

RUNNING HEAD: AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Identifying At-Risk Profiles and Protective Factors for Problem Gambling: A Longitudinal Study Across Adolescence and Early Adulthood

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AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

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AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Abstract

Past studies identified various risk and protective factors for Problem Gambling (PG). However, no study examined the interplay between these factors using a combination of person-centered and variable-centered approaches embedded within a longitudinal design. The present study aimed to: 1) identify distinct profiles in early adolescence based on a set of risk factors commonly associated with PG (impulsivity, depression, anxiety, drug/alcohol use, aggressiveness, and antisociality), 2) explore the difference in reported gambling problems between these profiles during mid-adolescence and early adulthood, and 3) identify family and peer-related variables that could operate as protective or compensatory factors in this context. Two samples were used: a) a population sample (N = 1,033) living in low socio-economic status neighborhoods, and b) a population sample (N = 3,017) representative of students attending Quebec schools. Latent Profile Analyses were conducted to identify at-risk profiles based on individual risk factors measured at age 12 years. Negative binomial regression models were estimated to compare profiles in terms of their reported gambling problems at ages 16 and 23 years. Finally, family- and peer-related variables measured at age 14 years were included to test their protective or compensatory role with respect to the link between at-risk profiles and gambling problems. Four profiles were identified : Well-Adjusted, Internalizing, Externalizing, and Comorbid. Compared to the Well-Adjusted profile, Externalizing and Comorbid profiles reported more gambling problems at ages 16 and 23 years, but the Internalizing profile did not differ significantly. Various protective and compensatory factors emerged for each profile at both time-points.

Keywords: gambling, latent profile analysis, protective factor, adolescence, longitudinal design.

Introduction

Gambling is a widespread activity; between 50 and 80% of adolescents and adults report at least some gambling over a previous year (Williams, Volberg, & Stevens, 2012). However, only a minority develop gambling problems (i.e., problems directly related to their gambling behavior). The term “problem gambling” (PG) is generally defined as gambling behavior that leads to any number of negative consequences for the gambler, his or her social network, and the community at large (Ferris & Wynne, 2001; Neal, Delfabbro, & O’Neil 2005). Clinical assessment tools, such as the *Diagnostic and Statistical Manual of Mental Disorders: Fifth Edition* (DSM-5; American Psychiatric Association, 2013), use the term “disordered gambling” to describe PG that reaches a pre-set number of legal, social, or self-regulatory problems due to their gambling activities. The prevalence of disordered gambling among the general adult population varies between 2-5%, and between 4-7% for adolescents and young adults, depending on the population studied and the scoring criteria used (Shaffer & Hall, 2001; Williams et al., 2012). Moreover, early-onset gamblers tend to develop more severe gambling-related problems compared to their later-onset counterparts (Burge, Pietrzak, & Petry, 2006; Lynch, Maciejewski, & Potenza, 2004). As such, in order to refine current etiological models of PG and improve prevention programs, there is an urgent need to identify young adolescents who are at risk for gambling problems before they develop.

A variety of PG risk factors first become apparent in childhood and adolescence (Dowling et al., 2017; Gupta & Derevensky, 1998); many of which pertain to individual characteristics. Given their number and their nature, these factors may combine additively or interactively (Milosevic & Ledgerwood, 2010). In either case, variable-centered approaches (i.e., regression based models) are at a disadvantage when accounting for the effects of the many numerous

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

interactions which may result. For example, a regression model using six risk factors (i.e., predictors) would yield only six main effects, but could potentially include 36 two-way interactions alone, not counting for three- and four-way interactions. Given the need to simplify the identification of risk factors and their interactive effects, a person-centred approach such as Latent Profile Analysis (LPA; Collins & Lanza, 2010) should be employed. LPA is a statistical tool that examines participants' scores on a number of continuous indicator variables in order to identify qualitatively distinct participant subgroups (DiStefano, 2012). For example, participants who score highly on variables A and B, but low on variables C and D, are grouped together and separated from participants who display low scores on all variables. Therefore, the first goal of the present study was to use LPA to identify profiles of individuals in the general population that are differently at risk for gambling problems by early adolescence, before the emergence of such problems.

Individual Risk Factors

Many aspects of an individual's personality, whether behavioral, cognitive, or affective, have been linked to gambling problems in adolescence or adulthood. For example, impulsivity, whether based on paper-and-pencil instruments or on laboratory tasks, has been repeatedly linked to PG (Johansson, Grant, Kim, Odlaug, & Gotestam, 2009; Vitaro, Arseneault, & Tremblay, 1999). In these studies, the predictive power of impulsivity remained significant after accounting for influences such as socio-demographic variables, early gambling behavior, and other personality variables (e.g., aggressiveness and anxiety). Other problematic externalizing behaviors can also come into play. For instance, PG has been linked to antisocial (Jacobs, 2000; Stinchfield, 2000; Vitaro, Brendgen, Ladouceur, & Tremblay, 2001) and aggressive behavior (Martins et al., 2013).

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Behavioral disorders such as substance use are also repeatedly associated with PG (Maccallum & Blaszczyński, 2002; Petry, Stinson, & Grant, 2005). Notably, both appear to have much in common at the physiological and phenotypic level (Wareham & Potenza, 2010). Moreover, drug and alcohol problems predict an increase in gambling problems over time (Vitaro et al., 2001). It is therefore not surprising that disordered gambling is now listed among addictions, such as substance use, in the DSM-5.

Problem gamblers generally show higher than average levels of internalizing symptoms (e.g., anxiety and depression; Becona, Del Carmen Lorenzo, & Fuentes, 1996; Petry et al., 2005). Similar findings are also illustrated in longitudinal studies. For example, while higher depressive symptoms predict increases in gambling problems from mid-adolescence to young adulthood, after other risk factors are accounted for, this relationship is no longer evident across early- to mid-adolescence (Dussault, Brendgen, Vitaro, Wanner, & Tremblay, 2011).

Whatever their possible additive or interactive combination, the presence of any or all of these risk factors does not guarantee the emergence of gambling problems (Lussier, Derevensky, Gupta, & Vitaro, 2014). This is highlighted by the fact that effect sizes are generally small to moderate (Dowling et al., 2017) and that, when predicting the emergence of PG, the effect of important risk factors such as impulsivity or alcohol consumption may be counteracted or mitigated by social factors (Barnes, Welte, Hoffman, & Dintcheff, 2005; Scholes-Balog, Hemphill, Dowling, & Toumbourou, 2014). This suggests that compensatory or protective factors are most likely at play. The former is identified by an additive (i.e., countering main) effect which decreases the probability of PG emergence (akin to a risk factor, but in the opposite direction), whereas the latter is suggested when an interactive (i.e., a multiplicative/mitigating) effect is present. Either can derive from social agencies such as family or the peer group. Given

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

these possibilities, another goal of the present study was to examine a series of social factors that may compensate or moderate the link between at-risk personality-based profiles and problem gambling.

Compensatory and Protective Factors for Gambling Problems

Social support from parents and friends positively affects multiple physical and mental health outcomes in youth (Abazari, Haghdoost, & Abbaszadeh, 2014; King, Tergerson, & Wilson, 2008). With regards to gambling, support from family, but not from friends, appears to minimize harmful gambling behavior (Rasanen, Lintonen, Tolvanen, & Konu, 2016). In turn, evidence indicates that peer conformity (i.e, peers with normative values and no deviant behaviors) is a consistent compensatory factor against adolescent gambling problems (Lussier et al., 2014; Vitaro et al., 2001). Positive parenting practices hold sway as well. Lee, Stuart, Ialongo, and Martins (2014) demonstrated that higher parental monitoring from 11 to 14 years of age was associated with fewer gambling problems in late-adolescence and young adulthood.

Sociodemographic factors also contribute to the emergence of PG in youths and adults. The incidence of PG is higher among men and ethnic minorities living in underprivileged neighborhoods (Jacobs, 2005). Moreover, Socioeconomic Status (SES) appears to moderate the link between early impulsivity and PG, as impulsivity has been associated with earlier-onset gambling mainly in low-SES participants (Auger, Lo, Cantinotti, & O'Loughlin, 2010). In summation, while the individual risk factors associated with PG are numerous and varied, their effects may fluctuate depending on a host of compensatory or protective factors, as well as participants' age.

Study Objectives

The current study aimed to identify subtypes of young adolescents that are differentially at risk for gambling problems. Subtypes were determined according to individual risk factors most often associated to gambling (i.e., impulsivity, depression, anxiety, substance use, aggressiveness, and antisociality). A second objective was to explore the difference in reported gambling problems between these profiles by middle adolescence or by early adulthood, as well as the temporal stability between the two time-points. A third and final objective was to explore the compensatory or protective effects of various social factors. The compensatory or protective factors retained for the present study represent two domains: peers and family. For each of these socializing agents, a distinction was made between their behavior (i.e., what parents and peers do that could compensate or protect), and adolescents' connectedness to them (i.e., a form of social support).

Using a longitudinal design, we followed two Quebec (Canada) samples. The first sample ("Sample A") consists of low socioeconomic status (SES) French-speaking adolescent males. The second sample ("Sample B") is representative of all Quebec students attending francophone schools. Personality variables (i.e., impulsive, depressive, anxious, antisocial, and aggressive behaviors) were reported by teachers when participants were 12 years old, an age where most have not yet gambled for the first time (Traoré et al., 2015). Teacher ratings were chosen over parent ratings because the former better predict problem behavior in children (Power et al. 1998; Verhulst et al. 1994). Substance use was assessed using a self-report measure at age 14. Self-reports were chosen because young adolescents are likely to hide their substance use from their teachers, thereby resulting in an underestimation from the teacher's perspective. Moreover, surveys in Quebec have shown that most adolescents start using drugs or alcohol around the age

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

of 14 years (Dubé et al. 2009). Putative compensatory/protective factors (parental involvement, parent-child connectedness, peer conformity, and peer connectedness) were assessed through self-reports at age 14 years. Gambling problems were measured in both samples when participants were 16 and 23 years old. Given that both samples were merged, we also examined whether results varied from one sample to another.

Material and Methods

Participants

Sample A. Participants were part of a longitudinal study started in 1984 with 1,033 French-speaking kindergarten boys attending schools in economically disadvantaged areas in Montreal, Quebec, Canada. Participants included in the initial sample represented 87% of all boys attending the 53 schools that participated in the study. Data used in this study were collected when the participants were 12, 14, 16 and 23 years old.

Sample B. Participants were part of the Quebec Longitudinal Study of Kindergarten Children, a representative, random sample of the French-speaking children attending kindergarten in the province of Quebec, Canada, in 1986–1987. From an initial pool of 6,397 families with six-year old children who were contacted, 4,360 (68%) agreed to participate. Of these, 2,000 participants were randomly selected in order to ensure good participation during follow-up and due to budget limitations. An additional 1,142 participants from the initial pool who had elevated scores on a disruptive behavior scale (Tremblay et al., 1991), were included to provide statistical power in studies dealing with problematic behavior. The final sample consisted of 3,142 participants (58% males). See Rouquette et al. (2014) for a complete explanation of sampling procedure. Data used in this study were collected when the participants were 12, 14, 16 and 23 years old.

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Procedure

The study was approved by the University of Montreal Institutional Review Board and by the respective school boards. Active written consent was obtained from parents in both samples. All participants actively provided their assent to take part in the study. Participants were also informed before data collection that their answers were strictly confidential and that they could end their participation at any time. All measures were administered in the Spring towards the end of the school year. The same instruments were administered in both samples. All instruments were administered in French. Instruments that were written originally in English were translated into French and then translated back into English. English-speaking judges verified the semantic similarity between the back-translated items and the original items in the questionnaire. Descriptive statistics (i.e., correlations, means, and standard deviations) are reported in Table 1.

Measures: At-risk Personal Characteristics Used for LPA

With the exception of drug/alcohol use that was self-reported when participants were 14 years old, all measures used to assess personal characteristics were teacher-rated using the Social Behavior Questionnaire (SBQ; Tremblay, Desmarais-Gervais, Gagnon, & Charlebois, 1987) when participants were 12 years old. From the SBQ, items were selected to assess impulsivity, depression, anxiety, aggressiveness, and antisociality. Each item was rated on a 3-point scale (0: Does not apply, 1: Applies sometimes, and 2: Frequently applies). Item scores were summed to obtain a total score for each variable. Therefore, higher scores indicate higher levels on each respective scale.

Impulsivity. A total of seven items (e.g. “acts without thinking”) were included in this scale (Sample A: Cronbach’s $\alpha = .89$; Sample B: $\alpha = .88$). Total scores varied between 0 and 13.

Depression. A total of four items (e.g. “appears miserable, unhappy, tearful or distressed”) were

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

included in this scale (Sample A: $\alpha = .62$; Sample B: $\alpha = .63$). Total scores varied between 0 and 7. **Anxiety**. A total of three items (e.g. “is worried about many things”) were included in this scale (Sample A: mean $r = .43$; Sample B: mean $r = .44$; for very short scales, Clark & Watson, 1995, recommend using the mean of inter-item correlation instead of Cronbach’s alpha). Total scores varied between 0 and 6. **Antisociality**. A total of three items (e.g. “has stolen things on one or more occasions.”) were included in this scale (Sample A: mean $r = .25$; Sample B: mean $r = .25$). Total scores varied between 0 and 6. **Aggressiveness**. A total of six items (e.g. “uses physical force, or threatens to use force, in order to dominate other children.”) were included in this scale (Sample A: $\alpha = .89$; Sample B: $\alpha = .88$). Total scores varied between 0 and 12. **Drug Consumption at Age 14 Years**. The Personal Experience Screen Questionnaire (PESQ; Henly & Winters, 1988) was used to gauge illicit drug and alcohol consumption. The frequency scale was derived by asking the following question: “During the last 12 months, how many times have you consumed (blank)?”. The blank was replaced by “marijuana or haschich”, “alcohol”, “cigarettes”, and “other drugs”, resulting in a total of 4 questions, which were then averaged into a composite frequency score. Answers were reported on a 7-point Likert scale, ranging from “never” to “40+ times”. Average scores varied between 1 and 7 (Sample A: $\alpha = .69$; Sample B: $\alpha = .68$). The following three items were included to detect if participants were lying: “In order to pay for alcohol or drugs, how many times have you conned people with counterfeit money?”, “How many times have you consumed alcohol or other drugs (including cigarettes and marijuana) while parachuting?”, and “How many times have you obtained alcohol or drugs from a police officer?” If a participant responded positively to one of these questions, the overall score was deleted and treated as missing data.

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Measures: Compensatory and Protective Factors

All instruments used to assess compensatory or protective factors were self-reported when participants were 14 years old.

Parental Involvement. Two items (“Do your parents know who you are with when you are out of the house?”, “Do your parents know where you are when you are out of the house?”) were answered on a scale from 1 (“never”) to 4 (“always”). Total scores varied between 2 and 8. Correlation between items for Samples A and B were .69 and .59, respectively. ***Parent-Child Connectedness.*** A total of seven items (e.g., “Do you talk with your parents about your thoughts and about your feelings?”) were included in this scale (Sample A: $\alpha = .74$; Sample B: $\alpha = .78$). Items were rated from 1 (“always”) to 4 (“never”). Total scores varied between 7 and 28. To facilitate interpretation of analysis results, final scores were reverse coded such that higher scores to indicate high parent-child connectedness. ***Peer Conformity.*** Three items (e.g., “Has the boy/girl who is your best friend already been arrested by the police?”, reverse-coded) were used to create a Peer Conformity scale. Items were scored 1 (“no”) or 2 (“yes”), yielding total scores between 3 and 6. Mean inter-item correlations were .45 and .38 for Samples A and B, respectively. ***Peer Connectedness.*** A total of 5 items (e.g., “Do you talk about personal things with the girl/boy who is your best friend?”) were included in this scale (Sample A: $\alpha = .65$; Sample B: $\alpha = .60$). Items were rated from 1 (“often”) to 4 (“never”). Total scores varied between 5 and 20. To facilitate interpretation of analysis results, final scores were reverse coded such that higher scores to indicate high peer connectedness.

Outcome Variables: Gambling Problems at Ages 16 and 23 Years. Adolescent and adult versions of the South Oaks Gambling Screen (SOGS) were used to assess gambling problems (Lesieur & Blume, 1987; Winters, Stinchfield, & Fulkerson, 1993). The SOGS is a self-reported

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

questionnaire designed to assess problems related to past-year gambling practices. The SOGS-Revised for Adolescents (SOGS-RA) comprises 12 Yes/No items, whereas the adult version consists of 20 items (both versions share 11 items). The adolescent questionnaire only has one Yes/No question indicating whether the participant has borrowed money for gambling or to pay gambling debts. In contrast, the adult questionnaire splits the “borrowing money to gamble or to pay gambling debts” indicator into nine items listing various money loaning sources (e.g., credit cards, loan sharks, etc.). For the purpose of the current study, the nine items in the adult version were collapsed into one Yes/No item indicating whether the participant has borrowed money to gamble. This resulted in a consistent set of items for both time-points and allowed a longitudinal (i.e., repeated-measures) comparison of gambling problems between adolescence and young-adulthood.

The SOGS-RA has been validated for screening gambling problems among adolescents aged 14 to 20 years old (Chiesi, Donati, Galli, & Primi, 2013), and the SOGS has been validated in a variety of settings (i.e., Gamblers Anonymous, university students, and hospital employees; Lesieur & Blume, 1987). In Sample A, Cronbach’s α was .76 and .88 at ages 16 and 23, respectively. In Sample B, Cronbach’s α was .76 and .75 at ages 16 and 23, respectively.

Control Variable: Socioeconomic Status. When the participants were 12 years old, parents answered Blishen, Carroll, and Moore (1987) Occupational Prestige Scale. This scale, specific to Canada, classifies occupations according to income and education. A composite score was created by summing up both parents’ scores.

Data Analysis Plan

Latent Profile Analysis (LPA; Collins & Lanza, 2010) was used for the first set of analyses. LPA is a type of Latent Class Analysis, which allows identification of profiles according to a set

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

of indicator variables (DiStefano, 2012). The number of profiles is not known beforehand and the optimal solution is found by using a set of model fit indicators, combined with maximum-likelihood tests (probability-based classification). Following Celeux and Soromenho (1996) and Nylund, Asparouhov, and Muthén (2007), the *Bayesian information criterion (BIC)*, *Entropy*, and *Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (LMR-ALRT)* were used to evaluate model fit. LPA was performed using a step-wise mixture modeling technique with MPlus 6.12 (Muthén & Muthén, 2010) to identify the optimal number of PG profiles based on the following indicator variables: impulsivity, depression, anxiety, antisociality, and aggressiveness at age 12 as well as drug/alcohol use at age 14 years.

All the analyses predicting gambling problems at ages 16 and 23 years statistically controlled for Gender, SES, and Sample and were also conducted with MPlus 6.12 (Muthén & Muthén, 2010). Analyses predicting gambling problems at age 23 years also controlled for gambling problems reported at age 16 years. Participants were classified into one of the four profiles identified by the LPA, based on their most likely class membership. The Well-Adjusted profile was set as the reference group, because it comprised the vast majority of participants and was considered a low risk group. For each time point (i.e., age 16 and age 23 years), a hierarchical two-step analysis was conducted. First, compensatory (i.e. main) effects were examined by using the profiles (dummy-coded) to predict gambling problems. Second, protective (i.e., interactive) effects were examined by computing interaction terms between each putative compensatory/protective factor and the dummy-coded variable for each profile. Considering that SOGS and SOGS-RA data are count data (i.e., number of problems), analyses of compensatory and protective factors were conducted by estimating regression models using a Negative Binomial distribution. A Negative Binomial regression model was preferred over a Poisson

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

model because SOGS and SOGS-RA data were both over-dispersed (i.e., variance 3 to 4 times greater than the mean, for both time points) (Gardner, Mulvey, & Shaw, 1995).

Finally, a linear growth model for a count outcome using a negative binomial model was estimated to examine changes in gambling problems over time. Intercept and slope (i.e., rate of change) were estimated by fitting our data using two time-points. The slope was then regressed, by controlling for the intercept, on dummy-coded variables indicating each at-risk profile (once again, with the Well-Adjusted profile serving as a reference group).

Results

Data Treatment and Preliminary Analyses

Missing Data. Both samples had missing data. Little's (1988) Missing Completely At Random (MCAR) test was conducted using all variables included in the LPA (listed in the next section) and was not significant: $\chi^2(40, N = 4,175) = 39.03, p = .514$, supporting the hypothesis that data are MCAR. Out of the 4,175 initial participants, 555 participants had missing data on all indicator variables and were therefore excluded from the LPA, resulting in 3,620 classified participants. Participants with partially missing data were included in the LPA and all subsequent analyses (i.e., negative binomial regression estimations and linear growth model), because they use a Full Information Maximum Likelihood estimation method, thus overcoming any limitations introduced by missing data (as long as data is not Missing Not At Random).

Sample A. After removing participants with missing data, 939 participants remained out of the initial 1,033. When participants were 16 years old, 5% reported 3 or more gambling problems, and 1.4% reported 5 or more gambling problems. At age 23 years, 6.7% had 3 or more gambling problems, and 3.3% had 5 or more gambling problems. These rates are higher than

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

what is usually found in population studies, but are explained by the high-risk nature of this sample (i.e., low SES males).

Sample B. After removing participants with missing data, 2,681 participants remained out of the initial 3,142. When participants were 16 years old, 3.2% reported 3 or more gambling problems, and 1.1% reported 5 or more gambling problems. At age 23 years, 1.8% had 3 or more gambling problems, and 0.5% had 5 or more gambling problems. These proportions are consistent with population studies conducted in various regions across the world (Williams et al., 2012).

Latent Profile Analysis

Model fit indices are reported in Table 2. Two- and three-class models separated groups based on their degree of severity across all variables (i.e., high on all vs. low on all). Furthermore, although the five- and six-class models had lower BIC scores, this indicator kept decreasing no matter how many classes were added. The tendency for the BIC to consistently decrease has been observed across many other studies that have used continuous, rather than categorical, indicators to determine the optimal number of classes (Geiser, Okun, & Grano, 2014; Marsh, Lüdtke, Trautwein, & Morin, 2009; Nower, Martins, Lin, & Blanco, 2013). The five-class model also had a profile with less than 5% participants. As such, and in accordance with Marsh et al.'s (2009) recommendations, the best-fitting solution was selected based on qualitative and quantitative changes between the classes. A four-class model turned out to be optimal, as demonstrated by the statistically significant *LMR-ALRT* and profiles that were qualitatively meaningful (i.e., not simply separated into high, medium, and low levels across all variables).

The most common profile ($n = 2,498$; 69.01%; “Well-Adjusted”) displayed low levels on all indicator variables. The second-largest profile ($n = 576$; 15.91%; “Externalizing”) had high

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

levels of impulsivity, aggressiveness, antisocial behavior, and substance use. The “Internalizing” profile ($n = 331$; 9.14%) scored highly on anxiety and depression symptoms, and low on everything else. Finally, the “Comorbid” profile ($n = 215$; 5.94%) scored highly on all variables. Table 3 summarizes each profile’s scores on all indicator variables. Notably, similar profiles were found in both samples, albeit in different proportions.

To confirm differences between profiles on indicator variables, a multivariate Analysis of Variance (ANOVA) was conducted, with profiles serving as a fixed factor. The multivariate result was significant, indicating a difference between groups across all indicator variables: Pillai’s Trace = 1.34, $F(18, 5,835) = 262.15$, $p < .001$. All univariate F tests for between-subjects effects were significant (see Table 3). A chi-square test of independence was conducted next to test gender distribution across profiles. The test was statistically significant, $\chi^2(3, N = 3,620) = 231.47$, $p < .001$. Specifically, women were more likely to have a Well-Adjusted profile, and were underrepresented in the Externalizing and Comorbid profiles. An ANOVA was conducted to examine SES differences between profiles. There was a significant effect of profiles on SES, $F(3, 1978) = 12.61$, $p < .001$. SES was higher for Well-Adjusted participants, compared to the other three profiles. Finally, a chi-square test of independence was conducted to test whether profile distribution was different across samples. The test was also statistically significant, $\chi^2(3, N = 3,620) = 129.38$, $p < .001$. Well-Adjusted participants were more likely to come from Sample B, whereas Internalizing, Externalizing and Comorbid profiles were more likely to come from Sample A. To account for these significant effects, subsequent analyses included Gender and Sample as covariates, in addition to parents’ occupational prestige scores.

Comparison of Gambling Problems Between Profiles

As shown in Table 4, significant differences in gambling problems emerged between profiles at age 16 years. More specifically, Externalizing ($M = 0.52$; $SD = 1.39$; $\beta = 0.56$; $p < .001$) and Comorbid ($M = 0.60$; $SD = 1.30$; $\beta = 0.70$; $p = .001$) profiles both reported more gambling problems at age 16 years compared to the Well-Adjusted profile ($M = 0.25$; $SD = 0.85$), but the Internalizing ($M = 0.30$; $SD = 0.95$; $\beta = 0.16$; $p = .486$) profile did not. Gender and SES were significant covariates, but Sample was not, indicating that males and low-SES participants reported more gambling problems at age 16.

At age 23, Gender and Sample were significant predictors, indicating that males and participants from Sample A reported more gambling problems. Regarding at-risk profiles, Externalizing ($M = 0.58$; $SD = 1.46$; $\beta = 0.45$; $p = .026$) and Comorbid ($M = 0.99$; $SD = 2.32$; $\beta = 0.81$; $p = .004$) profiles both reported more gambling problems at age 23 years compared to the Well-Adjusted profile ($M = 0.24$; $SD = 0.92$), but the Internalizing ($M = 0.31$; $SD = 0.95$; $\beta = 0.04$; $p = .904$) profile did not.

When examining changes over time in terms of gambling problems (from ages 16 to 23 years) the mean slope across all participants was not significantly different from zero ($\beta = -0.10$; $p = .764$), indicating a lack of evidence for an increase or decrease in gambling problems over time. However, when including participants' profiles as predictor variables (with the Well-Adjusted profile serving as a reference point), results indicated that Externalizing ($\beta = 0.47$; $p = .018$) and Comorbid profiles ($\beta = 0.83$; $p = .005$) both reported an increase in gambling problems from ages 16 to 23 years. The predictive effect of the Internalizing profile on the slope of gambling problems was not significant ($\beta = 0.06$; $p = .842$).

Compensatory and Protective Factors

The next section examines the social factors related to the family and peers that could operate as compensatory or protective factors with respect to the link between at-risk profiles and gambling problems either at age 16 or at age 23 years. Regression coefficients for main (i.e., compensatory) and interaction (i.e., protective) effects for both time-points are reported in Table 5. It is important to note that all the putative compensatory or protective factors were at best moderately correlated with the profiles (i.e., Spearman ρ ranging from .06 to .11).

Parental Involvement. At age 16 years, higher parental involvement significantly predicted fewer gambling problems for all participants. No interaction effects emerged, indicating that all the profiles equally benefitted from parent involvement. At age 23 years, again, higher parental involvement significantly predicted fewer gambling problems for all participants. However, when participant profiles were included in the analysis, only Internalizing participants reported fewer gambling problems when parental involvement was high, indicating that the compensatory effect observed previously might be unique to this profile (and possibly the Comorbid profile, which was close to significance at $p = .056$).

Parent-Child Connectedness. At age 16 years, higher parent-child connectedness significantly predicted fewer gambling problems for all participants. No interaction effects emerged, indicating that all the profiles equally benefitted from parent involvement. At age 23 years, there was no main and no interaction effect of parent-child connectedness on gambling problems.

Peer Conformity. At age 16 years, participants with higher levels of peer conformity reported fewer gambling problems. No interaction effect was found. Similar results emerged at age 23 years.

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Peer Connectedness. At age 16 years, there were no main and no interaction effects of peer connectedness on gambling problems. At age 23 years, higher peer connectedness significantly predicted fewer gambling problems for all participants. No interaction effects emerged, indicating that all the profiles equally benefitted from parent involvement.

Discussion

The present study aimed (a) to identify distinct profiles of individuals at-risk of developing gambling problems on the basis of individual risk factors measured during early adolescence and (b) to explore whether certain social factors linked to family and peers could exert a compensatory or a protective role. The findings support the notion that some individuals are more at risk of developing gambling problems by virtue of their behavioral profile (and more so over time) compared to individuals with a different behavioral profile. At the same time, not all individuals sharing the same at-risk behavioral profile develop gambling problems, suggesting protective/compensatory factors. The impact of these protective/compensatory factors, however, seems to vary depending on participants' profile and age.

At-Risk Profiles

Regarding the first and second study objectives, we identified four distinct profiles based on the behavioral patterns of early adolescents. Three represented "at risk" profiles: (1) an Internalizing profile (i.e., participants with high scores on anxiety and depression scales), (2) an Externalizing profile (i.e., participants with high scores on antisociality, aggressiveness, and impulsivity scales, and medium scores on drug/alcohol consumption scales), and (3) a Comorbid profile (i.e., participants with high levels on all scales). The fourth was a Well-Adjusted profile, characterized by its low scores on all individual personality risk factors. Compared to the Well-

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Adjusted profile, the Externalizing and the Comorbid profiles manifested more gambling problems when participants were 16 and 23 years old. These two profiles were also the only ones to report an increase in gambling problems between both time-points.. These results deserve a number of comments.

First, the prospective links between risk profiles based on individual factors and gambling problems found in the current study are consistent with Dowling et al.'s (2017) systematic review of early risk factors. Particularly, profiles reporting high levels of impulsivity, substance use, and antisociality (i.e., Externalizing and Comorbid profiles) reported the most gambling problems at ages 16 and 23. Current results are also consistent with certain etiological models (e.g., Multiple Pathways Model to Problem and Pathological Gambling; Blaszczynski & Nower, 2002), which claim that gamblers with impulsive and antisocial traits display the most severe levels of gambling problems.

Second, it is important to note that the Well-Adjusted profile still reported some gambling problems in adolescence and young adulthood, albeit to a smaller extent than the other three profiles. Our findings are based on two samples: one was a high-risk sample, whereas the other was derived from an oversampling of high-risk individuals. As such, the descriptive term of "Well-Adjusted" used to identify their constituent participants refers to their initial profile configuration relative to the other profiles. These individuals were not totally exempt of any personal or environmental risk factors. Indeed, youths with this profile reported more substance use when compared to those with the Internalizing profile. Considering the significant links between substance use and gambling problems (Dowling et al., 2017; Vitaro et al., 2001), it is possible that Well-Adjusted participants' gambling problems emerged as a corollary of their drug/alcohol consumption habits, which in turn flow from the high-risk nature of our combined

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

sample. Thus, whatever the reason for Well-Adjusted participants' gambling problems, findings from the at-risk profile comparisons reported in the current study are conservative.

Third, the present results indicate that young adolescents with only internalizing problems are not necessarily more at risk for later gambling problems than well-adjusted individuals. This may suggest that internalizing symptoms alone, even though generally linked to PG, may exert a weaker effect than externalizing symptoms on the emergence of PG. Considering that past studies have found clear links between internalizing symptoms and gambling problems, a few explanations may be offered to account for this unexpected finding (other than the high-risk nature of our Well-Adjusted profile and therefore the conservative results). One possibility may be that the links identified in the literature are accounted for by subgroups of gamblers analogous to our Comorbid profile (who reported high levels of internalizing symptoms and gambling problems). The age at which internalizing symptoms were assessed might also play a role. For example, Walther, Morgenstern, & Hanewinkel (2012), who have also used a sample of 12 years old participants, found no association between depression or social anxiety and PG, whereas those who did use older participants (e.g., Dussault et al., 2011).

Finally, stability of gambling problems depended on profile membership. Externalizing and Comorbid participants were the only profiles to report an increase in gambling problems. Both profiles reported high levels of impulsive, antisocial, and aggressive behaviors. Hence, these types of behaviors may be particularly responsible for an increase in gambling problems, possibly by motivating individuals to engage in delinquent activities to fund gambling behavior and debts.

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Protective and Compensatory Factors for PG

In line with the third study objective, social compensatory and protective factors relevant to the risk of PG emerged. Once more, a developmental dimension seems to be involved as the role and the nature of the compensatory and protective factors differed depending on whether gambling problems were assessed during adolescence (i.e., age 16) or during early adulthood (i.e., age 23). Finally, the role of some compensatory or protective factors also varied depending on participants' profile.

Regarding parental influences, parent-child connectedness served as a compensatory factor against gambling problems at age 16, but not at age 23. Results at age 16 years are consistent with previous studies (e.g., Rasanen et al., 2016), but the literature is lacking information regarding the link between parent-child connectedness assessed in adolescence and PG in young adulthood. An explanation for the present results may be that, as offspring transition into adulthood, they tend to spend less time with their parents and become closer to their peer group and romantic partner, thus leading parents to play a smaller role in their lives.

Yet, parent involvement emerged as a compensatory factor both at age 16 and at age 23, suggesting that parents' awareness of their children's activities may have an enduring sheltering effect against developing PG. However, when participants' at-risk profile was accounted for, only Internalizing participants benefited from parent involvement at age 23 years (although the effect for Comorbid participants was close to statistical significance), suggesting that participants with internalizing symptoms (e.g., anxiety and depression) are most sensitive to the enduring beneficial effect of parent involvement on PG. This is in stark contrast to findings by Scholes-Balog, Hemphill, Toumbourou, & Dowling (2015), which showed no link between various indicators of parent-child relationships (family concord, attachment, interaction, and prosocial

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

behavior) and PG and no interaction between Internalizing symptoms and parent-child indicators when predicting PG. However, it should be noted that, unlike the present study, all potential protective factors were assessed when participants were between 17 and 24 years of age. Also, and perhaps more importantly, PG was dichotomized based on whether participants answered positively to at least one of two screening questions. Therefore, findings from the Scholes-Balog et al. (2015) study must be interpreted with great caution.

With regards to peer influences, we found little evidence for a compensatory or interactive effect of peer connectedness (i.e., a form of social support) on the risk of PG at age 16, which is consistent with previous findings (Rasanen et al., 2016). Studies that have found a positive association between peer connectedness and PG in adolescence have assessed both variables concurrently (Rasanen et al., 2016). As adolescents grow older, peers become their main gambling partners (Gupta & Derevensky, 1998). Peer connectedness, in this case, may give adolescents some access to gambling partners in an unsupervised setting (compared to gambling with parents). Thus, peer connectedness may have an effect on PG, but that effect likely depends on peer gambling behavior. In the present study, most participants likely had nongambling peers, which may explain the lack of association between peer connectedness and PG at age 16. However, unexpectedly, the present study has uncovered a delayed compensatory effect from peer-connectedness in early adolescence on PG at age 23 years. Developing close emotional bonds with peers during adolescence may have allowed individuals to develop adequate social skills to properly fit into society once they reach adulthood. Finally, all participants benefited at age 16 and 23 from having conformist peers. This supports findings generally found in the literature regarding peer conformity (Lussier et al., 2014).

Strength, Limitations and Conclusions

Several strengths of this study should be noted. This is the first prospective cohort study to a) identify profiles of adolescents among the general population at risk for gambling problems and b) examine compensatory and protective factors for gambling problems among these profiles. In comparison to cross-sectional studies, the results of our longitudinal analyses help reinforce the directionality (albeit not the causality) from risk or compensatory factors to gambling problems. Next, the use of various sources of information (i.e., teachers and participants) minimizes the risk of shared-method variance in our data. Finally, at-risk profiles were determined when participants were 12 years old, before gambling problems generally appear. It is therefore highly unlikely that profile characteristics were affected by gambling problems.

On the other hand, some limitations remain. First, a number of variables assessed in this study were derived from scales that consisted of only two or three items. Second, the model fit indicators used to determine the optimal LPA model did not consistently converge toward the same number of profiles; a qualitative analysis of results was needed to address this issue. Third, it would have been useful to gather additional variables about peers and family, especially in terms of specific gambling practices, in order to determine participants' specific sources of gambling exposure, and explore any moderating effects with regards to peer and family connectedness. Finally, although the missing data analysis allowed us to safely remove a small portion of our participants, it should be noted that it is always preferable to have complete data. Despite these limitations, the longitudinal and profiling analyses conducted in the current study provide additional and innovative insights into the current state of knowledge of individuals at risk for developing gambling problems and about compensatory/protective factors for PG, thus allowing for a refining of etiological models and prevention efforts. Finally, the current study

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

showed that, depending on when the problematic behavior is measured, differences between profiles may vary and the same compensatory/protective factors may have different effects. Together, these findings call for careful analyses when deducing any given variable's effect on a problem gambling.

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AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Tables

Table 1

Correlations (with Pairwise Deletion; N Between 1129 and 3338) and Descriptive Statistics for all Variables

Variable (age in years)	1	2	3	4	5	6	7	8	9	10	11	12
1. Impulsivity (12)	1											
2. Anxiety (12)	.42**	1										
3. Depression (12)	.26**	.58**	1									
4. Antisociality (12)	.52**	.30**	.25**	1								
5. Aggression (12)	.69**	.29**	.24**	.60**	1							
6. Drug use (14)	.07**	-.03	-.06**	.09**	.10**	1						
7. Parental Monitoring (14)	-.10**	-.03	-.01	-.10**	-.12**	-.29**	1					
8. Peer Bonding (14)	-.06*	-.10**	-.10**	-.04	-.05*	.20**	.02	1				
9. Parent-child Connectedness (14)	-.05*	-.03	-.04	-.05*	-.06**	-.18**	.39**	.12**	1			
10. Peer Conformity (14)	-.17**	-.06**	-.01	-.19**	-.22**	-.44**	.31**	-.06**	.16**	1		
11. Gambling Problems (16)	.11**	.08**	.07**	.08**	.14**	.09**	-.12**	-.03	-.08**	-.13**	1	
12. Gambling Problems (23)	.16**	.07**	.09**	.18**	.16**	.10**	-.08**	-.12**	-.02	-.16**	.22**	1

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Table 1

Continued

Variable	1	2	3	4	5	6	7	8	9	10	11	12
M	2.39	1.74	1.09	0.40	1.66	1.72	6.34	12.99	17.54	5.61	0.31	0.33
SD	3.25	1.56	1.44	0.75	2.62	1.09	1.43	2.88	4.24	0.69	0.97	1.16

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

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Table 2

Model Fit Indicators for Latent Profile Analysis

Model	BIC ^a	Entropy	LMR-ALRT ^b (<i>p</i> value)
2-class	66530	.890	.000
3-class	64945	.902	.000
4-class	63915	.868	.000
5-class	60520	.934	.000
6-class	59548	.919	.698

Note. Best-fitting model is shown in bold.

^a Bayesian Information Criterion

^b Lo-Mendell-Rubin Adjusted Likelihood Ratio Test

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Table 3

Mean Scores for Latent Profile Analysis Indicator Variables, According to Profile

Variables	Well-Adjusted	Internalizing	Externalizing	Comorbid	<i>F</i>
Anxiety	0.94*	2.31*	5.68*	8.62*	413.48
Depression	1.11*	3.90*	2.49*	2.81*	493.05
Impulsivity	0.54*	3.57*	1.39*	2.22*	842.37
Aggressiveness	0.12*	0.41*	0.90*	1.87*	3710.82
Antisocial behavior	0.38*	0.78*	4.38*	8.96*	453.55
Drug/Alcohol use	1.70	1.48*	1.83	2.01*	8.28

* Statistically different from all other profiles ($p < .05$)

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Table 4

Negative Binomial Regression of Profiles Predicting Gambling Problems (GP)

at Age 16 and 23 years

<u>Variable</u>	<u>Age 16</u>		<u>Age 23</u>	
	β	p	β	p
Sample (0 = A; 1 = B)	0.21	.156	-0.45	.017
SES	-0.01	.000	0.00	.965
Gender (0 = M; 1 = F)	-1.09	.000	-1.04	.000
Internalizing	0.16	.486	0.04	.904
Externalizing	0.56	.001	0.45	.026
Comorbid	0.70	.002	0.81	.004
Well-Adjusted	1		1	
GP at age 16 years	(not applicable)		0.34	.000

AT-RISK PROFILES AND PROTECTIVE FACTORS FOR PG

Table 5

Main (i.e., Compensatory) and Interaction (i.e., Moderating) Effects of Social Factors on Gambling Problems at Age 23 Years

<u>Age</u>	<u>Variable</u>	<u>Main effect</u>		<u>Interaction effect</u>		
		β	<u>Well-Adjusted</u> (Reference group)	<u>Internalizing</u>	<u>Externalizing</u>	<u>Comorbid</u>
16 years	Parental Involvement	-0.20**	-0.20**	0.08	0.05	0.04
	Parent-Child Connectedness	-0.06**	-0.08**	0.04	0.03	0.04
	Peer Conformity	-0.41**	-0.38**	-0.03	0.05	-0.03
	Peer Connectedness	0.02	0.00	0.00	0.04	0.07
23 years	Parental Involvement	-0.15*	-0.09	-0.17**	-0.06	-0.16
	Parent-Child Connectedness	-0.03	-0.01	-0.04	-0.02	-0.05
	Peer Conformity	-0.36**	-0.30**	-0.16	-0.01	-0.03
	Peer Connectedness	-0.08**	-0.07**	-0.07	-0.02	-0.02

Note: Significant effects shown in bold.

* $p < .05$; ** $p < .01$