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Latent class analysis of gambling activities in a sample of young Swiss men: association with gambling problems, substance use outcomes, personality traits and coping strategies

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Conflict of Interest: The authors declare that they have no conflict of interest.

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Abstract

The study aimed to identify different patterns of gambling activities (PGAs) and to investigate how PGAs differed in gambling problems, substance use outcomes, personality traits and coping strategies.

A representative sample of 4,989 young Swiss males completed a questionnaire assessing seven distinct gambling activities, gambling problems, substance use outcomes, personality traits and coping strategies. PGAs were identified using latent class analysis (LCA). Differences between PGA in gambling and substance use outcomes, personality traits and coping strategies were tested.

LCA identified six different PGAs. With regard to gambling and substance use outcomes, the three most problematic PGAs were extensive gamblers, followed by private gamblers, and electronic lottery and casino gamblers, respectively. By contrast, the three least detrimental PGAs were rare or non-gamblers, lottery only gamblers and casino gamblers. With regard to personality traits, compared with rare or non-gamblers, private and casino gamblers reported higher levels of sensation seeking. Electronic lottery and casino gamblers, private gamblers and extensive gamblers had higher levels of aggression-hostility. Extensive and casino gamblers reported higher levels of sociability, whereas casino gamblers reported lower levels of anxiety-neuroticism. Extensive gamblers used more maladaptive and less adaptive coping strategies than other groups.

Results suggest that gambling is not a homogeneous activity since different types of gamblers exist according to the PGA they are engaged in. Extensive gamblers, electronic and casino gamblers and private gamblers may have the most problematic PGAs. Personality traits

and coping skills may predispose individuals to PGAs associated with more or less negative outcomes.

Introduction

Gambling, i.e. "wagering money or something of material value on an event with an uncertain outcome with the primary intent of winning additional money and/or material goods" (Molde et al. 2009), is a very popular activity. In Europe, twelve-month prevalence rates of gambling ranged from 39% to 80% in the general population (Griffiths 2010), and in Switzerland more specifically, about 56.8% of the general population reported 12-month gambling (Arnaud et al. 2009). Although most gamblers do not exhibit any problems, some gamblers show pathological gambling, associated with financial, social, psychological, physical and family consequences and co-morbidities, such as alcohol, tobacco and cannabis use (Lorains et al. 2011; Toneatto and Brennan 2002; Welte et al. 2001; Hayatbakhsh et al. 2012), and suicide attempts (Maccallum and Blaszczynski 2003; Ledgerwood and Petry 2004; Nower et al. 2004b). According to the Diagnostic and Statistical Manual of Mental Disorder (DSM), fourth edition (DSM-IV; American Psychiatric Association 1994) and to the International Classification of Diseases tenth revision (ICD-10; World Health Organizazion 1991), pathological gambling is defined as an impulse-control disorder (not elsewhere classified). In the fifth edition of the DSM (DSM-5; American Psychiatric Association 2013), pathological gambling was moved to the substance-related and addictive disorders category and renamed *gambling disorder* (see Reilly and Smith 2013, for more details between DSM-IV and DSM-5 categorization). Less severe forms of gambling problems are generally labelled as *problem gambling* (Sassen et al. 2011). Problem and pathological gambling are often grouped together under the term *excessive gambling* (Stucki and Rihs-Middel 2007). In European countries, twelve-month prevalence rates of pathological gambling ranged from 0.15% to 0.60% in the adult population (Sassen et al. 2011), including 0.50% in Switzerland (Bondolfi et al. 2008) and prevalence rates of problem

gambling ranged from 0.25% to 1.40% (Sassen et al. 2011), including 0.80% in Switzerland (Bondolfi et al. 2008). Thus, gambling constitutes an important public health problem, particularly in emerging adults and males – a population in which excessive gambling is overrepresented (Tomei et al. 2014; Tozzi et al. 2013; Luder et al. 2010; see Williams et al. 2012, for review).

Previous studies investigating the link between psychological variables and problem gambling identified some personality traits and coping strategies that may constitute risk factors for excessive gambling. With regard to personality traits, higher neuroticism (Bagby et al. 2007; Blaszczynski et al. 1986; MacLaren et al. 2011), higher impulsivity (Steel and Blaszczynski 1998; Lawrence et al. 2009), higher sensation seeking (Harris et al. 2013; Gupta et al. 2006), higher sociability (Zuckerman and Kuhlman 2000), higher psychoticism (Blaszczynski et al. 1986), higher hostility (MacLaren et al. 2011; Petry 2000), higher aggression (Slutske et al. 2005) and lower agreeableness (MacLaren et al. 2011) scores were found in excessive gamblers compared to non-problem gamblers. With regard to coping, gambling problems were found to be positively associated with the use of avoidant and emotion-focused strategies, and negatively associated with the use of problem-focused strategies (Bergevin et al. 2006; Gupta and Derevensky 2001; Lightsey and Hulsey 2002; Nower et al. 2004a).

Another important factor associated with gambling problems is the gambling activities individuals engage in. To date, studies investigating this topic yielded inconsistent findings. Some authors reported that gambling problems were more prevalent among gambling machine players (Breen and Zimmerman 2002; Dowling et al. 2005), whereas others highlighted that internet gambling (Griffiths and Barnes 2008; Griffiths et al. 2009), or scratch cards (Griffiths 2002) may be particularly risky forms of gambling with regard to gambling problems. Other

studies reported that almost all gambling activities were related with increased rates of gambling problems (Afifi et al. 2014; LaPlante et al. 2011; Welte et al. 2009). However, these studies also reported that when analyses were adjusted for the number of games played in the past year, the coefficients of associations of each gambling activity greatly decreased or even became non significant. Thus, the number of games played may account for a large part of the association between gambling activities and gambling problems. This suggests that individuals who participate in a given gambling activity also combine it with other forms of gambling. It may not be a specific activity *per se* that drives individuals to be more likely to experience gambling problems, but rather some specific patterns of gambling activities (PGAs), i.e. the combination of different activities.

This view is supported by results of two studies investigating how PGAs relate to gambling problems and associated outcomes (Boldero et al. 2010; Goudriaan et al. 2009). These studies used a person-centred approach, i.e. latent class analysis (LCA; see e.g. Goodman 2002), to identify subgroups of individuals with different PGAs, and compared subgroups on the basis of gambling problems and other risk factors.

In a U.S. sample of college students, Goudriaan and colleagues (2009) identified four different PGAs, based on a series of ten activities. There were a group of extensive gamblers (i.e. with a high probability of having almost all gambling activities) and a group of low gamblers (i.e. with a low probability of having any activity). Extensive gamblers had the highest rates of days of gambling, number of gambling activities, gambling problems, heavy use of alcohol and drugs, conduct disorders, psychological distress and novelty seeking. By contrast, low gamblers had the lowest rates of days of gambling, number of gambling activities, gambling problems and heavy alcohol and drug use. The two remaining groups had more specific PGAs: the casino/slot

machine gamblers engaged mainly in slot machine and casino gambling, and the card gamblers consisted of people who engaged in card gambling, other non-regulated forms of gambling (sports betting, games of skill) and lottery gambling. Card gamblers had higher rates of gambling activities, gambling problems and novelty seeking than casino/slot machine gamblers.

In an Australian sample of high school students, Boldero and colleagues (2010) identified six different PGAs, based on a series of twelve gambling activities. As in Goudriaan and colleagues' study, there were two extreme groups, namely extensive and low gamblers. In addition, there was a group of lottery/scratch card gamblers with high probabilities of lottery and scratch card gambling, moderate probabilities of gambling on horse races and cards, and low probabilities of participation in other forms of gambling; a group of "broad" gamblers, that resembles the group of extensive gamblers with the exception that they had moderate to high rather than very high probabilities of engaging in all activities; a group of "pool" gamblers, with high probability of betting on pool games, moderate probabilities of gambling on cards, races, and sports, but with a low probability of betting the lottery, scratch card, or legally-restricted gambling; and a group of "unrestricted activity" gamblers, with high probabilities of gambling in activities with relatively unrestricted access. Results showed that lottery/scratch card and low gamblers reported the lowest number of gambling activities, the lowest levels of gambling problems and the least money spent on gambling. By contrast, extensive, unrestricted activity, and pool gamblers reported the highest levels of gambling problems. Broad gamblers fell between these two extremes.

Thus, previous studies showed that latent class analysis may be particularly useful to identify distinct PGAs, in particular when investigating the link between gambling activities, gambling behaviours and related problems. However, these studies are sparse and limited to

Australian and U.S. non-representative samples of students. Thus, results of these studies may neither apply to European countries such as Switzerland, nor to non-students. Moreover, previous studies investigating differences between PGAs essentially focused on differences in gambling problems and substance use outcomes. As gambling problems and behaviours were previously related to certain personality traits and coping strategies, differences between PGAs may also exist in such variables. However, except for the study of Goudriaan et al. (2009), in which differences between PGAs in one personality trait, namely novelty seeking, were examined, possible differences between PGAs in other personality traits and coping strategies have not, to our knowledge, been investigated yet. The present study aimed to overcome these limitations and to extend previous studies by using a representative sample of young Swiss men to investigate the associations of PGAs not only with gambling problems and substance use outcomes, but also with several personality traits and coping strategies.

Methods

Study design and participants

The present study used data from the Cohort Study on Substance Use Risk Factors (C-SURF). C-SURF is a longitudinal study designed to investigate risk and protective factors of substance use in emerging adulthood. The research protocol (15/07) was approved by the ethics committee for clinical research of Lausanne University Medical School. Participants were enrolled in three of the six army recruitment centres, covering 21 of 26 Swiss cantons. As army recruitment is mandatory in Switzerland for 20-year-old males, virtually all young males of this age were eligible for participation. Thus, contrary to the majority of existing studies on substance use among young adults, whose samples consist essentially of college students, C-SURF had the unique advantage of enrolling a highly representative sample of the general population of young

men. Women were not eligible for inclusion in C-SURF, because army recruitment is not mandatory for females and the small number of females who decided to enrol in the army was consequently not representative of the general population of women in this age group.

All young men showing up in the army centres were eligible for inclusion, provided that they gave written consent for study participation. Enrolment was carried out on all recruitment days over a full year, which avoided the impact of seasonal factors on the sample as a whole (e.g. more recent alcohol use in summer).

Although army recruitment centres were used to inform and enrol participants, the study was independent of the army. More information on enrolment procedure has been described in previous studies (Studer et al. 2013a; Studer et al. 2013b).

A total of 7,563 participants gave written consent to participate, of which 5,990 participants (79.2%) completed the baseline questionnaire between September 2010 and March 2012. Of the latter, 5,223 participants (87.2% of the baseline respondents) completed the follow-up questionnaire between March 2012 and April 2013. As questionnaires were completed at home, participants were not influenced by army procedures when filling out questionnaires.

In the present study, some variables were assessed only once, i.e. either in the baseline or in the follow-up questionnaire. Hence, we only included participants who had completed both baseline and follow-up surveys (N = 5,223). Moreover, missing values were listwise deleted, resulting in the exclusion of 234 participants (4.5% of baseline and follow-up respondents) with incomplete data. Thus, the final analytic sample consisted of 4,989 participants.

Measures

Gambling and substance use outcomes

Gambling activities. Participants were asked how many times in the previous twelve months they had spent money on seven gambling activities. Gambling activities were assessed at follow-up and comprised (1) lottery playing (e.g. lottery, scratch cards, lotto/bingo, sports events), (2) electronic lotteries, (3) gambling machines (e.g. slot machine, poker automat), (4) gambling tables in casinos (e.g. roulette, black jack, poker), (5) internet gambling, (6) gambling in private settings (question wording: money and card games with money (e.g. poker) in private), and (7) other gambling activities. Participants responded on a 5-point scale ranging from never to daily or nearly daily. Responses were then recoded to get the number of times each gambling activity was played in the previous twelve months: never was recoded as 0, a few times a year as 6.5 times a year, several times a month but not weekly as 38 times, several times a week but not daily as 182 times and daily or nearly daily as 338 times. The yearly frequency of engaging in any gambling activity was obtained by summing up the number of times each gambling activity was played in the previous twelve months. The number of distinct gambling activities played in the previous twelve months was also computed. In order to identify PGAs, the frequency of each gambling activity was recoded as *never* (coded 0) versus *at least once a year* (coded 1) and then submitted to latent class analyses (see the statistical analyses section).

Self-reported gambling problem. Self-reported gambling problem was assessed at follow-up by asking participants the following question: *During the past twelve months, has your betting or gambling caused you personal problems?* Possible responses were *No* (coded 0) if no personal problem was experienced, and *Yes* (coded 1) if personal problems were experienced. Participants reporting no gambling activity were recoded as having no self-reported gambling problems.

Gambling disorder criteria. Participants were asked at follow-up whether they had experienced any of the nine criteria for gambling disorder in the previous twelve months according to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013). Questions were translated into French and German, based on the DSM-IV Pathological Gambling Diagnostic Form (Office of Alcoholism and Substance Abuse Services, n.d.). For participants indicating no gambling activity, each criterion was set as not endorsed. Following DSM-5 recommendations, gambling disorder was identified as soon as four or more criteria were endorsed.

Substance use. Participants were asked about the frequency of their risky single occasion drinking (RSOD)–defined as drinking occasions with at least six standard drinks–in the previous twelve months. They were also asked whether they used cigarettes daily, used smokeless tobacco products (i.e. snus, snuff, chewing tobacco) at least once, and used cannabis more than once a week. Substance use was assessed at follow-up. Based on these questions, at-risk versus not at-risk substance use dichotomous variables were created. Risky RSOD differentiated between less than monthly RSOD and at least monthly RSOD; daily cigarette use differentiated between non-daily and daily cigarette users; and risky cannabis use between once a week or less and more than weekly cannabis users. Smokeless tobacco use differentiated between non-users and users of at least one smokeless tobacco product.

Personality and coping

Personality. Different aspects of personality were assessed at baseline. Aggression/hostility, anxiety/neuroticism and sociability traits were assessed using the French and German versions of the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ-50-cc; Aluja et al. 2006). Each personality trait was measured with ten true/false statements and scores

were computed by summing the statements endorsed (possible score range: 0 to 10). Sensation seeking was measured using French and German translations of the Eight-item Brief Sensation Seeking Scale (BSSS; Hoyle et al. 2002). Participants answered each item on a five-point scale (ranging from strongly disagree to strongly agree). Sensation seeking scores were computed by averaging response to the eight items (scores ranging from 1 to 5).

Coping. Participants' coping strategies were evaluated at follow-up using the Brief Cope questionnaire (Carver 1997; German version, Knoll et al. 2005; French version, Muller and Spitz 2003). Problem-focused coping was assessed using the active coping and planning scales, emotion-focused coping using the use of emotional support scale, and avoidant coping using the denial and behavioural disengagement scales. Each scale comprised two statements dealing with how individuals cope with stress, rated on a four-point scale ranging from "I usually don't do this at all" to "I usually do this a lot". Scale scores were computed by summing the corresponding items to obtain scores ranging from 2 to 8.

Socio-demographics

Socio-demographic variables including age and highest completed level of education were assessed. Highest completed level of education consisted of three categories of schooling: primary schooling (9 years); vocational training (>9–12); post-secondary schooling (13 years long or more including high school which can be only twelve years long in some cantons). Language (French, German) was only measured at baseline.

Statistical analyses

First, descriptive statistics were computed to characterize participants in terms of socio-demographics, gambling behaviours and gambling problems, substance use, personality and coping characteristics.

Then, in order to identify homogenous subgroups of participants with different patterns of gambling activities, latent class analyses (LCAs) were conducted on the seven gambling activities using the Mplus 7.11 software (Muthén and Muthén 1998-2012). LCA is a statistical method for identifying unmeasured homogenous subgroups or subtypes of cases (i.e. latent classes) within a population using multivariate categorical data (Clogg 1995). Because the number of classes was *a priori* unknown, different LCA models varying from two to eight classes were fitted and statistical criteria were used to determine the optimal number of classes to retain. Statistical criteria included Akaike's information criterion (AIC), Bayesian information criterion (BIC) and sample size adjusted BIC (ABIC), entropy and Lo-Mendel-Rubin likelihood ratio test (LMR-LRT). For AIC, BIC and ABIC, lower values indicate better fit (Yang 2006), whereas for entropy, values close to 1 indicate better fit (Celeux and Soromenho 1996). The LMR-LRT was used to examine whether a model with k classes fitted the data significantly better than a model with k-1 class (Lo et al. 2001). A non-significant LMR-LRT indicates that a model with k-1 classes provides a more parsimonious fit to the data than a model with k classes.

Once the optimal number of classes was identified, conditional probabilities were used to determine participants' most likely class membership. Differences between classes in gambling problems and substance use outcomes, coping strategies and personality traits were tested using ANOVAs and Kruskal-Wallis test for continuous outcomes, and using chi squared tests and Fisher's exact tests for categorical outcomes.

Results

Descriptive characteristics of the sample

Descriptive characteristics of the sample for demographics, gambling, and substance use outcomes are reported in Table 1. Participants were about 21 years and 3 months of age and a

little more than half of them were French-speaking. A little less than half of the participants reported post-secondary schooling and vocational training as their highest achieved level of education, whereas only 7% reported primary schooling. Over the previous twelve months, more than half of the participants (55.5%) gambled, and participants were engaged in 1.25 distinct gambling activities on average. They had played any gambling activity 22.92 times on average in the previous twelve months. The prevalence of self-reported gambling problems and DSM-5 gambling disorder was low, i.e. 0.6% and 1.0% in the total sample, respectively, and 1.1% and 1.7% among gamblers. A little less than half of the sample reported monthly or more frequent RSOD. About one in five was a daily cigarette user. About 8% used cannabis more than weekly, and about 31% had used at least one smokeless tobacco product in the last twelve months. Mean scores of personality traits and coping strategies are reported in Table 2.

Insert Table 1 and 2 about here

LCA

Fit indices of the two- to eight-class LCA are shown in Table 3. AIC provided support for a seven-class solution, BIC for a 5-class solution, ABIC for a five- or six-class solution, LMR-LRT for a six- and entropy for a four-class solution. Based on these fit indices, the six-class solution was retained. PGAs of the six-class solution are depicted in Figure 1. Figure 1 depicts the probability that individuals classified in each of the six PGAs had engaged in each gambling activity in the previous twelve months. For example, individuals classified as rare or non-gambler have a .16, .005, .017, .051, .005, .038, and .014 probability of having played the lottery, electronic lottery, gambling machine, gambling tables in casinos, internet gambling, gambling in private settings, and engaging in other gambling activities in the previous twelve months, respectively. The first class consisted of rare or non-gamblers, characterized by a low probability

of engaging in all gambling activities. This group represents 67.7% (n = 3,380) of the sample. The second class consisted of lottery only gamblers, characterized by a high probability of playing the lottery and a low probability of engaging in any other gambling activity. This class comprised 6.7% (n = 336) of the sample. All other classes of gamblers were also characterized by a high probability of playing the lottery. The third class consisted of electronic lottery and casino gamblers characterized by a high probability of playing the lottery and electronic lottery, playing gambling machines, and gambling tables in casinos, and a low probability of engaging in all other gambling activities. This group comprised 2.3% (n = 115) of the sample. The fourth class consisted of casino gamblers, characterized by a high probability of playing the lottery and playing gambling tables, a moderate probability of playing gambling machine, and a low probability of engaging in other gambling activities. This group comprised 16.6% (n = 827) of the sample. The fifth class consisted of private gamblers, characterized by a high probability of gambling in private settings and playing the lottery, a moderate probability of playing gambling tables in casinos, and a low probability of engaging in all other gambling activities. This group represents 4.0% (n = 197) of the sample. Finally, the sixth class consisted of extensive gamblers, characterized by a high probability of participating in all gambling activities. This group comprised 2.7% (n = 134) of the sample.

Insert Table 3 and Figure 1 about here

Differences between patterns of gambling activities

When omnibus tests were significant, specific contrasts were conducted to obtain insight into the ways that classes with specific gambling activities differed from extensive gamblers and rare or non gamblers. Thus, lottery only gamblers, electronic lottery and casino gamblers, casino gamblers, private gamblers, extensive gamblers were compared with rare or non gamblers and

rare or non gamblers, lottery only gamblers, electronic lottery and casino gamblers, casino gamblers, private gamblers were compared with extensive gamblers. The threshold of significance was adjusted following a Bonferroni correction, in order to reduce Type I errors due to multiple comparisons.

Gambling outcomes. Table 4 shows the prevalence of self-reported gambling problems, DSM-5 gambling disorders, the mean number of distinct gambling activities played in the previous twelve months, and the yearly frequency of engaging in any gambling activity as a function PGA. Rare or non-gamblers had the lowest rate with regard to self-reported gambling problems, DSM-5 gambling disorders, the mean number of distinct gambling activities, and the yearly frequency of engaging in any gambling activity. For example, only one individual out of 3,380 rare or non-gamblers reported having gambling problems (less than 0.1% of this group). Rare or non-gamblers showed an average of 0.34 distinct gambling activities and had gambled 4.68 times in the previous twelve months. The lottery only gamblers had the second lowest rate with regard to self-reported gambling problems, DSM-5 gambling disorders, the mean number of distinct gambling activities and the yearly frequency of engaging in any gambling activity, followed by casino gamblers, private gamblers (electronic lottery and casino gamblers for DSM-5 gambling disorders), electronic lottery and casino gamblers (private gamblers for DSM-5 gambling disorders), and extensive gamblers. Compared with rare or non-gamblers, the groups of electronic lottery and casino gamblers, casino gamblers, private gamblers and extensive gamblers were significantly more likely to report self-reported gambling problems, DSM-5 gambling disorders, and reported significantly more gambling activities and a significantly higher yearly frequency of engaging in any gambling activity. Lottery only gamblers also reported significantly more distinct gambling activities and a significantly higher yearly

frequency of engaging in any gambling activity than rare or non-gamblers. Compared with extensive gamblers, the groups of rare or non-gamblers, lottery only gamblers and casino gamblers were significantly less likely to report self-reported gambling problems, DSM-5 gambling disorders, and reported significantly less gambling activities and a significantly lower yearly frequency of engaging in any gambling activity. Electronic lottery and casino gamblers were also significantly less likely to report DSM-5 gambling disorders than extensive gamblers, whereas private gamblers were significantly less likely to report DSM-5 gambling disorders and reported a significantly lower yearly frequency of engaging in any gambling activity than extensive gamblers.

Substance use outcomes. Table 4 shows the prevalence of substance use outcomes as a function of PGA. Prevalence of more than monthly RSOD was the lowest in rare or non-gamblers, followed by lottery only gamblers, electronic lottery and casino gamblers, casino gamblers, extensive gamblers and private gamblers. Significant differences were found between rare or non-gamblers and, casino gamblers, private gamblers, extensive gamblers. With regard to daily cigarette use, rates were the lowest in rare or non-gamblers, followed by lottery only gamblers, casino gamblers, private gamblers, extensive gamblers, electronic lottery and casino gamblers. Rare or non-gamblers differed significantly from electronic lottery and casino gamblers, casino gamblers, private gamblers and extensive gamblers. With regard to the use of smokeless tobacco, rates were the lowest in rare or non-gamblers, followed by electronic lottery and casino gamblers, lottery only gamblers, extensive gamblers, casino gamblers, and private gamblers. Lottery only gamblers, casino gamblers and private gamblers differed significantly from rare or non-gamblers. With regard to using cannabis more than once a week, its prevalence was the lowest in rare or non-gamblers, followed by casino gamblers, lottery only gamblers,

electronic lottery and casino gamblers, private gamblers, and extensive gamblers. Extensive gamblers and private gamblers differed significantly from rare or non-gamblers, whereas casino gamblers differed significantly form extensive gamblers.

Insert Table 4 about here

Personality traits. Table 5 displays the means and standard deviations of the four personality traits as a function of PGAs. With regard to sensation seeking, rare or non-gamblers reported the lowest scores, followed by lottery only gamblers, electronic lottery and casino gamblers, extensive gamblers, private gamblers and casino gamblers. The only significant differences observed were between rare or non-gamblers and casino gamblers, and between rare or non-gamblers and private gamblers. Regarding the aggression/hostility trait, lowest scores were found in rare or non-gamblers, followed by lottery only gamblers, casino gamblers, electronic lottery and casino gamblers, private gamblers and extensive gamblers. All types of gamblers except lottery only gamblers differed significantly from rare or non gamblers. As far as the sociability trait is concerned, the lowest scores were observed in rare or non-gamblers, followed by private gamblers, lottery only gamblers, electronic lottery and casino gamblers, casino gamblers and extensive gamblers. Significant differences were observed between rare or non-gamblers and lottery only gamblers, casino gamblers, extensive gamblers. With respect to anxiety/neuroticism, casino gamblers scored the lowest, followed by rare or non-gamblers, electronic lottery and casino gamblers, private gamblers, lottery only gamblers and extensive gamblers, respectively. The only significant difference observed was between extensive gamblers and casino gamblers.

Coping strategies. Table 5 depicts the means and standard deviations of problem-focused, emotion-focused and avoidant coping as a function of PGAs. With regard to problem-

focused strategies, results showed that extensive gamblers reported using less active coping and less planning than all other types of gamblers (although the difference with electronic lottery and casino gamblers in planning was not significant). Moreover, electronic lottery and casino gamblers had significantly lower scores in planning than rare or non-gamblers. With regard to emotion-focused coping, no significant difference was found in the use of emotional support between groups. With regard to avoidant coping, extensive gamblers reported higher levels of denial than all other types of gamblers (although the difference with electronic lottery and casino gamblers was not significant), whereas electronic lottery and casino gamblers had significantly higher scores than rare or non-gamblers. A similar pattern of results emerged in behavioural disengagement, although differences were less strong: significant differences were only observed between extensive gamblers and rare or non-gamblers, casino gamblers and private gamblers.

Insert Table 5 about here

Discussion

The objective of the study was to identify different PGAs in a sample of young Swiss men and to examine whether PGAs differed in gambling and substance use outcomes, and in personality traits and coping strategies. Results showed that about 55% of the sample reported gambling in the previous twelve months. This prevalence is similar to the rates observed by Tomei et al. (2014) in 18–22 year-old French-speaking men (56.1%) and by Inglin and Gmel (2011) in the French-speaking adult population (56.8%), suggesting that gambling is a popular activity in Switzerland. Moreover, although low, the prevalence of DSM-5 gambling disorder observed in the present study (1.0 of the total sample, 1.7% of gamblers) is slightly higher than the rates of pathological gambling (1.4% of gamblers) observed by Tomei et al. (2014) in a comparable sample of Swiss French-speaking young men, and is about twice the prevalence of

pathological gambling (0.5%) reported by Bondolfi et al. (2008) in the Swiss adult population. As a result, male emerging adults may constitute a particularly vulnerable population with regard to gambling disorders. Therefore, the implementation of prevention measures specifically designed to target this population should be developed.

Moreover, the present study suggests that considering PGAs may be useful to refine prevention programs. Indeed, results of LCA identified six distinct PGA that differed in several gambling and substance use outcomes, personality traits and coping strategies.

Consistent with previous studies (Boldero et al. 2010; Goudriaan et al. 2009), LCA yielded two extreme groups: a group of rare or non-gamblers with a low probability of engaging in any gambling activity, and a group of extensive gamblers with a high probability of engaging in all gambling activities. Rare or non-gamblers comprised more than two thirds of the sample, and therefore may be considered as the normative group. They had the lowest rates of self-reported gambling problems, DSM-5 gambling disorders, at least monthly RSOD, risky cannabis use, daily cigarette use and smokeless tobacco use, and were involved in the fewest distinct gambling activities and reported the lowest yearly frequency of engaging in any gambling activity. On the opposite side, the group of extensive gamblers was relatively small and was associated with higher levels of gambling and substance use outcomes. Extensive gamblers had the highest rates of self-reported gambling problems, DSM-5 gambling disorders, risky cannabis use, were involved in the greatest number of distinct gambling activities and reported the highest yearly frequency of engaging in any gambling activity. They had the second highest prevalence of at least monthly RSOD and daily cigarette use. Extensive gamblers differed significantly from rare or non-gamblers in all gambling and substance use outcomes. Consistent with results of previous studies on PGAs (Boldero et al. 2010; Goudriaan et al. 2009), this result suggests that

rare or non-gamblers have the least problematic PGA, whereas extensive gamblers had the most negative outcomes.

This proposition is further supported by differences observed in personality traits and coping strategies. Indeed, consistent with previous research showing that risky gambling was positively related with aggression/hostility and sociability traits (Zuckerman and Kuhlman 2000; MacLaren et al. 2011; Petry 2000; Slutske et al. 2005), we found that rare or non-gamblers and extensive gamblers differed significantly in these traits from rare or non-gamblers reporting the lowest levels and from extensive gamblers reporting the highest levels of aggression/hostility and sociability. In addition, consistent with previous studies indicating that gambling problems versus non-gambling problems were associated with the use of more maladaptive and less adaptive coping strategies (Bergevin et al. 2006; Gupta and Derevensky 2001; Lightsey and Hulsey 2002; Nower et al. 2004a), extensive gamblers (i.e. those with the highest rates of gambling disorders) reported using more avoidant coping and less problem-focused coping strategies than rare or non-gamblers (i.e. those with the lowest rates of gambling disorders).

The remaining groups of gamblers identified in the LCA lied between the rare or non-gamblers and the extensive gamblers groups. All had a high probability of playing the lottery. Lottery only gamblers may be more similar to rare or non-gamblers than to extensive gamblers, as they only differed from rare or non-gamblers in the number of distinct gambling activities, the yearly frequency of engaging in any gambling activity, the use of smokeless tobacco and the sociability trait. By contrast, several significant differences were found between lottery only gamblers and extensive gamblers: lottery only gamblers were less likely to report gambling problems and DSM-5 gambling disorders, reported fewer distinct gambling activities, a lower yearly frequency of engaging in any gambling activity, a higher use of problem-focused coping

strategies, and a lower use of avoidant coping strategies than extensive gamblers. This suggests that lottery only gamblers constitute a low risk group, and that playing the lottery may be relatively innocuous, at least when it is not combined with other gambling activities. However, it may also be that individuals who are less prone to gambling disorders choose to only play the lottery–if any gambling activity at all.

Casino gamblers differed from both rare or non-gamblers and extensive gamblers with regard to gambling and substance use outcomes. They had higher rates of gambling outcomes than rare or non-gamblers but lower rates than extensive gamblers, and were more likely than rare or non-gamblers to report frequent RSOD, daily cigarette use and smokeless tobacco use, and less likely to report risky use of cannabis than extensive gamblers. This finding is consistent with the results of a previous study, showing that individuals gambling only in casinos had a less negative risk profile than those who combined casino gambling with other activities (Franco et al. 2011). Yet, casino gamblers were closer to extensive gamblers than to rare or non-gamblers with regard to levels of aggression/hostility, sensation seeking and sociability (traits related to gambling problems, see Harris et al. 2013; Zuckerman and Kuhlman 2000), but had lower levels of anxiety/neuroticism and avoidant coping and higher levels of problem-focused coping than extensive gamblers. This may indicate that casino gamblers may gamble rather for recreational purposes than extensive gamblers, possibly because they are less prone to anxiety and stress (associated with neuroticism/anxiety) and use more adaptive coping strategies.

As casino gamblers, electronic lottery and casino gamblers had a high probability of playing gambling tables in casinos and lottery, but they also had a higher probability of playing the gambling machine and electronic lottery than casino gamblers. Consistent with previous studies pointing to the gaming machine as the most addictive form of gambling (e.g. Breen and

Zimmerman 2002; see Dowling et al. 2005, for review), electronic lottery and casino gamblers had high rates of gambling problems and DSM-5 gambling disorders. Electronic lottery and casino gamblers significantly differed from rare or non-gamblers in five out of eight gambling and substance use outcomes, whereas the only significant difference with extensive gamblers was a lower prevalence of the DSM-5 gambling disorder. Thus, electronic lottery and casino gamblers bore more resemblance to extensive gamblers than to rare or non-gamblers. As a consequence, they may constitute a high risk group with regard to gambling outcomes. This may be related to the characteristics of gambling machines and electronic lottery, such as rapid playing speed and payout intervals allowing immediate reinforcement, that may contribute to cause more gambling problems than other gambling activities (Dowling et al. 2005). This may also be related to the use of maladaptive coping strategies by electronic lottery and casino gamblers. Indeed, electronic lottery and casino gamblers reported the second lowest level of problem-focused and the second highest level of avoidant coping strategies after extensive gamblers. Further research is needed to better understand the respective contributions of characteristics of gambling machines and characteristics of machine gamblers to the development of gambling disorders.

Private gamblers were also more similar to extensive gamblers than to rare or non-gamblers with regard to gambling and substance use outcomes. They had significantly higher rates on gambling and substance use behaviours than rare or non-gamblers, whereas they did not significantly differ from extensive gamblers, except that they were significantly less likely than extensive gamblers to experience DSM-5 gambling disorders and reported a lower yearly frequency of engaging in any gambling activity. Private gamblers also had the highest prevalence of at least monthly RSOD and of smokeless tobacco use, and the second highest prevalence of

DSM-5 gambling problems, and frequent cannabis use. This suggests that private gamblers represent a high-risk group with regard to gambling outcomes and substance use comorbidities. One of the reasons to that may be that some personality traits related to gambling problems and substance use (Harris et al. 2013; Zuckerman and Kuhlman 2000), such as high levels of aggression/hostility and sensation seeking, may predispose private gamblers to negative gambling outcomes and substance use comorbidities. An alternative explanation may be that gambling activities in private settings are subject to no policy regulation. Indeed, private gambling is not regulated, contrary to other types of gambling activities (e.g. casino and lottery gambling) for which measures have been developed in Switzerland: the national lottery adheres to the responsible gambling principles of the World Lottery Association, and casinos are responsible for the early detection, supervision and exclusion of problem gamblers. Moreover, smoke free policy and limited opening hours in public locations typically do not apply to private settings. Thus, this lack of regulation in private gambling activities may contribute to increase the risk of developing gambling problems and substance use comorbidities.

Limitations

The major limitation of this study is the cross-sectional design. Consequently, it was not possible to examine the transition between classes over time. The sample was also limited to young adult males. As gender and age differences with regard to gambling activities were observed in previous studies (e.g. Bakken et al. 2009; Goudriaan et al. 2009), further studies are needed to investigate whether PGA and associations with gambling and substance use outcomes as well as personality traits and coping strategies differ between gender categories and with other age groups.

Conclusions

To conclude, the results of the present study support that gamblers do not constitute a homogenous group, but that different types of gamblers can be identified on the basis of the forms of gambling they are engaged in. Individuals were clustered in six distinct PGAs, namely rare or non-gamblers, lottery only gamblers, electronic lottery and casino gamblers, casino gamblers, private gamblers and extensive gamblers. The most negative outcomes were found in extensive gamblers followed by private gamblers and electronic lottery and casino gamblers. Individuals in these groups were more likely to report several negative gambling outcomes and risky substance use than rare or non-gamblers. By contrast, the least negative pattern was found in rare or non-gamblers, followed by lottery only gamblers and casino gamblers. These groups were less likely to report negative gambling outcomes and risky substance use than extensive gamblers. PGAs also differed with regard to personality traits and coping strategies. Results suggest that high levels of aggression/hostility and sociability traits and to a lesser extent sensation seeking may predispose individuals to involve in problematic PGAs. Also, extensive gamblers used more maladaptive and less adaptive coping strategies than other groups of gamblers. As some treatments of pathological gambling based on training coping skills were successful in reducing the number of pathological gambling criteria and the desire to gamble (Sylvain et al. 1997), our results suggests that training problem-focused coping skills in high involvement gamblers (especially extensive gamblers) may also be effective in preventing the development of gambling problems.

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Figure caption

Figure 1. Probability of engaging in seven gambling activities within six latent classes

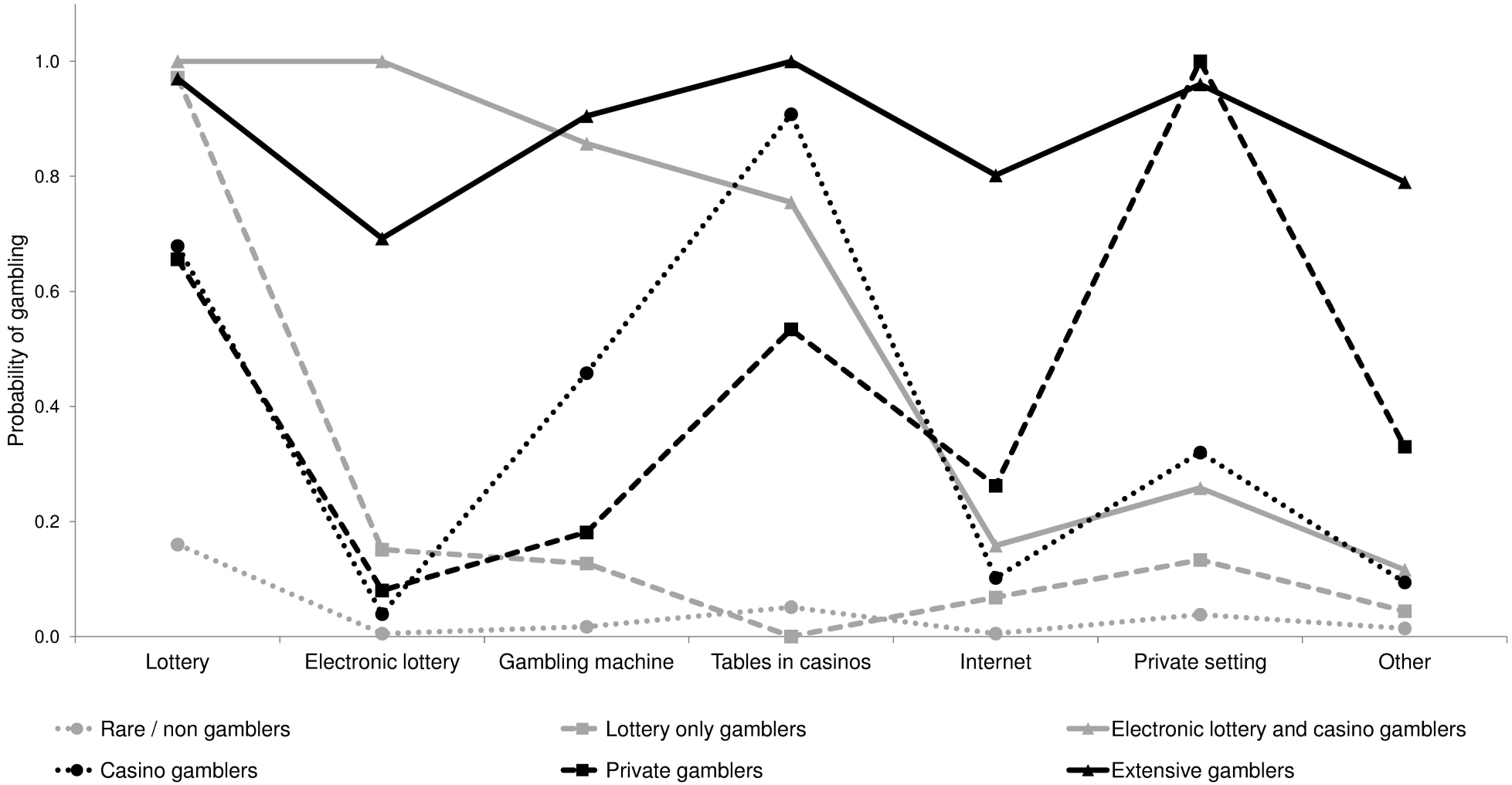
Probability of gambling
1.0
0.8
0.6
0.4
0.2
0.0
Lottery
Electronic lottery
Gambling machine
Tables in casinos
Internet
Private setting
Other
Rare / non gamblers
Lottery only gamblers
Electronic lottery and casino gamblers
Casino gamblers
Private gamblers
Extensive gamblers

Table 1. Descriptive characteristics for demographics, gambling and substance use outcomes (*N* = 4989)

Age (*M, SD)*	21.26	1.23
Highest achieved education		
Primary schooling (*n*, %)	347	7.0
Vocational training (*n*, %)	2287	45.8
Post secondary schooling (*n*, %)	2355	47.2
Language		
French-speaking (*n*, %)	2730	54.7
German-Speaking (*n*, %)	2259	45.3
Gambling		
12-month prevalence (*n*, %)	2220	55.5
Number of distinct gambling activities played (*M, SD)*	1.25	1.56
Yearly frequency of playing any gambling activity (*M, SD*)	22.92	78.03
Self-reported gambling problems (*n*, %)	31	0.6
DSM-5 gambling disorder (*n*, %)	48	1.0
Alcohol use		
At least monthly RSOD (*n*, %)	2203	44.2
Tobacco use		
Daily cigarette use (*n*, %)	1025	20.5
Smokeless tobacco use (*n*, %)	1566	31.4
Cannabis use		
More than weekly cannabis use (*n*, %)	388	7.8

Note. n: number of cases. *M:* Mean. *SD:* Standard deviation. RSOD: Risky single occasion drinking. DSM-5: Diagnostic and statistical manual of mental disorders fifth edition.

Table 2. Mean, standard deviation, range and Cronbach α for personality traits and coping strategies

	Mean	Standard deviation	Range	Cronbach α
Personality				
Sensation seeking	3.05	0.86	1-5	.80
Aggression/hostility	4.15	2.22	1-10	.62
Sociability	5.83	2.25	1-10	.66
Anxiety/neuroticism	1.97	1.98	1-10	.70
Coping				
Problem-focused coping				
Active coping	6.04	1.47	2-8	.68
Planning	5.89	1.53	2-8	.71
Emotion-focused coping				
Use of emotional support	4.76	1.64	2-8	.76
Avoidant coping				
Denial	3.31	1.37	2-8	.68
Behavioural disengagement	3.45	1.37	2-8	.65

Table 3. Fit indices of the 2- to 8-class LCA solutions

	AIC	BIC	ABIC	LMR-LRT	P[a]	Entropy
2 classes	25778	25876	25828	3780.38	<.001	.774
3 classes	25349	25499	25426	439.14	<.001	.786
4 classes	25238	25440	25341	125.18	<.001	.809
5 classes	25144	25398	25274	108.38	<.001	.773
6 classes	25117	25423	25274	41.88	.002	.798
7 classes	25109	25467	25293	23.93	.115	.775
8 classes	25111	25522	25322	13.37	.275	.770

Note. LCA: Latent class analysis. AIC: Akaike's information criterion. BIC: Bayesian information criterion. ABIC: sample size adjusted BIC. LMR-LRT: Lo-Mendel-Rubin likelihood ratio test. [a]P-value for the k vs. k-1 class solution.

Table 4. Gambling and substance use outcomes as a function of patterns of gambling activities

	RG (*n* = 3380)		LOG (*n* = 336)		ELCG (*n* = 115)		CG (*n* = 827)		PG (*n* = 197)		EG (*n* = 134)			
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	p	Effect size[c]
Gambling														
Self-reported gambling problems	1	<0.1[b]	1	0.3[b]	5	4.3[a]	9	1.1[ab]	5	2.5[a]	31	7.5[a]	<.001*	.180
DSM-5 gambling disorder	3	0.1[b]	3	0.9[b]	4	3.5[ab]	9	1.1[ab]	8	4.1[ab]	21	15.7[a]	<.001*	.268
Number of distinct gambling activities played (mean, SD)	0.34[b]	0.47	2.15[ab]	0.36	4.12[a]	0.72	2.84[ab]	0.86	3.42[a]	0.83	6.37[a]	0.62	<.001**	.748
Yearly frequency of playing any gambling activity (mean, SD)	4.86[b]	18.20	38.07[ab]	73.44	90.51[a]	113.66	39.57[ab]	56.76	59.87[ab]	76.68	225.57[a]	328.91	<.001**	.647
Alcohol use														
At least monthly RSOD	1345	39.8[b]	154	45.8	53	46.1	457	55.3[a]	118	59.9[a]	76	56.7[a]	<.001***	.139
Tobacco use														
Daily cigarette use	599	17.7[b]	78	23.2	41	35.7[a]	199	24.1[a]	64	32.5[a]	44	32.8[a]	<.001***	.118
Smokeless tobacco use	963	28.5	117	34.8[a]	34	29.6	317	38.3[a]	88	44.7[a]	47	35.1	<.001***	.101
Cannabis use														
More than weekly cannabis use	223	6.6[b]	32	9.5	15	13.0	67	8.1[b]	28	14.2[a]	23	17.2[a]	<.001***	.090

Note. RG: rare or non gamblers, LOG: lottery only gamblers, ELCG: electronic lottery and casino gamblers, CG: casino gamblers, PG: private gamblers, EG: extensive gamblers, *n*: Number of cases, *SD:* Standard deviation *Fisher's exact test. **Kruskal-Wallis test. ***Chi square test. [a]differ from RG at $p < .05$ Bonferroni adjusted. [b]differ from EG at $p < .05$ bonferroni adjusted. [c]Cramer's V for chi squared and Fisher's exact tests, η^2 for Kruskal-Wallis test.

Table 5. Means and standard deviation for personality traits and coping strategies as a function of patterns of gambling activities

	RG (n = 3380)		LOG (n = 336)		ELCG (n = 115)		CG (n = 827)		PG (n = 197)		EG (n = 134)				
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	$F(5,4983)$	*p*	Effect size[c]
Personality															
Sensation seeking	2.99	0.88	3.02	0.78	3.11	0.87	3.22[a]	0.82	3.19[a]	0.86	3.13	0.86	11.30	<.001	.011
Aggression-hostility	3.98[b]	2.20	4.32	2.19	4.68[a]	2.24	4.41[a]	2.20	4.76[a]	2.21	4.87[a]	2.16	13.84	<.001	.014
Sociability	5.64[b]	2.30	6.02[a]	2.32	6.07	2.09	6.37[a]	1.94	5.96	2.21	6.44[a]	1.98	17.64	<.001	.017
Anxiety-neuroticism	1.96	1.98	2.26	2.14	2.01	1.92	1.78[b]	1.79	2.22	2.14	2.34	2.24	4.72	<.001	.005
Coping															
Problem-focused coping															
Active coping	6.04[b]	1.50	6.17[b]	1.28	5.94[b]	1.40	6.07[b]	1.40	6.19[b]	1.28	5.34[a]	1.67	7.27	<.001	.007
Planning	5.93[b]	1.56	5.77[b]	1.40	5.44[a]	1.38	5.91[b]	1.46	5.98[b]	1.40	5.24[a]	1.59	8.07	<.001	.008
Emotion-focused coping															
Use of emotional support	4.73	1.67	4.88	1.47	4.74	1.44	4.81	1.59	4.92	1.63	4.66	1.54	1.16	.326	.001
Avoidant coping															
Denial	3.26[b]	1.38	3.38[b]	1.34	3.69[a]	1.37	3.30[b]	1.30	3.34[b]	1.27	4.01[a]	1.58	9.82	<.001	.010
Behavioural disengagement	3.43[b]	1.38	3.53	1.37	3.64	1.25	3.39[b]	1.32	3.40[b]	1.29	3.83[a]	1.51	3.28	.006	.003

Note. RG: rare or non gamblers, LOG: lottery only gamblers, ELCG: electronic lottery and casino gamblers, CG: casino gamblers, PG: private gamblers, EG: extensive gamblers, *n*: Number of cases, *M:* mean, *SD:* Standard deviation. [a]differ from RG at $p < .05$ Bonferroni adjusted. [b]differ from EG at $p < .05$ bonferroni adjusted. [c]η^2.