2012; Templer et al. 1993; Turner et al. 2009), Europe (Pastwa-Wojciechowska 2011; Tessényi and Kovács 2016; Zurhold et al. 2014), and Australia (Abbott et al. 2005; Abbott and McKenna 2005). While these findings validate the general link between gambling and offenses, the causal relationships from gambling to offenses have remained uncertain (Adolphe et al. 2018). Our study applied a pathways model (Blaszczynski and Nower 2002) to predict income-generating (May-Chahal et al. 2017), drug-related (Cuadrado and Lieberman 2012), and violent offenses (Turner et al. 2013) based on the craving for gambling in a Japanese prison population.

Three Pathways to PG

In the literature, the pathways model has been validated through a questionnaire (Lobo et al. 2014; Moon et al. 2017; Nower and Blaszczynski 2017; Turner et al. 2008), structured interviews (Ledgerwood and Petry 2010; Valleur et al. 2016), and a literature review (Milosevic and Ledgerwood 2010). The model explains three pathways to PG: The behaviorally conditioned, emotionally vulnerable, and antisocial-impulsive paths

[1] To prioritize readability, this paper consistently uses the term “problem gambling” to refer to impaired ability to control gambling and negative consequence from gambling, although we acknowledge that “pathological gambling” and “gambling disorder” have been used in many papers (Turner et al. 2016).

(Blaszczynski and Nower 2002). First, in the behaviorally conditioned path, people learn subjective excitement and irrational beliefs through their gambling behavior. They gradually establish a pattern of habitual gambling, and finally crave gambling, losing more money than they expected. Gamblers in this path had more irrational beliefs regarding gambling than did those in the other two paths (Milosevic and Ledgerwood 2010). Their extreme evaluation of their economic losses was also supported in experimental settings (Takeuchi et al. 2016). Because their economic rationality was impaired, they experienced financial issues (Turner et al. 2008). However, they did not suffer from problems related to alcohol (Moon et al. 2017), mood disorders, or illegal activity (Nower et al. 2013) in their lifetime. Furthermore, they demonstrated the least severity of gambling of all those in the three paths (Moon et al. 2017; Nower and Blaszczynski 2017). Thus, people in this path are considered the mildest gamblers (Blaszczynski and Nower 2002; Nower and Blaszczynski 2017).

Second, people in the emotionally vulnerable path experience negative emotions such as depression and anxiety (Valleur et al. 2016) in addition to all the elements of the behaviorally conditioned path (Blaszczynski and Nower 2002). They use gambling to reduce or avoid their negative emotions (Moon et al. 2017). Gamblers in this path experience more problems with alcohol and drugs than do those in the other two paths (Nower et al. 2013), because alcohol and drug use also reduces or helps them avoid their negative emotions (Stewart et al. 2008). Essentially, PG has been linked with mood disorders (Lorains et al. 2011) and substance use disorders (Potenza Marc N 2008) among general populations. These findings indicate that gamblers in the emotionally vulnerable path use gambling to reduce their distress. Many studies have pointed out that people in this path demonstrate more severe gambling behaviors than those in the behaviorally conditioned path, because their gambling is motivated by both their subjective excitement of gambling and negative distress in daily life (Blaszczynski and

Nower 2002; Nower and Blaszczynski 2017).

Third, people in the antisocial-impulsive path suffer from antisocial tendencies and impulsivity (Moon et al. 2017; Valleur et al. 2016), as well as experiencing all the elements of the emotionally vulnerable path (Blaszczynski and Nower 2002). Because of their uncontrollable impulsivity and antisocial tendency, they engage in gambling and other antisocial behaviors (Preston et al. 2012). Gamblers in this path demonstrate high impulsiveness and an antisocial personality (Ledgerwood and Petry 2010). They also exhibit a poor ability to cope with emotions and psychiatric problems (Ledgerwood and Petry 2010). Gambling behavior has been linked with psychopathic tendency in a prison population (Pastwa-Wojciechowska 2011). People in this path suffer from their impulsivity and emotional problems, and are thus considered the most severe gamblers among those in the three paths (Blaszczynski and Nower 2002; Nower and Blaszczynski 2017).

Three Pathways from Gambling to Offense

Based on the pathways model and three paths—behaviorally conditioned, emotionally vulnerable, and antisocial-impulsive paths (Blaszczynski and Nower 2002)—we posit that people with PG have three motivations for gambling: Solving their financial, emotional, and impulsive issues. These motivations for gambling might predict their different offenses. For example, gamblers in the behaviorally conditioned path mainly experience financial issues (Turner et al. 2008). To finance their gambling, they may commit income-generating offenses (Turner et al. 2009). Accordingly, interviews with prisoners clarified that they committed offenses to finance their gambling (Turner et al. 2013). The severity of gambling has also been related to income-generating offenses among prisoners (May-Chahal et al. 2017). Theft (Tessényi and Kovács 2016) and payment fraud (Kuoppamäki et al. 2014) were the most common offenses among

prisoners with PG. One study suggested that 64% of the offenses among prisoners with PG were property and economic offenses (Kuoppamäki et al. 2014). Furthermore, areas with numerous gambling machines also have high rates of income-generating offenses (Wheeler et al. 2007). A review of PG-related offenses indicated the links between gambling and income-generating offenses (Adolphe et al. 2018). These findings show that gamblers' craving for gambling in the behaviorally conditioned path predicts their engagement in income-generating offenses.

Furthermore, gamblers in the emotionally vulnerable path primarily suffer from negative emotions (Valleur et al. 2016). To reduce or avoid their negative emotions, they may commit drug-related offenses, because drug use is the typical method they employ to cope with their emotions (Stewart et al. 2008). Gambling behavior has been linked to alcohol and substance abuse (Pantalon et al. 2008), and to drug-related offenses among the general population (Laursen et al. 2016). Among prison inmates, PG has also been linked to alcoholism (Templer et al. 1993) and smoking (Abbott et al. 2005), and gambling more generally to drug-related offenses (Cuadrado and Lieberman 2012). Similarly, gambling during incarceration is associated with alcohol-related charges among prisoners (Turner et al. 2013). These findings indicate that gamblers' craving for gambling in the emotionally vulnerable path predicts their drug-related offenses.

Gamblers in the antisocial-impulsive path mainly suffer from uncontrollable impulsivity (Valleur et al. 2016), which can lead them to commit violent offenses (Adolphe et al. 2018), because violence is the method they typically employ to cope with their impulsivity (Skeem et al. 2007). Among the general population, gambling has been associated with violent offenses (Laursen et al. 2016) and with drinking-related physical fighting (Nower et al. 2013). Among prison inmates, commission of felonies is more related to those with PG than non-problem gamblers (Cuadrado and Lieberman 2012). Furthermore, gambling during incarceration has been associated with prisoners'

current violent offenses (Turner et al. 2013). These findings indicate that gamblers' craving for gambling in the antisocial-impulsive path predicts their engagement in violent offenses.

Although their offenses may be motivated by personal suffering due to financial, emotional, and impulsive problems, their age and experience of imprisonment may also exacerbate their engagement in this behavior. Many longitudinal studies confirmed that offenses were negatively linked with age, but positively linked with number of imprisonments in North American (Durose et al. 2014) and Asian populations (Yokotani and Tamura 2017). To adjust for these influences, we added age and number of imprisonments to our model. Fig. 1 shows our conceptual pathways model from addiction/psychopathy to offense via gambling. The model includes addiction variables for the emotionally vulnerable path and psychopathy variables for the antisocial-impulsive path. All variables are interrelated and predict habitual gambling (Blaszczynski and Nower 2002). Habitual gambling has also been found to predict craving for gambling (Kim et al. 2009) in all three paths, including the behaviorally conditioned path. Based on the path from addiction/psychopathy to gambling, the model yields three hypotheses from gambling to offense. If participants in the behaviorally conditioned path mainly experience financial issues, they would commit income-generating offenses (Hypothesis 1). If they are in the emotionally vulnerable path and mainly suffer from emotional issues, they would commit drug-related offenses (Hypothesis 2). If they are in the antisocial-impulsive path and mainly suffer from issues related to impulsiveness, they would commit a violent offense (Hypothesis 3).

To test our model, we utilized a Japanese prison population, because the rate of PG among prison populations has rarely been reported in the Asian context. That for the general population has been confirmed in Asia, including Korea (Back et al. 2015), China (Tang et al. 2010), Singapore (Arthur et al. 2008), and Japan (Toyama et al. 2014).

The addition of studies of an Asian prison population to those of Western prison populations (Abbott et al. 2005; Abbott and McKenna 2005; Pastwa-Wojciechowska 2011; Preston et al. 2012; Templer et al. 1993; Tessényi and Kovács 2016; Turner et al. 2009; Zurhold et al. 2014) could extend the generalizability of the results of previous studies. As in previous studies, we hypothesized that the rate of PG among a prison population would be higher than that among the general population in Japan (Hypothesis 0).

Moreover, to assess the research variables, we used a questionnaire and official records. To assess patterns of habitual gambling, we used the South Oaks Gambling Screen [SOGS] (Lesieur and Blume 1987), and to evaluate craving for gambling, we employed the Gambling Symptom Assessment Scale [GSAS] (Kim et al. 2009). The Barratt Impulsiveness Scale 11th edition [BIS] (Patton et al. 1995) and Primary and Secondary Psychopathy Scale [PSPS] (Levenson et al. 1995) were used to assess impulsiveness and psychopathic tendency, respectively, and the Alcohol Use Disorders Identification Test [AUDIT] to determine habitual drinking (Bush et al. 1998). We also measured Internet addiction through Young's Internet Addiction Test [IAT] (Young 1998), because Internet addiction could be a pathological coping method for emotional issues (Byun et al. 2008; Ko et al. 2008). Finally, we examined Japanese official records (Yokotani and Tamura 2015) and collected information on the sample's current offense, number of imprisonments, education level, and Intelligence Quotient equivalence (IQ).

Methods

Participants and Procedure

The potential participants were 536 inmates in a Japanese local prison mainly for repeat offenders. The questionnaire was distributed and collected two times in January of X year by prison staff. The staff indicated their identification numbers during the

collection of the questionnaires. In this way, the two questionnaires were matched through the identification number. Furthermore, the identification number was used to collate the questionnaires with official documents.

Among the 536 inmates, we distributed the questionnaire to 445. We excluded 91 inmates of whom 57 needed to be isolated and 34 were being prepared to move. Among the 445 inmates to whom the questionnaire was distributed, 113 did not complete the SOGS (Lesieur and Blume 1987); thus, they were excluded from the study because our focus was on gambling behavior. The final number of participants was 332 male inmates. Although the final participants (n = 332) had a significantly higher IQ (equivalence) than those excluded (n = 113) [M = 85.93(SD = 15.20), 78.51(SD = 19.21), respectively, t = 3.51, df = 135.27, $p < .01$], they were not significantly different in terms of age, sentence length, number of imprisonments, length of education, nationality, income-generating offenses, drug-related offenses, or violent offenses. Hence, the final participants were representative of the local Japanese prison in age, criminal tendency, and educational level but not IQ.

The average age of the final participants was 51.34 years (SD = 12.82). The nationality of 306 of the inmates was Japanese. The remaining 12 were from Korea (n = 4), China (n = 2), Taiwan (n = 1), Brazil (n = 1), Argentina (n = 1), Laos (n = 1), Sri Lanka (n = 1), and Vietnam (n = 1). Furthermore, 14 inmates did not report their nationality. All participants responded in Japanese regardless of their nationality.

Measures in the Questionnaire

Habitual gambling: To assess habitual gambling, we used the SOGS (Lesieur and Blume 1987). The SOGS is a 16-item questionnaire that includes multiple-choice questions based on the Diagnostic and Statistical Manual of Mental Disorders Third edition (DSM-3) criteria for pathological gambling (e.g., “When you gamble, how often

do you go back another day to win back the money you lost?"). It has been validated worldwide (Stinchfield 2002). The original SOGS comprised 16 questions, but the first 3 were not scored. Thus, the current Japanese version of the SOGS comprises only 13 questions (Saito 1996). We were also interested in participants' gambling experience before they entered their current prison. We therefore used the following instruction: "Remember a year of social life before entering this prison. We would like to ask you about your gambling experience during that one year." The SOGS is scored one point for each question that indicates being "at risk." As in a previous study (Stinchfield 2002), we regarded those who scored 5 or more points as having (probable) PG, and those with less than 5 points as having (probable) non PG. Cronbach's alpha of the SOGS in this study was .913.

Craving for gambling: To assess craving for gambling, we used the GSAS (Kim et al. 2009). The GSAS is a 12-item questionnaire anchored with a 5-point scale (ranging from 0 = *None* to 4 = *Extreme*). It was developed to assess the severity of gambling symptoms over a period of one week (e.g., "If you had unwanted urges to gamble during the past WEEK, on average, how strong were your urges?"). We used the Japanese version of the GSAS (Yokomitsu and Kamimura 2019). We were interested in participants' gambling experience before entering the current prison. Thus, we included the following instruction: "Remember a week of social life before entering this prison. We would like to ask you about your gambling experience in that one week." A high score on the GSAS indicates a high craving for gambling. Cronbach's alpha for the GSAS in this study was .974.

Habitual drinking: To assess habitual drinking, we used the AUDIT (Bush et al. 1998). The AUDIT is a 10-item screening tool used to assess a risky drinking style (e.g., "How many drinks containing alcohol do you have on a typical day when you are drinking?"). The AUDIT is mostly anchored on a five-point scale ((0) *1 or 2*; (1) *3 or 4*;

(2) *5 or 6*; (3) *7, 8, or 9*; (4) *10 or more*), and has been validated worldwide (Meneses-Gaya et al. 2009). We used the Japanese version of the AUDIT (Hiro and Shima 1996). We were interested in participants' drinking experience before they entered the current prison. Thus, we included the following instruction: "Remember a year of social life before entering this prison. We would like to ask you about your drinking experience during that one year." A high score on the AUDIT indicates a risky drinking style. As in a previous study (Meneses-Gaya et al. 2009), we regarded those who scored 8 or more points as having a risky drinking style. Cronbach's alpha of the AUDIT in this study was .888.

Internet addiction: To assess Internet addiction, we used Young's IAT (Young 1998). The IAT is a 20-item scale anchored on a six-point scale (ranging from 0 = *Not Applicable* to 5 = *Always*) used to assess the severity of Internet dependency among adults (e.g., "How often do you stay online longer than you intended?"). The IAT has been validated worldwide (Chang and Man Law 2008). We therefore used the IAT for the Japanese population (Lai et al. 2015). We were also interested in participants' Internet experience before they entered the current prison. Thus, we used the following instruction: "Remember a year of social life before entering this prison. We would like to ask you about your Internet experience during that one year." A high score on the IAT indicates a high dependency on the Internet. As in a previous study (Chang and Man Law 2008), we regarded those who scored between 20 and 39, 40 and 69, and 70 to 100 as having mild (1), middle (2), and severe (3) Internet addiction, respectively. Cronbach's alpha of the IAT in this study was .950.

Psychopathic tendency: To assess psychopathic tendency, we used the PSPS (Levenson et al. 1995). PSPS is a 26-item questionnaire anchored on a 4-point scale used to assess a typical interpersonal style of psychopathy (e.g., "People who are stupid enough to get ripped off usually deserve it"). The PSPS has been validated worldwide

(Sellbom 2011). The current study used the 21-item PSPS for the Japanese population (Osumi et al. 2012). A high score on the PSPS indicates a high tendency for psychopathy. Cronbach's alpha of the PSPS in this study was .798.

Impulsivity scale: To assess impulsivity, we used the BIS 11th edition (Patton et al. 1995). The BIS is a 30-item self-report instrument developed to assess the personality/behavioral construct of impulsiveness (e.g., "I do things without thinking"). It is anchored on a four-point scale (ranging from 1 = *Rarely/Never* to 4 = *Almost Always/Always*). The BIS has been validated worldwide (Stanford et al. 2009), and we used the Japanese version thereof (Someya et al. 2001). Cronbach's alpha of the BIS in this study was .848.

Measures in Official Records

We collected data from official records on participants' age, current offense, length of current sentence, number of imprisonments, length of education, and IQ. IQ was measured using the Correctional Association Psychological Assessment Series (CAPAS) (Yasuki et al. 2003). CAPAS is a Binet-type intelligence test, and has both group and individual forms (Yasuki et al. 2003). The combined scores of both forms were standardized for Japanese prisoners (M = 100, SD = 15) around three decades ago (Ohnishi et al. 1996). Therefore, the CAPAS score can be regarded as an IQ (equivalence) score (Yasuki et al. 2003).

Categorization of offense: Participants' current offenses were encoded as income-generating, drug-related, and violent offenses. Income-generating offenses included 170 economic and property offenses: Theft (n = 126), attempted theft (5), fraud (21), attempted fraud (1), robbery (4), robbery causing injury (8), embezzlement (3), counterfeiting of securities (1), and violation of tax laws (1). Drug-related offenses included 96 violations of drug control laws: Stimulants control law (n = 92), cannabis

control law (3), and narcotics and psychotropic control law (1). Violent offenses included 61 illegal use of force incidents: Injury (n = 10), injury causing death (2), rape (9), gang rape causing injury (1), attempted rape (4), rape causing injury (3), quasi rape (2), forcible indecency (4), forcible indecency causing injury (4), quasi forcible indecency (2), robbery (4), robbery causing injury (8), homicide (1), attempted homicide (1), intimidation (1), extortion (1), kidnapping of minors (1), obstruction of performance of public duty (1), act of punishment of physical violence and others (1), and violation of swords and firearms control law (1).

Analysis

To compare the differences between prisoners with and without PG, we performed a *t*-test and chi-squared test. To show the relevance among research variables, we calculated Pearson's correlation coefficients.

To test our three hypotheses, we constructed a structural equation model (Fig. 1). Fig. 1 shows our model from addiction/psychopathy to offense via gambling. The model includes addiction variables, such as habitual drinking and internet addiction, and psychopathy variables, such as psychopathy and impulsivity. All variables are interrelated and predict habitual gambling (Blaszczynski and Nower 2002). Habitual gambling also predicts craving for gambling (Kim et al. 2009). Based on the path from addiction/psychopathy to gambling, the model predicts income-generating, drug-related, or violent offenses. To adjust for the influence of age and number of imprisonments on offenses (Durose et al. 2014; Yokotani and Tamura 2015), we also added these variables to our model (Fig. 1).

For the addiction/psychopathy variables, participants' self-report AUDIT, IAT, PSPS, and BIS were used to assess their habitual drinking, internet addiction, psychopathy, and impulsivity, respectively (Fig. 2). Similarly, their self-report SOGS and GSAS were

used to assess their habitual gambling and craving for gambling, respectively (Fig. 2). To assess their age, number of imprisonments, and category of current offense, we used official records including their age, number of imprisonments, and current offense.

To evaluate our model, we employed the maximum likelihood method, because this method has been a predominant approach in the field of psychology (Anderson and Gerbing 1988). To evaluate the model, we used absolute fit indices, which indicate how well the model fits the sample data, including the chi-squared test (χ^2), normed chi-squared test (χ^2/df), Root Mean Square Error of Approximation (RMSEA), Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), and Standardized Root Mean Square Residual (SRMR). Although there is no consensus on an acceptable range for the chi-squared test (Jöreskog and Sörbom 1996), an acceptable ratio for the normed chi-squared test (χ^2/df) has been suggested of less than 5.0 (Wheaton et al. 1977), while a strict upper limit for the chi-squared test has been suggested of 2.0 (Tabachnick and Fidell 2007). The upper limit of acceptable values of RMSEA is 0.07 (Steiger 2007), and a strict upper limit for RMSEA has been suggested of 0.06 (Hu and Bentler 1999). Values of 0.90 or greater of GFI and AGFI indicate well-fit models (Hooper et al. 2008), while strict lower limits of GFI and AGFI are 0.95 (Shevlin and Miles 1998). Similarly, values of SRMR less than 0.05 are regarded as indicating a well-fit model (Diamantopoulos and Siguaw 2013).

We also used comparative fit indices, including the Comparative Fit Index (CFI). The CFI compares the chi-squared values of our model to the chi-squared values of the baseline model, which assumes that all variables are not correlated with each other. A value of CFI greater than 0.95 indicates good fit (Hu and Bentler 1999).

Furthermore, we used parsimony fit indices including the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), which penalize model complexity. Smaller values of AIC and BIC indicate good fit, but as these values are not

normed between 0 and 1, they do not have cut-off scores (Hooper et al. 2008).

For the evaluation of specific paths, we used standardized path coefficients. We set the significance level at 0.05. SPSS 21 (IBM) and HAD 15.7 (Shimizu 2016) were used for the analysis.

Ethical Considerations

Our study was approved by the board of a local prison and an ethics committee of a national university in Japan. Furthermore, all procedures were conducted in accordance with guidelines for studies involving human participants, the ethical standards of the institutional research committee, and the revised 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Results

Comparisons of Prisoners with and without PG

Among the male Japanese prison population, 38.55 % are considered as having PG during the reported year of their life before entering the current prison. Considering the rate of PG among the general population in Japan (Toyama et al. 2014) (men 9.04 %, women 1.6 % over the lifetime; prevalence for one year is unknown), that among Japanese male prison inmates is at least four times higher.

Table 1 compares prisoners with and without PG, indicating that they did not differ in terms of age, length of sentence, number of imprisonments, length of education, or IQ (equivalence). The rate of drug-related offenses, income-generating offenses, drug-related offenses, and violent offenses did also not significantly differ among the groups. These findings indicate no differences in the basic traits of the two groups.

However, prisoners with PG scored significantly higher on the SOGS, GSAS, AUDIT, and IAT than those without PG (Table 1). These findings suggest that their

gambling behavior was linked to other addictive behaviors including alcohol and Internet use. Furthermore, prisoners with PG also scored significantly higher on the PSPS and BIS than did those without PG, suggesting that their gambling behavior was linked with their psychopathic tendency and impulsivity.

Correlations among Research Variables in the Pathways Model

Before testing our pathways model, we checked the correlations among the research variables (Table 2). Table 2 shows that income-generating offenses were positively correlated with participants' age and number of imprisonments, but negatively correlated with IQ (equivalence). In contrast, Table 2 shows that violent offenses were negatively correlated with age and number of imprisonments, but positively correlated with IQ (equivalence). Table 2 also shows that GSAS, SOGS, AUDIT, IAT, BIS, and PSPS were positively correlated with each other, except for one correlation between BIS and IAT. This indicates that addictive behaviors such as gambling, drinking, and Internet use are related to the traits of impulsivity and psychopathy.

Three Paths from Gambling to Income-Generating, Drug-Related, and Violent Offenses

We tested our pathways model from addiction/psychopathy to income-generating offenses via gambling. Fig. 2 shows the significant paths and fit index. As expected, AUDIT, PSPS, and BIS positively predicted SOGS, although IAT did not. Furthermore, SOGS positively predicted GSAS. These significant paths demonstrate that the pathway from addiction/psychopathy to gambling fits the Japanese prison inmates well. Moreover, GSAS predicted income-generating offenses positively, indicating that the pathway from craving for gambling to an income-generating offense fits the Japanese prison inmate population well. The fit indices of our model were also satisfactory. The

CFI (.963), SRMR (.042), and GFI (.977) satisfied the strict criteria (West et al. 2012). Although the RMSEA (.066), AGFI (.920), and χ^2/df (2.12) did not satisfy the criteria (Hu and Bentler 1999; Shevlin and Miles 1998; Tabachnick and Fidell 2007), they were practically acceptable in the fields of psychology (Jackson et al. 2009) and social science (Hooper et al. 2008).

In the same way, we tested our model for drug-related offenses. The fit indices of the model were satisfactory (χ^2 = 28.72 (df = 13, p = .007), χ^2/df = 2.20, RMSEA = .068, SRMR = .043, GFI = .977, AGFI = .920, CFI = .959, AIC = 92.727, BIC = 206.792). Furthermore, AUDIT, PSPS, and BIS positively predicted SOGS. (The scores are the same as in Fig. 2.) However, GSAS did not predict drug-related offenses (β = −.005, not significant). These findings suggest that the pathway from addiction/psychopathy to gambling is supported in the Japanese prison population, but not the pathway from their craving for gambling to a drug-related offense.

Similarly, we tested our model for violent offenses. The fit indexes of the model were satisfactory (χ^2 = 24.60 (df = 13, p = .026), χ^2/df = 1.89, RMSEA = .058, SRMR = .041, GFI = .980, AGFI = .930, CFI = .970, AIC = 88.606, BIC = 202.671). Furthermore, AUDIT, PSPS, and BIS positively predicted SOGS. (The scores are the same as in Fig. 2.) However, GSAS did not predict violent offenses (β = −.088, not significant). These findings suggest that the pathway from addiction/psychopathy to gambling was supported in the Japanese prison population, but not the pathway from their craving for gambling to a violent offense.

Discussion

Three Paths from Gambling to Income-Generating, Drug-Related, and Violent Offenses (Hypotheses 1, 2, 3)

Our study found that male inmates' craving for gambling predicted income-generating

offenses in Japan, but not drug-related or violent offenses. Consistent with previous findings (Adolphe et al. 2018; Kuoppamäki et al. 2014; May-Chahal et al. 2017; Tessényi and Kovács 2016; Turner et al. 2009, 2013; Wheeler et al. 2007), these results indicate that craving for gambling is linked to financial issues. Thus, they engage in income-generating offenses to solve this problem. We also found that IQ (equivalence) was negatively linked with income-generating offenses (Table 2). Thus, people with a low IQ (equivalence) might commit income-generating offenses more frequently than those with a high IQ (equivalence). Previous studies have also suggested that people with PG had an irrational belief regarding gambling (Milosevic and Ledgerwood 2010; Takeuchi et al. 2016), namely that they could make money gambling this time, even though they had thus far not managed to do so. Together, these findings indicate their irrational belief that an income-generating offense could solve their financial problems in the short term (an hour), even though the offense cannot solve them in the long term (one year). To prevent committing an income-generating offense because of a craving for gambling, specialized treatment for this craving is recommended both inside and outside prison (May-Chahal et al. 2017).

Unlike previous studies (Cuadrado and Lieberman 2012; Laursen et al. 2016; Valleur et al. 2016), we did not find participants' craving for gambling to be related with drug-related offenses. One possible interpretation is that gamblers among Japanese male inmates in the emotionally-vulnerable path might use legal drugs such as alcohol (Templer et al. 1993; Turner et al. 2013) and nicotine (Abbott et al. 2005), rather than illegal ones such as methamphetamine and cannabis (Yokotani and Tamura 2015) to reduce or avoid negative emotions (Stewart et al. 2008). Actually, craving for gambling was positively related with habitual drinking (correlation between GSAS and AUDIT in Table 2). Because they use a legal drug, they likely do not often commit drug-related offenses. Treatment focused on alcohol and nicotine dependence might be important for

gamblers in the emotionally vulnerable path to prevent gambling behavior (Pantalon et al. 2008).

Although impulsivity (BIS) was not directly related with income-generating, drug-related, and violent offenses, it was positively correlated with the number of imprisonments and negatively correlated with length of education (Table 2). These findings indicate that impulsivity might hinder them from achieving good school grades and promote re-entry into prison. This is consistent with the findings of previous studies (Skeem et al. 2007). The pathway from impulsivity to social maladjustment is part of the antisocial-impulsive path (Cuadrado and Lieberman 2012; Laursen et al. 2016; Nower et al. 2013; Turner et al. 2013). Treatment at school age might be required for people in the antisocial-impulsive path to prevent their gambling and re-entry to prison (Nower and Blaszczynski 2017).

Furthermore, the combination of their socioeconomic disadvantage and high impulsivity might advance their start of gambling (Auger et al. 2010) and increase the risk of problem gambling (Griffiths and Wood 2000). The educational length of our participants was lower than that (M = 12.76) of the Japanese general populations (Yamamoto and Brinton 2010). Furthermore, their impulsivity was higher than that (M = 39.3) of Japanese general populations (Someya et al. 2001). Their low educational length and high impulsivity indicate that they experienced social disadvantage during school age (Reimers et al. 2009), which could advance their start of gambling (Auger et al. 2010) and onset of gambling symptoms (Griffiths and Wood 2000). Prevention programs focused on the socially-handicapped population during school age might be effective in decreasing the risk of problem gambling (Griffiths and Wood 2000).

Rate of PG among the Japanese Prison Population (Hypothesis 0)

In addition to the findings regarding the pathways model (Blaszczynski and Nower

2002), our study also clarified the rate of PG among an Asian prison population. Similar to previous studies of Western prison inmates (Abbott et al. 2005; Abbott and McKenna 2005; Pastwa-Wojciechowska 2011; Preston et al. 2012; Templer et al. 1993; Tessényi and Kovács 2016; Turner et al. 2009; Zurhold et al. 2014), the rate of PG among Japanese prison inmates was at least four times higher than that among the general Japanese population (Toyama et al. 2014). Furthermore, their PG was linked to alcohol addiction (Potenza Marc N 2008), Internet addiction (Byun et al. 2008; Ko et al. 2008), impulsivity (Ledgerwood and Petry 2010; Preston et al. 2012), and psychopathy (Moon et al. 2017; Pastwa-Wojciechowska 2011; Valleur et al. 2016). These findings extend those of previous studies of PG among the general Asian population (Arthur et al. 2008; Back et al. 2015; Tang et al. 2010) to a Japanese prison population.

Limitations

Although we have extended research beyond previous findings (Blaszczynski and Nower 2002; Toyama et al. 2014), our study had four limitations. First, our study adopted a retrospective design; thus, remembering their craving for gambling before entering prison could be biased by participants' memories. To reduce this bias, a prospective design is needed for a future study (Durose et al. 2014; Yokotani and Tamura 2017). Furthermore, the excluded sample in our study included participants with a low IQ (equivalence); thus, our findings may miss responses from those with an intellectual disability. An individual interview setting may be needed to include these participants (Ledgerwood and Petry 2010; Valleur et al. 2016). Third, our study sampled the prison population only, so generalization of our findings to Japanese general gamblers, most of whom are not imprisoned, requires caution. Future research needs to sample general Japanese gamblers without a criminal history to check the validity of our model among Japanese general gamblers. Fourth, our study did not evaluate parental

socioeconomic factors, such as parental income/educational levels, so our study missed the effects of parents' socioeconomic factors. Furthermore, we did not evaluate childhood adversity, such as physical/sexual abuse and poor living environments, which are common in prisoners (Godet- Mardirossian et al. 2011). Hence, our model did not cover their socioeconomic factors and family experiences during childhood. Future studies need to include these variables to build comprehensive models that can clarify the paths from socially handicapped experience during childhood to criminal offense via problem gambling.

Conclusions

Despite these limitations, our pathways model (Blaszczynski and Nower 2002; Lobo et al. 2014; Milosevic and Ledgerwood 2010; Moon et al. 2017; Nower and Blaszczynski 2017; Turner et al. 2008) clarified the paths from addiction/psychopathy to income-generating offenses via gambling. We found the pathways model useful in explaining not only the path from addiction/psychopathy to gambling, but also that from gambling to income-generating offenses (Adolphe et al. 2018; May-Chahal et al. 2017). Clarifying the path from gambling to a specific offense facilitates an in-depth understanding of gambling and specialized treatment for PG (Meyer and Stadler 1999; Mishra et al. 2011).

References

Abbott, M. W., & McKenna, B. G. (2005). Gambling and problem gambling among recently sentenced women in New Zealand prisons. *Journal of Gambling Studies*, *21*(4), 559–581. doi:10.1007/s10899-005-5563-5

Abbott, M. W., McKenna, B. G., & Giles, L. C. (2005). Gambling and problem gambling

among recently sentenced male prisoners in four New Zealand prisons. *Journal of Gambling Studies*, *21*(4), 537–558. doi:10.1007/s10899-005-5562-6

Adolphe, A., Khatib, L., van Golde, C., Gainsbury, S. M., & Blaszczynski, A. (2018). Crime and gambling disorders: A systematic review. *Journal of Gambling Studies*. doi:10.1007/s10899-018-9794-7

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103*(3), 411–423.

Arthur, D., Tong, W. L., Chen, C. P., Hing, A. Y., Sagara-Rosemeyer, M., Kua, E. H., & Ignacio, J. (2008). The validity and reliability of four measures of gambling behaviour in a sample of Singapore university students. *Journal of Gambling Studies*, *24*(4), 451–462. doi:10.1007/s10899-008-9103-y

Auger, N., Lo, E., Cantinotti, M., & O'Loughlin, J. (2010). Impulsivity and socio-economic status interact to increase the risk of gambling onset among youth. *Addiction*, *105*(12), 2176–2183. doi:10.1111/j.1360-0443.2010.03100.x

Back, K.-J., Williams, R. J., & Lee, C.-K. (2015). Reliability and validity of three instruments (DSM-IV, CPGI, and PPGM) in the assessment of problem gambling in South Korea. *Journal of Gambling Studies*, *31*(3), 775–786. doi:10.1007/s10899-014-9442-9

Blaszczynski, A., & Nower, L. (2002). A pathways model of problem and pathological gambling. *Addiction*, *97*(5), 487–499. doi:10.1046/j.1360-0443.2002.00015.x

Bush, K., Kivlahan, D. R., McDonell, M. B., Fihn, S. D., & Bradley, K. A. (1998). The AUDIT alcohol consumption questions (AUDIT-C): An effective brief screening test for problem drinking. *Archives of Internal Medicine*, *158*(16), 1789–1795. doi:10.1001/archinte.158.16.1789

Byun, S., Ruffini, C., Mills, J. E., Douglas, A. C., Niang, M., Stepchenkova, S., et al. (2008). Internet addiction: Metasynthesis of 1996–2006 quantitative research. *CyberPsychology & Behavior*, *12*(2), 203–207. doi:10.1089/cpb.2008.0102

Chang, M. K., & Man Law, S. P. (2008). Factor structure for Young's internet addiction test: A confirmatory study. *Computers in Human Behavior*, *24*(6), 2597–2619. doi:10.1016/j.chb.2008.03.001

Cuadrado, M., & Lieberman, L. (2012). Use of a short gambling screen with an arrestee population: A feasibility study. *Journal of Gambling Studies*, *28*(2), 193–205. doi:10.1007/s10899-011-9253-1

Diamantopoulos, A., & Siguaw, J. A. (2013). *Introducing LISREL: A Guide for the Uninitiated*. SAGE.

Durose, M. R., Cooper, A. D., & Snyder, H. N. (2014). Recidivism of prisoners released in 30 states in 2005: Patterns from 2005 to 2010. *Washington, DC: Bureau of Justice Statistics*. http://www.bjs.gov/content/pub/pdf/rprts05p0510.pdf. Accessed 13 November 2015

Godet - Mardirossian, H., Jehel, L., & Falissard, B. (2011). Suicidality in male prisoners: Influence of childhood adversity mediated by dimensions of

personality*. *Journal of Forensic Sciences*, *56*(4), 942–949. doi:10.1111/j.1556-4029.2011.01754.x

Griffiths, M., & Wood, R. T. A. (2000). Risk factors in adolescence: The case of gambling, videogame playing, and the Internet. *Journal of Gambling Studies*, *16*(2), 199–225. doi:10.1023/A:1009433014881

Hiro, H., & Shima, S. (1996). Availability of the Alcohol Use Disorders Identification Test (AUDIT) for a complete health examination in Japan. *Nihon Arukoru Yakubutsu Igakkai zasshi = Japanese journal of alcohol studies & drug dependence*, *31*(5), 437–450.

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural equation modelling: guidelines for determining model fit. *Electronic Journal of Business Research Methods*, *6*, 53–60.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. doi:10.1080/10705519909540118

Jackson, D. L., Gillaspy, J. A., & Purc-Stephenson, R. (2009). Reporting practices in confirmatory factor analysis: An overview and some recommendations. *Psychological Methods*, *14*(1), 6–23. doi:10.1037/a0014694

Jöreskog, K. G., & Sörbom, D. (1996). *LISREL 8: User's Reference Guide*. Scientific Software International.

Kim, S. W., Grant, J. E., Potenza, M. N., Blanco, C., & Hollander, E. (2009). The Gambling Symptom Assessment Scale (G-SAS): A reliability and validity study. *Psychiatry Research*, *166*(1), 76–84. doi:10.1016/j.psychres.2007.11.008

Ko, C., Yen, J.-Y., Yen, C., Chen, C., Weng, C., & Chen, C. (2008). The association between internet addiction and problematic alcohol use in adolescents: The problem behavior model. *CyberPsychology & Behavior*, *11*(5), 571–576. doi:10.1089/cpb.2007.0199

Kuoppamäki, S.-M., Kääriäinen, J., & Lind, K. (2014). Examining gambling-related crime reports in the national Finnish police register. *Journal of Gambling Studies*, *30*(4), 967–983. doi:10.1007/s10899-013-9393-6

Lai, C.-M., Mak, K.-K., Cheng, C., Watanabe, H., Nomachi, S., Bahar, N., et al. (2015). Measurement invariance of the internet addiction test among Hong Kong, Japanese, and Malaysian adolescents. *Cyberpsychology, Behavior, and Social Networking*, *18*(10), 609–617. doi:10.1089/cyber.2015.0069

Laursen, B., Plauborg, R., Ekholm, O., Larsen, C. V. L., & Juel, K. (2016). Problem gambling associated with violent and criminal behaviour: A Danish population-based survey and register study. *Journal of Gambling Studies*, *32*(1), 25–34. doi:10.1007/s10899-015-9536-z

Ledgerwood, D. M., & Petry, N. M. (2010). Subtyping pathological gamblers based on impulsivity, depression, and anxiety. *Psychology of Addictive Behaviors*, *24*(4), 680–688. doi:10.1037/a0019906

Lesieur, H. R., & Blume, S. B. (1987). The South Oaks Gambling Screen (SOGS): a new instrument for the identification of pathological gamblers. *The American journal of psychiatry*, *144*(9), 1184–1188. doi:10.1176/ajp.144.9.1184

Levenson, M. R., Kiehl, K. A., & Fitzpatrick, C. M. (1995). Assessing psychopathic attributes in a noninstitutionalized population. *Journal of Personality and Social Psychology*, *68*(1), 151–158.

Lobo, D. S. S., Quilty, L. C., Martins, S. S., Tavares, H., Vallada, H., Kennedy, J. L., & Bagby, R. M. (2014). Pathological gambling subtypes: A comparison of treatment-seeking and non-treatment-seeking samples from Brazil and Canada. *Addictive Behaviors*, *39*(7), 1172–1175. doi:10.1016/j.addbeh.2014.03.006

Lorains, F. K., Cowlishaw, S., & Thomas, S. A. (2011). Prevalence of comorbid disorders in problem and pathological gambling: systematic review and meta-analysis of population surveys. *Addiction*, *106*(3), 490–498. doi:10.1111/j.1360-0443.2010.03300.x

May-Chahal, C., Humphreys, L., Clifton, A., Francis, B., & Reith, G. (2017). Gambling harm and crime careers. *Journal of Gambling Studies*, *33*(1), 65–84. doi:10.1007/s10899-016-9612-z

Meneses-Gaya, C. de, Waldo Zuardi, A., Loureiro, S. R., & Crippa, J. A. S. (2009). Alcohol Use Disorders Identification Test (AUDIT): An updated systematic review of psychometric properties. *Psychology & Neuroscience*, *2*(1), 83–97.

Meyer, G., & Stadler, M. A. (1999). Criminal behavior associated with pathological

gambling. *Journal of Gambling Studies*, *15*(1), 29–43. doi:10.1023/A:1023015028901

Milosevic, A., & Ledgerwood, D. M. (2010). The subtyping of pathological gambling: A comprehensive review. *Clinical Psychology Review*, *30*(8), 988–998. doi:10.1016/j.cpr.2010.06.013

Mishra, S., Lalumière, M. L., Morgan, M., & Williams, R. J. (2011). An examination of the relationship between gambling and antisocial behavior. *Journal of Gambling Studies*, *27*(3), 409–426. doi:10.1007/s10899-010-9217-x

Moon, M., Lister, J. J., Milosevic, A., & Ledgerwood, D. M. (2017). Subtyping non-treatment-seeking problem gamblers using the pathways model. *Journal of Gambling Studies*, *33*(3), 841–853. doi:10.1007/s10899-016-9658-y

Nower, L., & Blaszczynski, A. (2017). Development and validation of the Gambling Pathways Questionnaire (GPQ). *Psychology of addictive behaviors : journal of the Society of Psychologists in Addictive Behaviors*, *31*(1), 95–109. doi:10.1037/adb0000234

Nower, L., Martins, S. S., Lin, K.-H., & Blanco, C. (2013). Subtypes of disordered gamblers: results from the national epidemiologic survey on alcohol and related conditions. *Addiction*, *108*(4), 789–798. doi:10.1111/add.12012

Ohnishi, M., Ohkawa, C., Harashima, M., Saito, S., Deguchi, Y., & Ibe, F. (1996). Capas nouryoku kensa 1·2 no saikentou (review for performance test with capas). *Chuo Kenkyusyo Kiyou (Chuo Acad. Res. Inst./Jpn. Correct. Assoc. Chuo Res. Cent.)*, *6*,

123–132.

Osumi, T., Nakao, T., Kasuya, Y., Shinoda, J., Yamada, J., & Ohira, H. (2012). Amygdala dysfunction attenuates frustration-induced aggression in psychopathic individuals in a non-criminal population. *Journal of Affective Disorders*, *142*(1), 331–338. doi:10.1016/j.jad.2012.05.012

Pantalon, M. V., Maciejewski, P. K., Desai, R. A., & Potenza, M. N. (2008). Excitement-seeking gambling in a nationally representative sample of recreational gamblers. *Journal of Gambling Studies*, *24*(1), 63–78. doi:10.1007/s10899-007-9075-3

Pastwa-Wojciechowska, B. (2011). The relationship of pathological gambling to criminality behavior in a sample of Polish male offenders. *Medical Science Monitor : International Medical Journal of Experimental and Clinical Research*, *17*(11), CR669–CR675. doi:10.12659/MSM.882054

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the barratt impulsiveness scale. *Journal of Clinical Psychology*, *51*(6), 768–774. doi:10.1002/1097-4679(199511)51:6<768::AID-JCLP2270510607>3.0.CO;2-1

Potenza Marc N. (2008). The neurobiology of pathological gambling and drug addiction: an overview and new findings. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *363*(1507), 3181–3189. doi:10.1098/rstb.2008.0100

Preston, D. L., McAvoy, S., Saunders, C., Gillam, L., Saied, A., & Turner, N. E. (2012). Problem gambling and mental health comorbidity in Canadian federal offenders.

Criminal Justice and Behavior, *39*(10), 1373–1388. doi:10.1177/0093854812448786

Reimers, S., Maylor, E. A., Stewart, N., & Chater, N. (2009). Associations between a one-shot delay discounting measure and age, income, education and real-world impulsive behavior. *Personality and Individual Differences*, *47*(8), 973–978. doi:10.1016/j.paid.2009.07.026

Saito, S. (1996). Compulsive/pathological gambling and its treatment; A introduction of a gambling screen (SOGS–Modified Japanese Version). *Alcohol Dependence & Addiction*, *13*(2), 102–109.

Sellbom, M. (2011). Elaborating on the construct validity of the Levenson self-report psychopathy scale in incarcerated and non-incarcerated samples. *Law and Human Behavior*, *35*(6), 440–451. doi:10.1007/s10979-010-9249-x

Shevlin, M., & Miles, J. N. V. (1998). Effects of sample size, model specification and factor loadings on the GFI in confirmatory factor analysis. *Personality and Individual Differences*, *25*(1), 85–90. doi:10.1016/S0191-8869(98)00055-5

Shimizu, H. (2016). An introduction to the statistical free software HAD : Suggestions to improve teaching, learning and practice data analysis. *Journal of Media, Information and Communication*, *1*, 59–73.

Skeem, J., Johansson, P., Andershed, H., Kerr, M., & Louden, J. E. (2007). Two subtypes of psychopathic violent offenders that parallel primary and secondary variants. *Journal of Abnormal Psychology*, *116*(2), 395–409.

doi:10.1037/0021-843X.116.2.395

Someya, T., Sakado, K., Seki, T., Kojima, M., Reist, C., Tang, S. W., & Takahashi, S. (2001). The Japanese version of the Barratt Impulsiveness Scale, 11th version (BIS-11): Its reliability and validity. *Psychiatry and Clinical Neurosciences*, *55*(2), 111–114. doi:10.1046/j.1440-1819.2001.00796.x

Stanford, M. S., Mathias, C. W., Dougherty, D. M., Lake, S. L., Anderson, N. E., & Patton, J. H. (2009). Fifty years of the Barratt Impulsiveness Scale: An update and review. *Personality and Individual Differences*, *47*(5), 385–395. doi:10.1016/j.paid.2009.04.008

Steiger, J. H. (2007). Understanding the limitations of global fit assessment in structural equation modeling. *Personality and Individual Differences*, *42*(5), 893–898. doi:10.1016/j.paid.2006.09.017

Stewart, S. H., Zack, M., Collins, P., & Klein, R. M. (2008). Subtyping pathological gamblers on the basis of affective motivations for gambling: Relations to gambling problems, drinking problems, and affective motivations for drinking. *Psychology of Addictive Behaviors*, *22*(2), 257–268. doi:10.1037/0893-164X.22.2.257

Stinchfield, R. (2002). Reliability, validity, and classification accuracy of the South Oaks Gambling Screen (SOGS). *Addictive Behaviors*, *27*(1), 1–19. doi:10.1016/S0306-4603(00)00158-1

Tabachnick, B. G., & Fidell, L. S. (2007). *Using Multivariate Statistics, 5th ed*. Boston,

MA: Allyn & Bacon/Pearson Education.

Takeuchi, H., Kawada, R., Tsurumi, K., Yokoyama, N., Takemura, A., Murao, T., et al. (2016). Heterogeneity of Loss Aversion in Pathological Gambling. *Journal of Gambling Studies*, *32*(4), 1143–1154. doi:10.1007/s10899-015-9587-1

Tang, C. S., Wu, A. M. S., Tang, J. Y. C., & Yan, E. C. W. (2010). Reliability, validity, and cut scores of the South Oaks Gambling Screen (SOGS) for Chinese. *Journal of Gambling Studies*, *26*(1), 145–158. doi:10.1007/s10899-009-9147-7

Templer, D. I., Kaiser, G., & Siscoe, K. (1993). Correlates of pathological gambling propensity in prison inmates. *Comprehensive Psychiatry*, *34*(5), 347–351. doi:10.1016/0010-440X(93)90022-V

Tessényi, J., & Kovács, P. (2016). A study of the connection between gambling and crime in Hungarian prisons. *International Journal of Law and Psychiatry*, *47*, 176–180. doi:10.1016/j.ijlp.2016.04.004

Toyama, T., Nakayama, H., Takimura, T., Yoshimura, A., Maesato, H., Matsushita, S., et al. (2014). Prevalence of pathological gambling in Japan. *Alcohol and Alcoholism*, *49*(suppl_1). doi:10.1093/alcalc/agu052.75

Turner, N. E., Jain, U., Spence, W., & Zangeneh, M. (2008). Pathways to pathological gambling: Component analysis of bariables related to pathological gambling. *International Gambling Studies*, *8*(3), 281–298. doi:10.1080/14459790802405905

Turner, N. E., Preston, D. L., McAvoy, S., & Gillam, L. (2013). Problem gambling inside and out: The assessment of community and institutional problem gambling in

the Canadian correctional system. *Journal of Gambling Studies*, *29*(3), 435–451. doi:10.1007/s10899-012-9321-1

Turner, N. E., Preston, D. L., Saunders, C., McAvoy, S., & Jain, U. (2009). The relationship of problem gambling to criminal behavior in a sample of Canadian male federal offenders. *Journal of Gambling Studies*, *25*(2), 153–169. doi:10.1007/s10899-009-9124-1

Turner, N. E., Stinchfield, R., McCready, J., McAvoy, S., & Ferentzy, P. (2016). Endorsement of criminal behavior amongst offenders: Implications for DSM-5 gambling disorder. *Journal of Gambling Studies*, *32*(1), 35–45. doi:10.1007/s10899-015-9540-3

Valleur, M., Codina, I., Vénisse, J.-L., Romo, L., Magalon, D., Fatséas, M., et al. (2016). Towards a validation of the three pathways model of pathological gambling. *Journal of Gambling Studies*, *32*(2), 757–771. doi:10.1007/s10899-015-9545-y

West, S. G., Taylor, A. B., & Wu, W. (2012). Model fit and model selection in structural equation modeling. In *Handbook of structural equation modeling* (pp. 209–231). New York, NY, US: The Guilford Press.

Wheaton, B., Muthén, B., Alwin, D. F., & Summers, G. F. (1977). Assessing reliability and stability in panel models. *Sociological Methodology*, *8*, 84–136. doi:10.2307/270754

Wheeler, S. A., Round, D. K., Sarre, R., & O'Neil, M. (2007). The influence of gaming expenditure on crime rates in South Australia: A local area empirical

investigation. *Journal of Gambling Studies*, *24*(1), 1. doi:10.1007/s10899-007-9070-8

Yamamoto, Y., & Brinton, M. C. (2010). Cultural capital in east Asian educational systems: The case of Japan. *Sociology of Education*, *83*(1), 67–83. doi:10.1177/0038040709356567

Yasuki, M., Fujiyabu, K., Kudo, H., Ibe, F., Yamaguchi, Y., & Asano, C. (2003). Capas nouryoku kensa 1·2 no saikentou (review for performance test with capas). *Chuo Kenkyusyo Kiyou (Chuo Acad. Res. Inst./Jpn. Correct. Assoc. Chuo Res. Cent.)*, *13*, 101–111.

Yokomitsu, K., & Kamimura, E. (2019). Factor structure and validation of the Japanese version of the Gambling Symptom Assessment Scale (GSAS-J). *Journal of Gambling Issues*, *41*(0). http://jgi.camh.net/index.php/jgi/article/view/4037. Accessed 15 March 2019

Yokotani, K., & Tamura, K. (2015). Effects of personalized feedback interventions on drug-related reoffending: a Pilot Study. *Prevention Science*, *16*(8), 1169–1176. doi:10.1007/s11121-015-0571-x

Yokotani, K., & Tamura, K. (2017). The effect of a social reintegration (parole) program on drug-related prison inmates in Japan: a 4-year prospective study. *Asian Journal of Criminology*, *12*(2), 127–141. doi:10.1007/s11417-016-9235-4

Young, K. S. (1998). *Caught in the Net: How to Recognize the Signs of Internet Addiction--and a Winning Strategy for Recovery*. John Wiley & Sons.

Zurhold, H., Verthein, U., & Kalke, J. (2014). Prevalence of problem gambling among the prison population in Hamburg, Germany. *Journal of Gambling Studies*, *30*(2), 309–319. doi:10.1007/s10899-013-9361-1

Figure

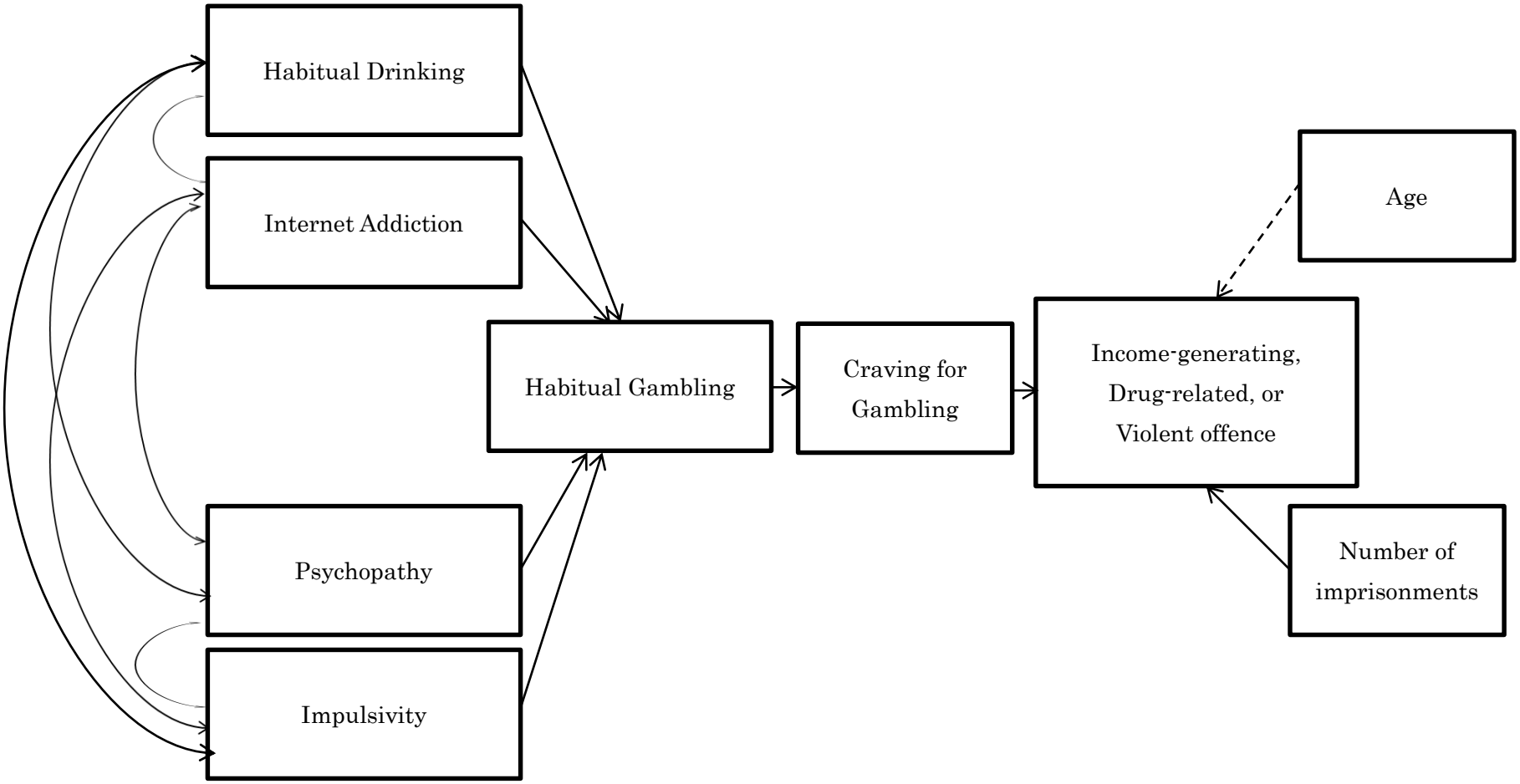

Fig. 1 Conceptual pathways from addiction/psychopathy to offence via gambling

Note: Solid line indicates positive effect, dashed line indicates negative effect

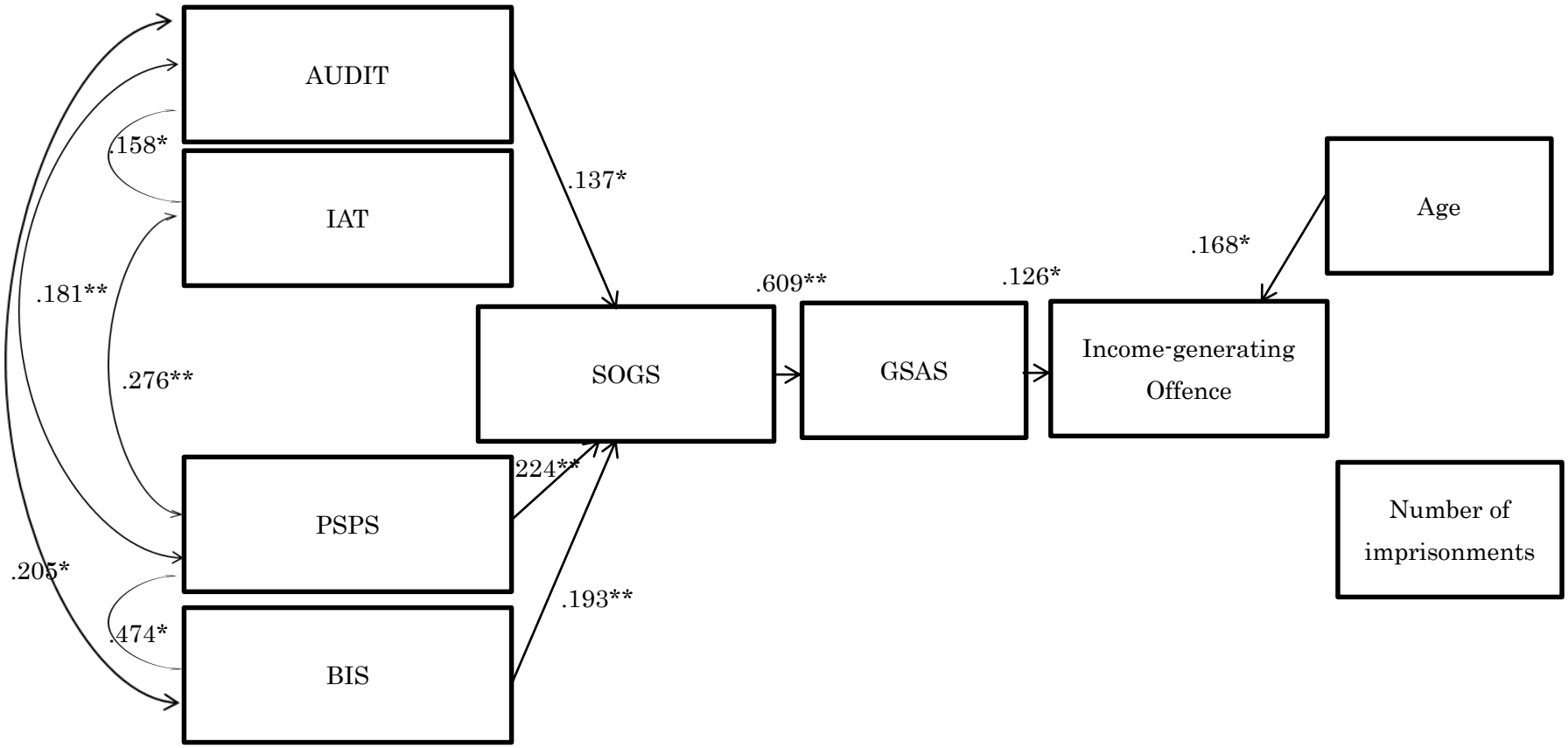

Fig. 2 Pathways from addiction/psychopathy to income-generating offence via gambling

Note: Scores indicate standardized coefficients. Only significant paths are shown in the figure. SOGS: the South Oaks Gambling Screen, GSAS: the Gambling Symptom Assessment Scale, AUDIT: Alcohol Use Disorders Identification Test, IAT: Young's Internet Addiction Test, PSPS: the Primary and Secondary Psychopathy, BIS: the Barratt Impulsiveness Scale 11th edition, **: $p < .01$, *: $p < .05$, $\chi^2 = 27.46$ (df = 13, $p = .010$), $\chi^2/df = 2.12$, RMSEA = .066, SRMR = .042,GFI = .977, AGFI = .920, CFI = .963, AIC = 91.642, BIC = 205.707

Table

Table 1 Comparison of basic traits between prisoners with and without problem gambling

	Prisoners with Problem Gambling (n = 128) SOGS ≧ 5		Prisoners without Problem Gambling (n =204) SOGS < 5				
	M	*S.D*	*M*	*S.D*	*t*	*df*	
Age (year)	52.57 [a]	12.46	50.58	13.06	1.39	276.81	
Length of Sentence (month)	40.83 [a]	25.13	44.63	29.34	-1.25	297.58	
Number of imprisonment	4.83 [a]	3.12	4.56	3.15	0.76	269.18	
Length of education (year)	10.54 [a]	1.93	10.39	2.16	0.63	290.06	
IQ (equivalence)	87.20 [b]	13.68	85.14 [f]	16.07	1.24	296.28	
SOGS	9.53	3.25	1.09	1.39	27.86	156.43	***
GSAS	16.56 [c]	13.26	3.96 [g]	6.73	9.70	159.26	***
AUDIT	11.62 [c]	9.89	8.09 [h]	8.44	3.27	223.34	**
AUDIT ≧ 8	0.55 [c]	0.50	0.44 [h]	0.50	2.03	252.75	*
IAT	32.56 [d]	14.51	27.83 [i]	11.89	2.88	200.74	*
IAT (3stage)	1.33 [d]	0.53	1.13 [i]	0.37	3.52	178.68	**
PSPS	48.10 [e]	8.92	41.96 [i]	8.38	5.85	230.78	***
BIS	71.69 [e]	11.25	65.10 [i]	11.42	4.84	244.26	***
	%		*%*		χ^2	*n*	
Income-generating offence	53		50		.307	332	
Drug-related offence	30		28		.244	332	
Violent offence	17		19		.195	332	

Note: SOGS: the South Oaks Gambling Screen, IQ: Intelligent Quotient (equivalent), GSAS: the Gambling Symptom Assessment Scale, AUDIT: Alcohol Use Disorders Identification Test, IAT: Young's Internet Addiction Test, PSPS: the Primary and Secondary Psychopathy, BIS: the Barratt Impulsiveness Scale 11th edition. [a]: $n = 127$, [b]: $n = 126$, [c]: $n = 121$, [d]: $n = 111$, [e]: $n = 114$, [f]: $n = 202$, [g]: $n = 193$, [h]: $n = 199$, [i]: $n = 175$, ***: $p < .001$, **: $p < .01$, *: $p < .05$

Table 2 Correlations among research variables in the pathways model

	2	3	4	5	6	7	8	9	10	11	12	13
1. Age (year)	.055 [a]	.511** [a]	-.371** [b]	.001 [c]	.055 [a]	-.092 [e]	-.309** [h]	.007 [l]	-.170** [l]	.221** [a]	-.111* [a]	-.199** [a]
2. Length of education (year)		-.181** [a]	.205** [b]	-.091 [c]	.014 [a]	-.028 [e]	.064 [h]	-.193** [l]	-.105 [l]	-.040 [a]	-.100 [a]	.068 [a]
3. Number of imprisonment			-.176** [b]	.082 [c]	.034 [a]	-.038 [e]	-.207** [h]	.117* [l]	-.051 [l]	.136* [a]	.015 [a]	-.211** [a]
4.IQ (equivalence)				.042 [d]	.088 [b]	.068 [f]	.308** [i]	-.095 [m]	.096 [p]	-.166** [b]	.083 [b]	.134* [b]
5. GSAS					.614** [s]	.157** [g]	.166** [j]	.345** [k]	.378** [k]	.145* [s]	-.027 [s]	-.071 [s]
6. SOGS						.238** [t]	.203** [h]	.331** [l]	.362** [l]	.012	.041	-.021
7. AUDIT							.145* [k]	.201** [n]	.175** [q]	-.035 [t]	-.050 [t]	.108 [t]
8. IAT								.056 [o]	.254** [r]	-.086 [h]	.045 [h]	.075 [h]
9. BIS									.486** [h]	.107 [l]	.043 [l]	-.113 [l]
10. PSPS										.054 [l]	.039 [l]	-.003 [l]
11. Income-generating offence											-.653**	-.299**
12. Drug-related offence												-.303**
13. Violent offence												

N = 332

Note: SOGS: the South Oaks Gambling Screen, IQ: Intelligent Quotient (equivalent), GSAS: the Gambling Symptom Assessment Scale, AUDIT: Alcohol Use Disorders Identification Test, IAT: Young's Internet Addiction Test, PSPS: the Primary and Secondary Psychopathy, BIS: the Barratt Impulsiveness Scale 11th edition, [a]: n = 331, [b]: n = 328, [c]: n = 313, [d]: n = 311, [e]: n = 319, [f]: n = 317, [g]: n = 306, [h]: n = 286, [i]: n = 283, [j]: n = 272, [k]: n = 276, [l]: n = 289, [m]: n = 287, [n]: n = 281, [o]: n = 279, [p]: n = 288, [q]: n = 280, [r]: n = 281, [s]: n = 314, [t]: n = 320, **: $p < .01$, *: $p < .05$