

Longitudinal links between impulsivity, gambling problems and depressive symptoms: a transactional model from adolescence to early adulthood

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Background: Research shows high co-morbidity between gambling problems and depressive symptoms, but the directionality of this link is unclear. Moreover, the co-occurrence of gambling problems and depressive symptoms could be spurious and explained by common underlying risk factors such as impulsivity and socio-family risk. The goals of the present study were to examine 1) whether common antecedent factors explain the concurrent links between depressive symptoms and gambling problems, and 2) whether possible transactional links between depressive symptoms and gambling problems exist from late adolescence to early adulthood. **Methods:** A total of 1004 males from low SES areas participated in the study. **Results:** Analyses revealed a positive predictive link between impulsivity at age 14 and depressive symptoms and gambling problems at age 17. In turn, gambling problems at age 17 predicted an increase in depressive symptoms from age 17 to age 23, and depressive symptoms at age 17 predicted an increase in gambling problems from age 17 to age 23. **Conclusions:** Common antecedent factors may explain the initial emergence of an association between depressive symptoms and gambling problems in adolescence. However, once emerged, their escalation seems to be better explained by a mutual direct influence between the two sets of disorders. **Keywords:** Impulsivity, gambling problems, depressive symptoms, adolescence, early adulthood.

Between 70 and 85% of adolescents report involvement in gambling activities at some point in their life and between 66 and 78% report having gambled within a given year (National Research Council, 1999; Shaffer & Hall, 1996). Although most adolescent gamblers can be considered 'recreational' or 'occasional' gamblers, a non-negligible portion (between 3 and 8%) can be considered problem gamblers (National Research Council, 1999; Turchi & Derevensky, 2006). These data raise concerns about gambling among adolescents because of the related problems that adolescent gamblers may experience and because of the relative stability of gambling from adolescence to early adulthood (Wanner, Vitaro, Ladouceur, Brendgen, & Tremblay, 2006; Winters, Stinchfield, Botzet, & Anderson, 2002).

Various studies identified a co-occurrence of gambling problems (i.e., problems resulting from gambling) and depressive symptoms in adolescents and adults alike (Blaszczynski, Steel, & McConaghy, 1997; Bonnaire, Bungener, & Varescon, 2009; Langhinrichsen-Rohling, Rhode, Seeley, & Rohling, 2004). However, these studies have several limitations. First, most of them used small clinical samples that may not be representative of the general population. For example, contrary to problem gamblers who do not seek treatment (i.e., the majority of problem gamblers), problem gamblers who seek

treatment are in their thirties, are married, have only a primary or secondary education and have an insecure job situation (Ciarrocchi & Richardson, 1989; Volberg, 1994).

Another limitation is the use of cross-sectional designs, which makes the directionality of the link between gambling problems and depressive symptoms unclear. Depressive symptoms are as likely to be a consequence as a precursor of gambling problems (Langhinrichsen-Rohling, 2004). For example, social isolation, money problems, repeated but unsuccessful efforts to chase losses, feelings of guilt and legal problems, which may all result from gambling problems, may trigger depressive symptoms in problem gamblers. Inversely, it is also possible that depressive symptoms precede gambling problems. Indeed, some scholars suggest that gambling may be used as a self-medication strategy to relieve a dysphoric state of mind and escape apathy (Gupta & Derevensky, 1998a; Thomas, Allen, & Phillips, 2009). Gambling activity may thus play a role similar to antidepressants and compensate for a lack of stimulation resulting from a depressed mood. This theoretical perspective is consistent with Jacobs' General Theory of Addictions (1986), which postulates that addictions (including gambling addiction) could be at least partly explained by a predisposing depressed state. At-risk individuals develop and maintain an addiction as a way to escape from a painful reality. This point of view is also consistent

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with one of the possible pathways proposed by Blaszczynski and Nower (2002) for the development of problem and pathological gambling. According to these authors, the ‘emotionally vulnerable problem gamblers’ have a *premorbid* history of depression and gambling participation is used to modulate negative states of mind.

Only one study examined longitudinal links between depressive feelings and problem gambling (Winters et al., 2002). Specifically, the predictive links between psychological distress during adolescence and problem gambling in young adulthood were assessed. The results led to the conclusion that psychological distress during adolescence is not a good predictor of problem gambling in young adulthood. Despite numerous strengths (large sample size, prospective design), a limitation of that study was its definition of depressive symptoms. The single-item construct of ‘psychological distress’ was a mix between depression and anxiety, which might confound possible links between depressive symptoms and problem gambling. More importantly, predictive links were assessed in one direction only. To our knowledge, no study has examined the possible cross-lagged links between gambling problems and depressive symptoms using a prospective longitudinal design.

Predicting gambling problems and depressive symptoms: the role of impulsivity and socio-family risk

The frequent co-occurrence of gambling problems and depressive symptoms might also be explained by the presence of common underlying risk factors, notably impulsivity and socio-family risk. Impulsivity is relatively stable throughout life and encompasses behavioral and cognitive components such as: (1) a drive for immediate reinforcement, (2) a tendency to

act without thinking about negative consequences, (3) an insensitivity to punishment, and (4) a lack of inhibitory control (Barratt & Patton, 1983; Patton, Stanford, & Barratt, 1995). Several studies point specifically to the predictive role of impulsivity in the development of gambling problems during adolescence or early adulthood (Slutske, Caspi, Moffitt, & Poulton, 2005; Vitaro, Arseneault, & Tremblay, 1999). Impulsive people may not only be highly sensitive to winning, but also insensitive to losing a game such that they will pursue the gambling activity despite a loss. This pattern of responses puts impulsive people not only at risk for developing gambling problems: it also facilitates the perpetuation of the behavior and, over time, may lead to an addiction (Wanner, Vitaro, Carbonneau, & Tremblay, 2009). Impulsivity has also been predictively linked to depression, as well as other psychiatric disorders (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Some authors suggested that impulsive individuals are more prone to encounter adverse situations, which, in turn, lead to depression (Granö et al., 2007). Another explanation is that impulsive people have poor emotion regulation strategies when facing negative events, as they are more prone to rumination, self-blame and catastrophizing than others, which may make them especially vulnerable to depression (d’Acremont & Van der Linden, 2007).

Socio-family risk is a multifaceted construct that refers to circumstances such as poverty, divorce, a low parental education level, or teen parenthood known to be risk factors for the development of externalizing and internalizing problems in offspring (Shaw & Emery, 1988). Especially when occurring cumulatively, these socio-familial circumstances have been related to elevated levels of impulsivity, gambling problems and depressive symptoms in adolescent offspring (Fisher, 1993). Socio-family risk, like impulsivity, can thus be viewed as an

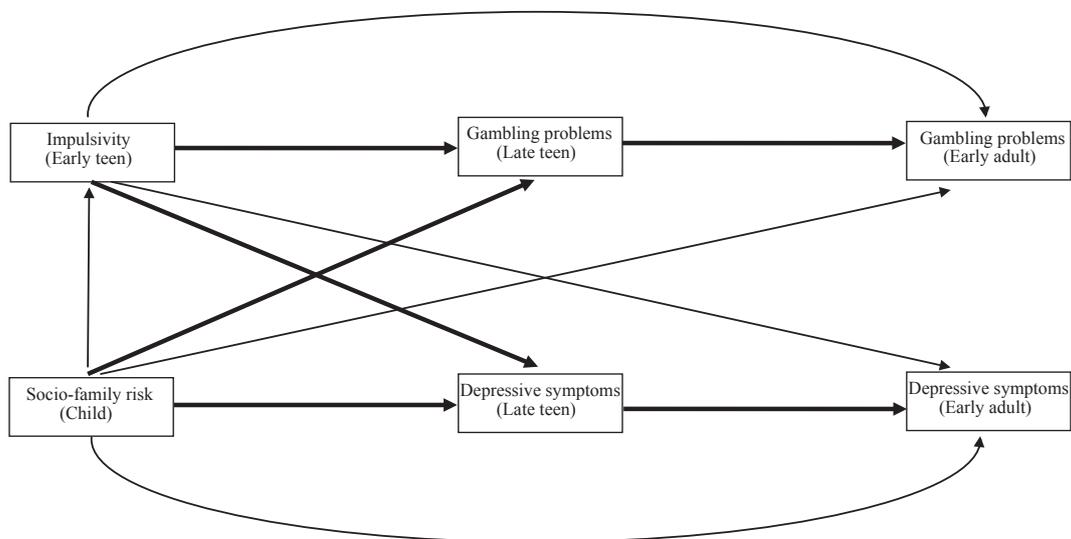


Figure 1 Common antecedents model. Paths of interest are in bold

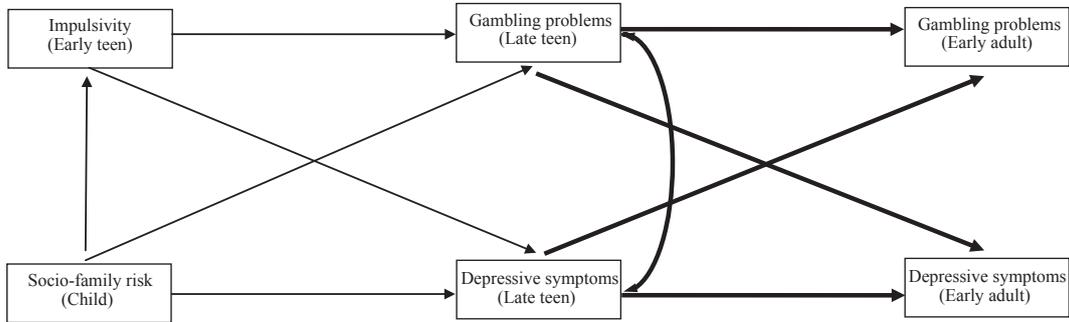


Figure 2 Direct influence model. Paths of interest are in bold

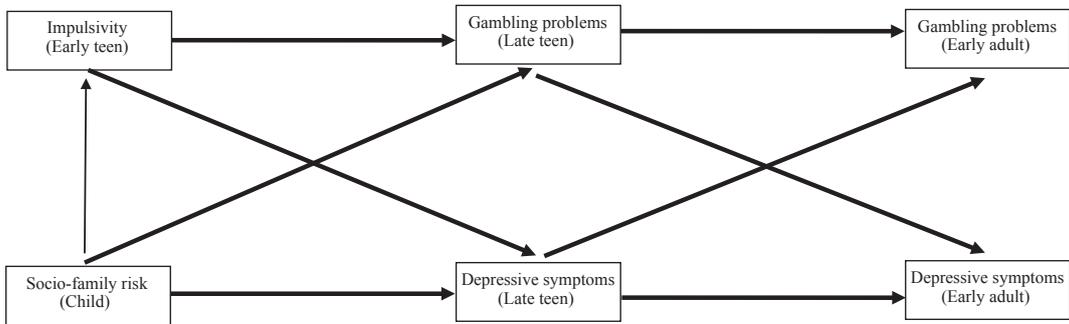


Figure 3 Mixed model. Paths of interest are in bold

underlying common risk factor for both gambling problems and depressive symptoms.

Goals of the present study

As noted, the longitudinal interplay between gambling problems and depressive symptoms remains unknown. Moreover, despite the fact that impulsivity and socio-family risk are predictively linked to gambling problems and depressive symptoms, it is not clear whether these risk factors are responsible for the concurrent, and possibly longitudinal, links between gambling problems and depressive symptoms. Thus, the goals of the present study were 1) to examine whether impulsivity and socio-family risk can explain the concurrent, and possibly longitudinal, links between gambling problems and depressive symptoms, and 2) to investigate possible cross-lagged links between gambling problems and depressive symptoms from adolescence to early adulthood, that may occur even when possible antecedent factors are controlled. On the basis of the theoretical background outlined previously, three competing models are proposed.

The ‘Common antecedents model’ (Figure 1) postulates that the co-occurrence of gambling problems and depressive symptoms is entirely explained by common underlying risk factors, e.g., impulsivity and socio-family risk. Moreover, these common factors not only explain the co-occurrence of gambling problems and depressive symptoms, but also, at least partially, the stability of these problems from

adolescence to early adulthood. Consequently, concurrent links by late adolescence and by early adulthood should disappear once common antecedent factors are controlled.

The ‘Direct influence model’ (Figure 2) postulates that the co-occurrence of gambling problems and depressive symptoms is not explained by common underlying risk factors. Instead, gambling problems and depressive symptoms should directly influence each other over time, which should be reflected in a cross-sectional link between gambling problems and depressive symptoms during adolescence, as well as mutual longitudinal (e.g., cross-lagged) links between the two disorders from adolescence to early adulthood. Moreover, the cross-lagged links between gambling problems and depressive symptoms should account for the concurrent links between the two disorders in early adulthood.

The ‘Mixed model’ (see Figure 3) postulates that common underlying risk factors explain the co-occurrence of gambling problems and depressive symptoms during adolescence. However, once established, the two disorders may become independent from their underlying antecedent factors and influence each other by late adolescence and into early adulthood. This mixed model is a combination of the common antecedent and direct influence models.

Empirical support for one of these models could have important implications at the theoretical and clinical level. If results support the ‘Common antecedents model’, efforts should be made to screen

highly impulsive adolescents or those exposed to high socio-family risk before the development of gambling problems and depressive symptoms. In contrast, if the results support the 'Direct influence model', researchers should look for other predictors than impulsivity and socio-family risk to prevent the concurrent emergence of gambling problems and depressive symptoms. In addition, treating one type of problem should alleviate the other type of problem. Finally, if results support the 'Mixed model', prevention should target impulsivity and, if possible, socio-family risk before gambling problems and depressive symptoms emerge. Once emerged, however, it may be necessary to treat either or both problems to prevent further escalation.

Previous findings report that gender and ethnicity influence gambling. Specifically, boys tend to gamble more and more often, spend more time and money and experience more problems than girls (Gupta & Derevensky, 1998b). Ethnicity has also been linked to gambling, with Latin American, African American, Hispanic and American Indian students gambling more often than their Caucasian and Asian American counterparts (Stinchfield, Cassuto, Winters, & Latimer, 1997). For these reasons, gender and ethnicity were controlled methodologically by using a sample of Caucasian boys.

Method

Participants

Participants were part of an ongoing longitudinal study that started in 1984 with 1162 kindergarten boys. They attended 53 schools in economically disadvantaged areas in Montreal, Canada (Mean age = 6.02; $SD = .52$). Boys included in the initial sample represented 87% of all boys attending the 53 schools that participated in the study. Socio-family risk data were collected when the boys were 10 years old. Impulsivity data were collected when the boys were 14 years old. Gambling and depression data were collected when the boys were 17 and 23 years old. Complete data for all assessments was not necessary for testing the model (as explained later in the Model testing section). Therefore, all participants who provided valid data on at least one of the measures were included in the main analysis, resulting in a final n of 1004.

Measures

Socio-family risk. This was assessed via mother reports on: (a) family structure (two parents or single), (b) educational level of both parents, (c) occupational status of both parents (or occupation of the parent with whom the child was living) based on the Blishen, Carroll, and Moore (1987) occupational prestige scale, and (d) mother's and father's age at the birth of the first child. The co-occurrence of several of these factors has been found to predict a variety of offspring adjustment problems in adolescence and early adulthood

(Brendgen, Wanner, Morin, & Vitaro, 2005; Loeber & Farrington, 2000; Velez, Johnson, & Cohen, 1989). A score of 0 was attributed to family structure if the child was living with both natural parents and a score of 1 was attributed to all other cases. Parental educational level, parental occupational status, and mother's or father's age at the birth of the first child were scored 1 when the individual scores were in the lower quartile of the respective variable distribution. A score of 0 was given to scores above the first quartile of the distributions. A total Socio-Family Risk index was then computed, with a high value indicating a high level of co-occurring socio-family risk.

Impulsivity. To partly overcome the problem of shared method variance (e.g., gambling problems and depressive symptoms are based on self-reports), we used participants', teachers' and mothers' reports to create a composite score of participants' impulsivity.

Self-reported impulsivity was assessed using a French version of the Impulsiveness Scale (EIS; Eysenck & Eysenck, 1978), which is composed of the following five items: 'do you generally do and say things without stopping to think?', 'do you often get into trouble because you do things without thinking?', 'are you an impulsive person?', 'do you usually think carefully before doing anything?', 'do you mostly speak before thinking things out?' Items could be answered yes (1) or no (0) (Cronbach's $\alpha = .69$). In addition, teachers and mothers rated participants' degree of impulsivity using three items from the Social Behavior Questionnaire (SBQ; Tremblay et al., 1991), which closely correspond to behaviors reflective of the DSM-IV hyperactivity-impulsivity syndrome (Achenbach, Dumenci, & Rescorla, 2003). These items were: 'acts without reasoning', 'jumps from one activity to another', 'attracts attention by shouting'. Together, the items from the three sources capture both the cognitive and the behavioral dimensions involved in the impulsivity construct (Moeller et al., 2001). Each item was scored 0, 1 or 2, with higher numbers meaning the item was more applicable to the boy being rated (Cronbach's $\alpha = .89$ for the teachers' assessment and Cronbach's $\alpha = .80$ for the mothers' assessment). Inter-informant correlations were moderate (r s between .19 and .30) but significant ($p < .01$). The scores were z -standardized and a mean value of the three scores was computed to create the composite impulsivity score.

Gambling. At age 17, a French translation of the South Oaks Gambling Screen for Adolescents (SOGS-RA; Winters, Stinchfield, & Fulkerson, 1993) was administered (Cronbach's $\alpha = .76$). At age 23, a French version of the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987) was administered (Cronbach's $\alpha = .88$). These instruments assess (a) gambling frequency and diversity as well as (b) the number of gambling-related problems experienced by the participants over the past 12 months using a list of possible problems (e.g., feeling of guilt, debts caused by gambling activities, etc.). For this study, only the total problem scale score (ranging from 0 to 12 for both instruments) was used. Higher scores indicate more problems.

Depressive symptoms. At age 17, the Child Depression Inventory (CDI; Kovacs, 1992) was used to assess depressive symptoms. The CDI is a self-reported 27-item scale assessing affective, cognitive, motivational and somatic symptoms of depression. Individual item scores ranged from 0 to 2, with higher ratings indicating more severe symptoms (Cronbach's $\alpha = .80$). At age 23, the Diagnostic Interview Schedule for the DSM-IV (DIS-IV; Robins, 1995) was used to assess symptoms of depression. The DIS-IV is a structured psychiatric interview designed to assess psychiatric symptoms based on the DSM-IV (American Psychiatric Association, 1994). To increase variability, we used a four-point scale ranging from '0' (never) to '3' (often) instead of a yes–no response. A higher score on the total measure indicates more severe depressive symptomatology (Cronbach's $\alpha = .90$).

Based on critical criterion cut-offs, 5.1% of participants at age 17 and 3% at age 23 could be considered problem gamblers. Moreover, 4.8% of participants at age 17 and 4.2% at age 23 met the criterion for major depression. These prevalence rates closely resemble those for men reported by the National Institute of Mental Health and the National Research Council. Owing to the small number of participants with clinical levels of gambling and depression, continuous measures were used for analyses.

Procedure

After approval from the School Board, teachers and parents of the target classrooms were contacted by mail and invited to participate. Active written consent was obtained from parents and teachers, as well as active verbal assent from the boys during adolescence. In adulthood, active written consent was obtained from all participants. Participants were informed before the data collection that their answers were strictly confidential and that they could stop their participation at all times.

Results

Preliminary analyses

Prior to analyses, variables were screened for outliers. Skewness and kurtosis values were acceptable for all variables except for gambling problems at 17 and 23 years. The scores for both measures were inversely transformed and reflected to improve distributional qualities. Subsequent screening of the residuals of all variables showed that assumptions of normality, linearity and homoscedasticity were met.

In Table 1, bivariate correlations, means and standard deviations of all variables are presented. Impulsivity at age 14 years was significantly correlated with all other variables, except depressive symptoms at age 23 years. Gambling problems and depressive symptoms scores were relatively stable from age 17 to 23 years. Finally, there were significant concurrent correlations between gambling problems and depressive symptoms at age 17 years and gambling problems and depressive symptoms at age 23 years ($r_s = .14$ and $.15$, respectively).

Model testing

Structural equation modeling was used to assess concurrent, predictive and stability links among the variables. The proportion of missing data across all variables at all times of measurement was on average 31.8%. Missing values were not assumed to be missing completely at random (MCAR) or missing at random (MAR) because participants at higher risk (e.g., those with higher levels of impulsivity or socio-family risk) might have been less likely to engage in the study in a consistent way. The full information maximum likelihood (FIML) method was therefore used to account for missing values because it allows us to deal with samples with moderate or large amounts of missing data, even those MNAR, if the predictors of missingness are included in the model (Widaman, 2006). With FIML, each parameter is estimated based on all available information from each participant, so that even participants with occasional missing data contribute to model estimation. Results of the full saturated model are presented in Figure 4.

Longitudinal links between early risk factors and gambling problems and depressive symptoms at age 17

Socio-family risk at age 10 was significantly linked to impulsivity at age 14 ($\beta = .207$, $p < .001$). However, there was no significant link between socio-family risk at age 10 and gambling problems ($\beta = .068$, $p = .11$) or depressive symptoms ($\beta = -.002$, $p = .96$) at age 17. Impulsivity at age 14 was significantly linked to gambling problems ($\beta = .161$, $p < .001$) and to depressive symptoms ($\beta = .225$, $p < .001$) at age 17.

Table 1 Bivariate correlations, means and standard deviations of variables at study

	A.	B.	C.	D.	E.	F.	<i>M</i>	<i>SD</i>
A. Socio-Family Risk	1	.21**	.10*	.04	.06	-.02	1.12	1.05
B. Impulsivity	–	1	.18**	.22**	.31**	.10*	0.00	1.00
C. Gambling problems (17)	–	–	1	.14**	.21**	.14**	.40	1.11
D. Depressive symptoms (17)	–	–	–	1	.13**	.25**	8.00	5.9
E. Gambling problems (23)	–	–	–	–	1	.15**	.63	1.80
F. Depressive symptoms (23)	–	–	–	–	–	1	13.43	8.02

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

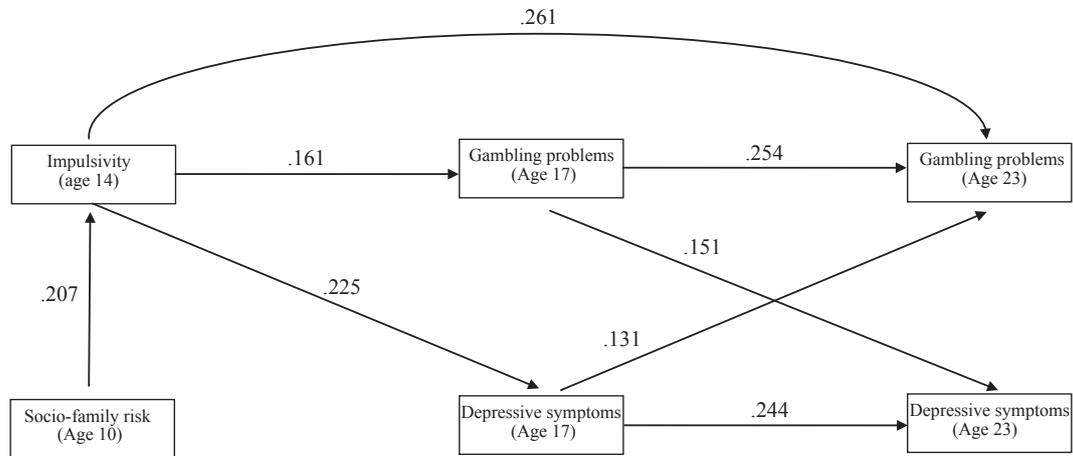


Figure 4 Results of the SEM analysis. Only significant paths are shown

Longitudinal and cross-lagged links between early risk factors and gambling problems and depressive symptoms at ages 17 and 23

Socio-family risk at age 10 was not significantly linked to gambling problems (beta = $-.023$, $p = .59$) and depressive symptoms (beta = $-.057$, $p = .18$) at age 23. In contrast, impulsivity at age 14 was significantly linked to gambling problems (beta = $.261$, $p < .001$), although not to depressive symptoms (beta = $.042$, $p = .44$) at age 23. Gambling problems and depressive symptoms were no longer concurrently linked at age 17 (beta = $.031$, $p = .38$), although their bivariate correlation in Table 1 had been significant. Gambling problems at age 17 was linked to both later gambling problems (beta = $.254$, $p < .001$) and later depressive symptoms (beta = $.151$, $p < .001$) at age 23. Similarly, depressive symptoms at age 17 was linked to both later depressive symptoms (beta = $.244$, $p < .001$) and later gambling problems (beta = $.131$, $p = .01$) at age 23. At age 23, gambling problems and depressive symptoms were no longer concurrently linked (beta = $-.018$, $p = .66$), although their bivariate correlation in Table 1 had been significant.

Discussion

The goals of the present study were to examine 1) whether impulsivity and socio-family risk could explain the concurrent links between gambling problems and depressive symptoms, and 2) possible cross-lagged links between gambling problems and depressive symptoms from late adolescence to early adulthood. For this purpose, three competing models were proposed: a ‘Common antecedents’ model, a ‘Direct influence’ model, and a ‘Mixed’ model. The results provided support for the Mixed model. Impulsivity, but not socio-family risk, was linked to the initial level of gambling problems and depressive symptoms in adolescence. When this common antecedent factor was controlled, the concurrent

relation between gambling problems and depressive symptoms in adolescence disappeared. Once in place, however, gambling problems and depressive symptoms appeared to influence each other over time from late adolescence to early adulthood. This direct effect accounted for the concurrent relation between gambling problems and depressive symptoms in young adulthood.

Support for the Mixed model may indicate differential patterns regarding the development of gambling problems and depressive symptoms in adolescence compared to early adulthood. In adolescence, both problems are not only predicted by earlier impulsivity, but impulsivity also explains their shared variance. Impulsive individuals’ inability to inhibit undesirable behaviors could explain why they continue to gamble, even after repeated negative outcomes resulting from their gambling habits (e.g., loss of money, social problems). Moreover, the fact that impulsive individuals are prone to emotion regulation problems may limit their coping capacities when facing such repeated negative events, the accumulation of which may eventually lead to the development of depressed mood. Thus, although impulsivity may have been linked to concurrent conditions such as attention deficit/hyperactivity disorder (ADHD) or manic depression in some participants, it is likely the underlying impulsivity-related behavior and emotion regulation difficulties that explain the co-occurrence of gambling problems and depressive symptoms in late adolescence. Common neuro-physiological mechanisms underlying these behavior and emotion regulation difficulties might play a role in this context. For example, impulsivity is related to diminished mesolimbic dopaminergic functioning (Beauchaine & Neuhaus, 2008). Gambling activity could be used by impulsive individuals to modulate dopaminergic functioning because dopamine release has been linked to high reward sensitivity, especially during risk-taking situations (Chambers & Potenza, 2003; Ibanez, Blanco, & Saiz-Ruiz, 2002). The same

mechanisms could explain the predictive link between high levels of impulsivity and the development of depressive symptoms, as under-regulation of the dopamine system has been linked to depressive mood (D'Aquila, Collu, Gessa, & Serra, 2000; Forbes & Dahl, 2005).

In contrast to impulsivity, socio-family risk during early adolescence was not directly linked to gambling problems and depressive symptoms in late adolescence and also did not explain their co-occurrence at this age. One explanation for the absence of a significant link could be that our sample was relatively homogenous in regard to family stressors, because all participants came from relatively low SES families. However, since socio-family risk was significantly associated with gambling problems on the bivariate level, an alternative explanation could be that the effect of socio-family risk on gambling is mediated by impulsivity. In either case, the present finding suggests that the use of distal socio-demographic variables as a screening tool for individuals at risk for gambling problems may be less useful than the use of more proximal personal characteristics, notably impulsivity.

Our results suggest that a common antecedent risk factor (i.e., impulsivity) contributes to the early development of both gambling and depressive symptoms and explains their co-occurrence in adolescence. However, once gambling problems and depressive symptoms have emerged, their escalation seems to be better explained by a mutual direct influence between the two sets of disorders. Noteworthy in this context is that the two cross-lagged paths were comparable in strength. These findings reconcile two opposing theoretical perspectives regarding the developmental interplay between gambling problems and depressive symptoms. According to the first perspective, gambling problems precede depressive symptoms (Langhinrichsen-Rohling, 2004). In this case, frequent gambling may cause social isolation and money problems, which may then lead to depressive symptoms. According to the second perspective, depressive symptoms precede gambling problems and gambling may be a way to achieve distraction from personal problems and to fight a state of apathy (Blaszczynski & Nower, 2002; Jacobs, 1986). Together, these two pathways result in a vicious cycle such that – once developed – gambling problems and depressive symptoms mutually influence each other.

Strengths, limitations, and conclusion

Overall, this study has important strengths. First, while numerous studies have identified a co-occurrence between gambling problems and depressive symptoms, this is the first study to assess cross-lagged links between these two problems. Second, the use of a composite score of impulsivity comprising three different reporting sources (parti-

pants' self-reports, mothers and teachers) reduces measurement error and shared method variance bias. A final strength of this study is the rigorous control of possible spurious links through the use of a saturated model with control variables.

Despite these strengths, the study also has several limitations. First, external validity is limited since all participants came from low SES families and were French-Canadian males of European origin. Previous studies suggest that European American youths gamble less often than Latin American, African American, Hispanic and American Indian youth (e.g., Stinchfield et al., 1997). The present findings thus need to be replicated with ethnically more diverse samples. Second, the measures used to assess gambling problems and depressive symptoms in adulthood were not completely identical to the ones used in adolescence, which may have led to lower stability coefficients for the two variables. A further limitation is the exclusive use of self-reports to assess gambling problems and depressive symptoms. However, given that these problems refer to private and sometimes secretive behaviors or feelings (Gupta & Derevensky, 1997), self-reports are arguably the most reliable source of information in this regard.

The associations of the present study observed at age 23 may also not be generalizable to later stages of adulthood. Arnett (2004) argues that, in Western societies, the adolescence period extends into the mid-20s. This extended adolescence period differs from later adulthood, which may have implications for the impact of gambling problems on a person's life. In contrast to the equivalent paths found in the present study, gambling problems may have a stronger impact on depressive symptoms than vice versa later in life because social and financial responsibilities often increase from early to mid-adulthood. The findings may also not generalize to females, who experience fewer gambling-related problems but more depressive symptoms from adolescence to early adulthood. In contrast to the equivalent cross-lagged paths found for males, the predictive effect of gambling problems to later depression symptoms may thus be relatively stronger than the reverse pathway in females. Finally, the use of a population-based sample with a limited range of gambling problems and depression symptoms may explain the relatively modest strength of the observed associations. Both the predictive effects of the common antecedent factors and the cross-lagged links between gambling and depression are likely more pronounced in clinical samples.

Despite these limitations, the present study offers important insights into the co-occurrence of gambling problems and depressive symptoms. At a theoretical level, the findings suggest that different mechanisms may explain the association between the two disorders at different developmental stages. From a clinical perspective, the findings suggest that impulsive boys should be targeted for early preven-

tion purposes as they are at risk for both gambling problems and depressive feelings later on. Failing early prevention, treating one problem may also curb to some extent the emergence or escalation of the other problem.

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Key points

- Research shows high co-morbidity between gambling problems and depressive symptoms, but the directionality of this link is unclear. The co-occurrence of gambling problems and depressive symptoms could also be spurious and explained by common antecedent factors.
- Our findings suggest that a common antecedent factor (i.e., impulsivity) explains the initial association between depressive symptoms and gambling problems in adolescence.
- The escalation of gambling problems and depressive symptoms from adolescence into adulthood is explained by a mutual direct influence between the two disorders.
- At a theoretical level, the findings suggest that different mechanisms explain the association between the two disorders at different developmental stages.
- From a clinical perspective, impulsive youth should be targeted for early prevention.

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