



Trajectory Classes of Externalizing and Internalizing Symptoms to Adolescent Gambling Participation: An Exploratory Study

Émilie Fletcher^{1,2} · Jérémie Richard^{1,2} · Stéphanie Boutin^{3,4} · Annie Lemieux^{4,5} · Michèle Déry^{4,5} · Jeffrey Derevensky^{1,2} · Caroline Temcheff^{1,2,4,5}

Accepted: 14 December 2022 / Published online: 7 January 2023

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2023

Abstract

Engagement in underage gambling remains a public health concern. Risk factors for the development of gambling behaviours in adolescence include the presence of externalizing and/or internalizing problems. This study aims to better understand the role of co-occurrence between externalizing and internalizing symptoms from childhood to adolescence in adolescent gambling. Participants were drawn from an ongoing longitudinal study of children with and without early conduct problems. Externalizing and internalizing problems were measured annually using teacher and parent reports. Gambling behaviours were measured using self-report when participants were approximately 15 years old. Latent class growth trajectory analyses identified five mental health trajectory classes: (1) a co-occurring trajectory characterized by stable clinical levels of both externalizing and internalizing problems, (2) an externalizing trajectory characterized by stable high clinical levels of externalizing problems, (3) an internalizing trajectory characterized by stable at-risk levels of internalizing problems, (4) an at-risk externalizing trajectory characterized by decreasing levels of externalizing problems, and (5) a non-clinical trajectory. Invariance analyses suggested that this model remained valid in both boys and girls. Logistic regression analyses suggested that youth who belonged in the externalizing trajectory reported a greater likelihood of past-year gambling behaviours when compared to youth who belong in the comorbid trajectory. No other mental health trajectory was significantly associated with adolescent gambling. Stable high externalizing behaviours in development appear to increase one's risk of gambling behaviours in adolescence. Efforts to target these throughout development could help decrease one's future risk of engaging in these behaviours.

Keywords Externalizing · Internalizing · Gambling · Adolescence · Longitudinal study

✉ Caroline Temcheff
caroline.temcheff@mcgill.ca

Extended author information available on the last page of the article

Introduction

Gambling behaviours in adolescents remain a public health concern, with research supporting the importance of early identification of these behaviours to help minimize future harms (Sideli et al., 2018). Epidemiological studies estimate that rates of participation in gambling over the past year amongst adolescents range from anywhere between 15 and 80% (Brezing et al., 2010; King et al., 2020; Molinaro et al., 2018), and it has been reported that the average age of onset for gambling is younger than the average age of onset for substance use in North America (Brezing et al., 2010; Jacobs, 2004). Additionally, gambling has become significantly more accessible to youth in recent years due to the popularization of online games blurring the distinction between gambling and gaming (e.g., free-to-play social casino games, loot boxes, skills-based gambling, sports wagering; King et al., 2010; Veselka et al., 2018). This has perhaps made gambling appear more appealing to youth. Furthermore, early engagement in addictive behaviours appears to be a significant predictor of future problematic engagement in gambling. Indeed, adults with problem gambling report an early age of gambling onset (Dowling et al., 2017; Kessler et al., 2008; Nower et al., 2013; Rahman et al., 2012; Winters et al., 2002). Using a developmental framework, early gambling engagement can be conceptualized as a precursory or necessary behaviour to the development of future problem gambling. Consequently, current rates of adolescent gambling behaviours paired with their increased social normalization (Derevensky et al., 2010) point towards the need for professionals to understand early childhood markers of these behaviours in order to promptly identify children at greater risk for later problems.

The few theoretical models that have been proposed to explain the development of gambling behaviours include the presence of mental health problems such as externalizing (e.g., conduct problems) and internalizing (e.g., anxiety, depression) problems as risk factors (Richard et al., 2020; Yakovenko & Hodgins, 2018). These include the *Pathways Model* (Blaszczynski & Nower, 2002) as well as three pathways to substance use that can help theoretically inform risk factors for the development of gambling behaviours in adolescence (Fergusson et al., 2005; Hussong et al., 2011; Khantzian, 1997; Maslowsky et al., 2014; Mason et al., 2008; Zucker et al., 2011). Briefly, both theoretical models argue for the existence of an *externalizing pathway* and an *internalizing pathway* to future gambling (respectively referred to as the antisocial/impulsivity pathway and the emotionally vulnerable pathway in the *Pathways Model*). There also exists a combined pathway which suggests that internalizing problems interact with externalizing problems to increase risk for future addictive behaviours (Maslowsky et al., 2014). However, evidence for this pathway remains inconclusive as comorbidity has also been found to lower one's future risk of addictive behaviours in adolescence (Mason et al., 2008). A systematic review from Richard et al. (2020) has concluded that both the externalizing and combined pathways appear to be especially relevant to the development of future gambling behaviours.

Gender differences have been observed in rates of externalizing behaviours and internalizing problems. Externalizing behaviours tend to be more common in boys while internalizing symptoms tend to be more common in girls (Askari et al., 2021; Mojtabei et al., 2016). However, girls who do display externalizing behaviours may be worse off than boys displaying similarly severe symptoms (Brennan & Shaw, 2013; Eme, 1992). As such, the externalizing, internalizing, and combined pathways may be differentially predictive for boys and girls. Gender differences have also been observed in the adolescent gambling literature. Indeed, boys have consistently been identified as having a greater risk for future involvement in gambling behaviours as well as gambling-related problems (Brezing et al.,

2010; Dowling et al., 2017; Johansson et al., 2009). This translates to the literature on adolescent gambling having samples that skew predominantly male (Richard et al., 2020). Taken together, this suggests a need for research to include samples with a greater proportion of girls when examining the mental health profiles that influence the risk of future gambling participation in adolescence.

Although the pathways model has been replicated in adolescent samples (Allami et al., 2017; Gupta et al., 2013), it has not been examined in samples of adolescents with clinical levels of mental health problems. Such examination remains important given the possible existence of subgroups within adolescents with mental health problems, including groups that would capture co-occurrence of externalizing and internalizing problems. For example, previous research has identified multiple trajectories of externalizing problems throughout development (Fanti & Henrich, 2010). These include a chronic trajectory (i.e., externalizing problems that remain high throughout development) as well as multiple desisting trajectories (i.e., externalizing problems that are present in childhood, but decrease over time at various rates). Variability in co-occurring trajectories were also observed, with some adolescents endorsing both externalizing and internalizing problems, but with different baseline levels and rates of growth. The use of samples with clinical levels of mental health problems therefore remains necessary to help capture these subgroups and evaluate whether they may be differentially associated with the development of a future risk for gambling behaviours in adolescence.

To our knowledge, few studies have examined longitudinal trajectories for externalizing and internalizing problems in the prediction of adolescent gambling behaviours, and even less have considered the co-occurrence of these (Richard et al., 2020). Our team has recently published (Richard et al., 2022) an article examining how mean trajectories of externalizing and internalizing problems relate to future gambling engagement. Endorsement of high externalizing problems at baseline was associated with an increased risk of future adolescent gambling engagement, as was a slower decrease in these problems over time. Furthermore, higher baseline levels of internalizing problems were associated with a decreased risk of future adolescence gambling engagement. Although the interaction between both externalizing and internalizing mean trajectories was examined, no significant effect was found. Given previous data suggesting high rates of comorbidity in childhood externalizing and internalizing problems (Cerdá et al., 2008; Loeber et al., 1999) as well as supporting the effect of comorbidity on adolescent gambling (Richard et al., 2020), we wish to further expand on our previous work by organizing trajectories in groups of individuals, using latent *class* analysis, to reflect variability of mental health profiles within externalizing and internalizing problems. In doing so, we hope to yield additional insights into the combined effects of co-developing internalizing and externalizing for future engagement in adolescent gambling behaviours.

Objectives

The overarching goal of the present study is to examine associations between longitudinal mental health pathways and adolescent gambling participation in a sample with clinical levels of mental health problems. This will be done through the identification of trajectory groups that will help us better capture profiles of co-occurrence (in contrast with only externalizing or internalizing profiles) from childhood to adolescence. If the externalizing pathway is supported, we would expect the presence of externalizing problems throughout development to be associated with later gambling participation. If the internalizing

pathway is supported, we would expect the presence of emotional problems throughout development to be associated with later gambling participation. If co-occurring externalizing and internalizing problems lead to later gambling participation, then the combined pathway will be supported. We also aim to test for the presence of gender differences in the above pathways to adolescent gambling behaviours. However, the paucity of gender-specific research for girls in this area precludes us from developing any specific hypotheses.

Methods

Participants

The current study uses data from an ongoing longitudinal study on the evolution of early conduct problems (CP) among boys and girls. Participants ($N=744$) were recruited in elementary schools from eight public school boards across different regions of Québec, Canada (Montréal, Montérégie, Eastern Townships, and Québec City). To deliberately oversample children with high levels of CP, approximately half of the participants ($n=370$) were randomly selected from the pool of children receiving psychosocial services for CP. Among this sample, 339 children obtained a score in the borderline or clinical range of the DSM-oriented scales for CP and oppositional defiant problems of the Achenbach System of Empirically Based Assessment (ASEBA; Achenbach et al., 2003). Additionally, 881 children were screened using the same scales to identify students who presented a level of CP in the borderline or clinical range but who were not receiving psychosocial services at school ($n=95$), for a total of 434 students identified as having CP. This method was applied to students from lower socioeconomic status neighbourhoods. The remaining children ($n=279$) were randomly selected from the pool of children screened that did not meet criteria for CP, for a total of 310 students identified as not having CP. These children did not differ significantly in sex and in age from the targeted sample of children with CP. The current study uses data from study inception (T1; ages 6.3–10.6 years old) through to wave 8 (T8; ages 12.3–16.7 years old).

Procedure

A repeated measures design was used to collect data from participants and their families at 12-month intervals. Children and their parents were met separately at home by trained research assistants while teachers were contacted via telephone to complete the study protocol. Since study inception, less than 9% of recruited participants have refused to continue participating or have become untraceable. Ethical approval was granted by the ethics board of the Université de Sherbrooke and all participants provided informed consent.

Measures

Externalizing and Internalizing Problems

These problems were assessed annually between T1 and T7 using parent (CBCL) and teacher (TRF) reports of the externalizing (35 and 32 items respectively; sample items include “threatens people”, “breaks rules”, “skips school”, etc.) and internalizing (32

and 33 items respectively; sample items include “cries a lot”, “nervous, high-strung, or tense”, “feels worthless”, etc.) problem scales of the ASEBA (Achenbach et al., 2003). Items are measured on a three-point scale ranging from 0 (not true) to 2 (very/often true), with higher scores indicating higher levels of problems. Raw scores were converted to T-scores according to informant appropriate norms of the instrument. We then created a cross-informant score by combining the CBCL and TRF and retaining the highest T-score on either problem scale. Cronbach’s alpha for the externalizing (CBCL: $\alpha=0.93\text{--}0.94$; TRF: $\alpha=0.94\text{--}0.95$) and internalizing (CBCL: $\alpha=0.87\text{--}0.89$; TRF: $\alpha=0.86\text{--}0.89$) problem scales demonstrated good internal consistency.

Gambling Participation

Gambling participation was assessed at T8 using the Diagnostic Statistical Manual-IV Adapted for Juveniles (DSM-IVJ; Fisher, 1992). Gambling participation was identified by participants reporting whether they had bought or asked someone to buy lottery tickets, or engaged in the betting of money or valuable objects during the past 12 months (yes/no).

Statistical Analyses

First, parallel growth modeling was utilized to identify the mean individual trajectories of both externalizing and internalizing problems between T1 and T7. We estimated the intercept, slope, and quadratic components within the model. The best-fitting parallel growth model was evaluated using model fit indices recommended by Kline (2015) including: (1) the overall χ^2 , (2) the comparative fit index (CFI; ≥ 0.90), (3) the Tucker–Lewis index (TLI; ≥ 0.90), (4) the root mean square error of approximation (RMSEA; ≤ 0.08), and (5) the standardized root mean squared residual (SRMR; ≤ 0.08). Significant variances (intercept, slope, and quadratic) were observed in the mean trajectories (all $p < 0.006$), thereby justifying our aim of grouping trajectories into homogeneous classes. Second, we estimated between 1 to 7 latent trajectories for T1 through T7 using latent class growth modeling. The best fitting latent class growth trajectories were evaluated using steps outlined in Infurna and Grimm (2018) including: (1) Bayesian information criteria (BIC; a lower value indicating a better-fitting model), (2) the entropy (a higher value indicating a better-fitting model), (3) the Lo et al. (2001) likelihood ratio test (LMR-LRT; a significant test indicating a better fit compared to a similarly structured model with one fewer latent trajectory class), and (4) latent class growth trajectory size, where each trajectory class should include a minimum of 5% of the sample. Third, we tested the structure of our final model to ensure it did not vary by sex by confirming the final model on each sex and validating their adjustment indices. The above statistical analyses were conducted using Mplus version 8.1 (Muthén & Muthén, 2017). We treated missing data with full information maximum likelihood (FIML) embedded within the software (Little & Rubin, 2019). Lastly, data for latent class trajectory membership was transferred onto SPSS version 25 (IBM Corp, 2017). We used binary logistic regression to test for associations between latent class trajectory membership and gambling outcomes, controlling for the effects of sex if the model turns out to be sex invariant and weighing cases by probability of latent class membership.

Results

Latent Class Growth Trajectories

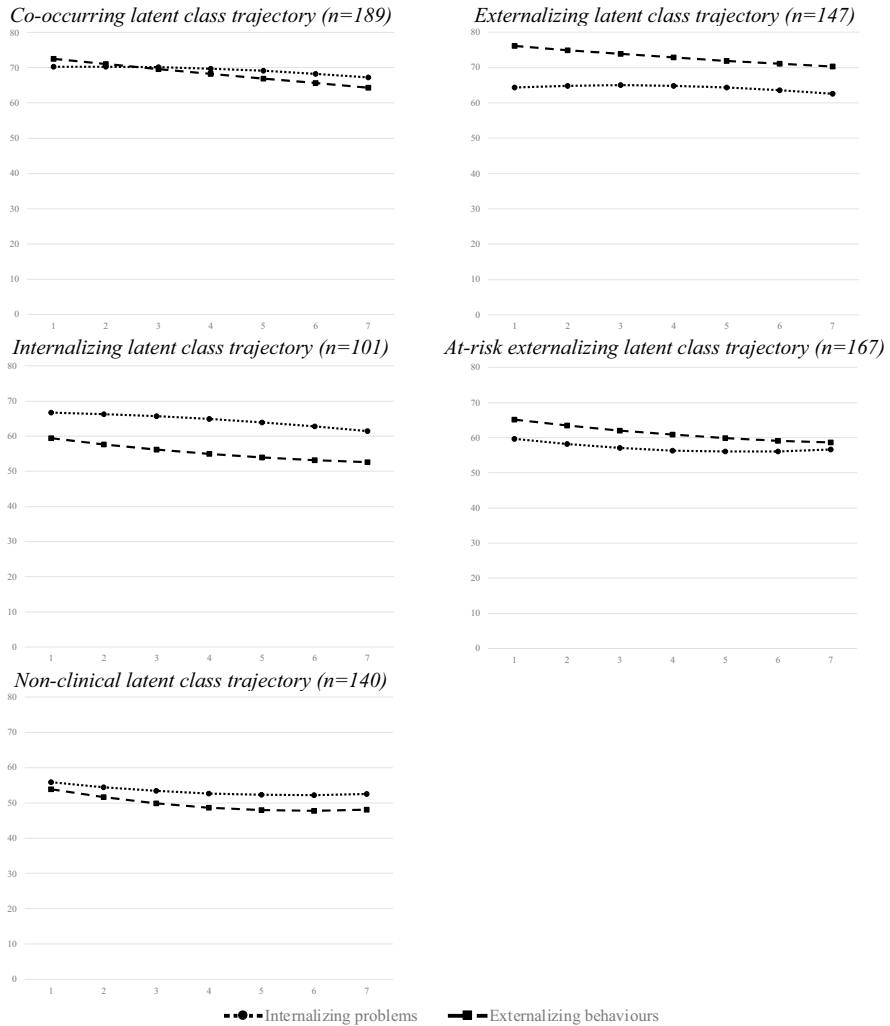
We obtained a 5-class model for the best-fitting latent class growth trajectories of externalizing and internalizing behaviours (see Table 1 and Fig. 1). Class 1 (the *co-occurring trajectory class*; 25.4%) is characterized by clinical levels of both externalizing and internalizing problems. For the co-occurring class, externalizing problems decrease over time and internalizing levels follow a quadratic shape, with increases seen in late childhood and decreases seen in adolescence. Class 2 (the *externalizing trajectory class*; 19.8%) is characterized by clinical levels of externalizing problems and at-risk levels of internalizing problems. The externalizing class follows a similar trend to the co-occurring class, with externalizing problems slightly decreasing over time (but remaining in the clinical range) and internalizing problems increasing until late childhood, only to decrease again in adolescence. Class 3 (the *internalizing trajectory class*; 18.8%) is characterized by at-risk levels of internalizing problems and non-clinical levels of externalizing problems. For the internalizing class, levels of internalizing problems remain stable over time while levels of externalizing problems follow a quadratic curve, decreasing until late childhood only to increase again during adolescence. Class 4 (the *at-risk externalizing trajectory class*; 22.4%) is characterized by at-risk levels of externalizing problems and non-clinical levels of internalizing problems. For the at-risk externalizing class, both externalizing and internalizing problems decrease over time, with externalizing problems falling in the non-clinical range. Although externalizing problems appear to increase again in adolescence, they remain in the non-clinical range. Lastly, class 5 (the *non-clinical trajectory class*; 13.6%) is characterized by non-clinical levels of both externalizing and internalizing problems. Although both follow a quadratic curve with decreases observed in late childhood and increases observed in adolescence, both externalizing and internalizing problems remain in the non-clinical range. The validity of the structure of our latent class trajectory model was evaluated based on sex, and the fit indices suggest that our model is invariant by sex and is applicable to both boys (entropy = 0.873) and girls (entropy = 0.872).

Associations with Gambling Participation

At T8, 31 (4.7%; 20 boys, 11 girls) participants reported gambling participation in the past 12 months. This is similar to the rate of habitual adolescent gambling (3.2%) observed in Quebec (Traoré et al., 2015). Chi-square analyses were initially run to evaluate differences

Table 1 Fit indices for latent class growth trajectories

	BIC	Entropy	LMR-LRT	# in classes						
2 classes	66,968.770	0.925	$p > 0.001$	422	322					
3 classes	66,265.806	0.884	$p = 0.015$	215	277	252				
4 classes	65,713.249	0.874	$p = 0.010$	201	230	156	157			
5 classes	65,314.482	0.868	$p = 0.017$	189	147	140	167	101		
6 classes	65,140.683	0.855	$p = 0.581$	93	121	121	153	152	104	
7 classes	64,989.503	0.851	$p = 0.356$	142	50	136	99	91	115	111



* non-clinical range = 0 – 64; at-risk range = 65 – 69; clinical range = 70+

Fig. 1 Mental health latent class growth trajectories

in counts of gambling participation amongst latent class trajectories. Participants in the externalizing trajectory class were significantly more likely to endorse past-year gambling participation compared to all other latent trajectory classes, $X^2(4) = 13.48, p = 0.009$. Only one participant classified in the internalizing trajectory endorsed past-year gambling participation. Given requirements for a gambling participation count greater than its expected value (McHugh, 2013), the internalizing trajectory class was excluded from logistic regression analysis. A logistic regression was then performed to examine the effects of latent class trajectory membership on past-year gambling participation whilst controlling for the effects of sex and weighing cases by probability of latent class growth trajectory membership (see Table 2). The logistic regression model was statistically significant, $X^2(4) = 10.06, p = 0.039$, and the model explained 5.6% (Nagelkerke R^2) of the variance in past-year

gambling participation. Sex and most latent class trajectories were not significantly associated with our gambling outcome. However, participants in the externalizing latent class trajectory were significantly more likely to report past-year gambling participation when compared to those in the co-occurring latent class trajectory (OR 3.99, 95% CI [1.32, 12.07]).

Discussion

This study aimed to identify whether developmental mental health trajectories were associated with gambling participation in adolescents. The mental health trajectories identified in our study seem to replicate two of the pathways found in the original *Pathways Model* (Blaszczynski & Nower, 2002), notably the emotionally vulnerable and antisocial/impulsivity pathways respectively. Our model also appears to replicate the externalizing, internalizing, and combined pathways identified in the adolescent substance use literature (Fergusson et al., 2005; Hussong et al., 2011; Khantzian, 1997; Maslowsky et al., 2014; Mason et al., 2008; Zucker et al., 2011). However, our model builds upon both theoretical models by capturing co-occurrence as well as including an at-risk externalizing trajectory and a non-clinical trajectory. The former trajectory appears to resemble moderate- and high-desister groups previously identified in the literature (Fanti & Henrich, 2010) given a decrease to non-clinical levels of externalizing problems over time, while the latter trajectory can be explained by our sample which includes participants without reported externalizing problems in childhood. Furthermore, the structure of our latent class trajectory model was sex invariant, meaning that it appears valid for both girls and boys.

Trajectories and Gambling

Our results appear to support the externalizing (or antisocial/impulsive) pathway to gambling behaviours in adolescence. Indeed, individuals who belonged in the externalizing trajectory class were significantly more likely to report having engaged in gambling behaviours over the past year when compared to individuals who belonged to the co-occurring trajectory class. This result appears to contradict the hypothesis that the co-occurrence of both externalizing and internalizing problems increase one's risk of future negative outcomes (Lewinsohn et al., 1995). Although some evidence appears to support the co-occurring effect of externalizing and internalizing problems on future

Table 2 Logistic regression model of adolescent gambling participation

	N	OR	95% CI	<i>p</i>
Sex				
Male	306	Reference	Reference	Reference
Female	263	0.60	[0.27, 1.35]	0.217
Trajectory class				
Co-occurring	162	Reference	Reference	Reference
Externalizing	136	3.99	[1.32, 12.07]	0.014
At-risk externalizing	143	1.06	[0.27, 4.12]	0.930
Non-clinical	128	1.71	[0.48, 6.04]	0.405

adolescent gambling behaviours (Richard et al., 2020), many of these studies are cross-sectional in nature, and the one longitudinal study that has modeled the effects of the externalizing and internalizing pathways on future adolescent gambling found an effect for the externalizing trajectory in the absence of an effect for the combined trajectory (Richard et al., 2022). Given that we had to exclude the internalizing (or emotionally vulnerable) trajectory from our regression analyses, we were unable to examine the effect of a pure internalizing trajectory on future gambling participation in adolescence. However, previous work from our research team suggests that higher internalizing scores in childhood decreases one's risk of engaging in adolescent gambling behaviours (Richard et al., 2022).

The adolescent substance use and broader addictive behaviours literature may help inform the above results. Indeed, the presence of externalizing problems throughout development appears to be a robust predictor of adolescent engagement in addictive behaviours (Hussong et al., 2017; Richard et al., 2020). As theorized in the externalizing pathway (Fergusson et al., 2005; Zucker et al., 2011), this is often explained by associations between externalizing problems and sensation-seeking, antisociality, delinquency, impulsivity, and behavioural disinhibition. Meanwhile, evidence for the predictive effects of the internalizing pathway on future addictive behaviors appears to be inconsistent—at least for the developmental period of adolescence. Indeed, much of the evidence supporting an internalizing pathway to future addictive behaviours measures internalizing symptoms in later adolescence (Dussault et al., 2011; Hussong et al., 2017), which has led some to argue that the internalizing pathway to addictive behaviours only begins to exert influence in later developmental years (Colder et al., 2010; Hussong et al., 2011, 2017). Additionally, the internalizing pathway considers both depression and anxiety symptoms, and some evidence appears to suggest that specific symptomatology may exert differential influence on the development of future addictive behaviours (Hussong et al., 2017). Indeed, depression symptoms seem to increase one's risk of future engagement in adolescent addictive behaviours while anxiety symptoms appear to decrease this risk.

Evidence for the role of a co-occurring pathway in the prediction of adolescent addictive behaviours remains inconclusive. Although some suggest that the presence of co-occurring externalizing and internalizing problems increases one's future risk of engagement in addictive behaviours (Allami et al., 2017, 2018; Maslowsky et al., 2014), others have also found that it either decreases one's risk (Mason et al., 2008) or exerts no significant influence in adolescence (Hussong et al., 2017; Richard et al., 2022). Some have theorized that this may be explained by specific internalizing symptomatology (e.g., social withdrawal) leading to a decreased likelihood of engaging with delinquent peers or a fear of experiencing the negative consequences associated with addictive behaviours (Colder et al., 2013; Hussong et al., 2017; Mason et al., 2008; Richard et al., 2022). Given our result that the externalizing trajectory predicts future gambling behaviours in adolescence when compared to the co-occurring trajectory, it appears that some of these mechanisms may be at play. Indeed, it may be that the presence of internalizing problems alongside co-occurring externalizing behaviours prevents the latter from exerting their influence on the development of adolescent gambling behaviours. Future research should aim to better understand this phenomenon, specifically by modeling groups of trajectories for specific internalizing symptoms (e.g., depression and anxiety) alongside externalizing problems.

Strengths and Limitations

To our knowledge, our study is the first to model latent classes of externalizing and internalizing trajectories in the prediction of future adolescent gambling behaviours. Our sample included a greater proportion of girls which allowed for an examination of sex differences, ultimately helping in informing the adolescent gambling literature that heavily skews towards male samples. Our sample also includes a clinical group of participants having been identified with conduct problems in childhood. This helps build upon similar studies that used mostly community samples while helping us better understand co-occurring profiles within clinical populations. Lastly, we observed a high retention rate (86.9%) across all our measurement time points.

These strengths should be considered alongside some limitations, including the low rate of gambling participation reported by participants. Although our rate of gambling participation resembles rates of habitual gambling practices amongst teenagers in Quebec (Traoré et al., 2015), it remains significantly lower than rates observed elsewhere (Brezing et al., 2010; King et al., 2020; Molinaro et al., 2018). Given this low rate of participation, it was not possible for us to consider youth problem gambling as an outcome as very few individuals reported any significant gambling-related problems. It is therefore important to note that this study remains exploratory in nature, and replication studies with greater sample sizes and associated greater statistical power are needed to support claims of an externalizing mental health trajectory as a risk factor for adolescent gambling behaviours, especially when compared to a co-occurring trajectory. Additionally, although our design is longitudinal, we cannot make any causal statements since our study remains correlation in nature.

Conclusion

Our study suggests that the presence of stable and high externalizing problems from childhood to mid-adolescence increases one's risk of engaging in gambling behaviours in adolescence. Notably, this result emerged when we compared the externalizing trajectory to the co-occurring externalizing and internalizing trajectory. In other words, stable high externalizing problems appear to be a robust predictor of future adolescent gambling behaviours, a finding that is in line with previous research. In conclusion, given the harms associated with early gambling initiation, early assessment and identification of externalizing problems remains necessary for effective prevention and intervention.

Acknowledgements The authors would like to thank everyone involved in this longitudinal study for their assistance with data collection.

Funding Funding was provided by the Canadian Institutes of Health Research (Grant Nos. NRF 82694 and 318770), the Social Sciences and Humanities Research Council of Canada (Grant No. 37890 as well as a Canada Graduate Scholarship - Doctoral award), and a doctoral award from the Fonds de recherche du Québec – Société et culture (FRQSC): Programme de bourse sur le jeu responsable.

Data availability The datasets generated and analysed during the current study are not publicly available due the fact that they constitute an excerpt of research in progress.

Declarations

Conflict of interest All authors report no conflicts of interest.

References

- Achenbach, T. M., Dumenci, L., & Rescorla, L. A. (2003). Dsm-oriented and empirically based approaches to constructing scales from the same item pools. *Journal of Clinical Child and Adolescent Psychology*, 32(3), 328–340. https://doi.org/10.1207/S15374424JCCP3203_02
- Allami, Y., Vitaro, F., Brendgen, M., Carbonneau, R., Lacourse, É., & Tremblay, R. E. (2017). A longitudinal empirical investigation of the pathways model of problem gambling. *Journal of Gambling Studies*, 33(4), 1153–1167. <https://doi.org/10.1007/s10899-017-9682-6>
- Allami, Y., Vitaro, F., Brendgen, M., Carbonneau, R., & Tremblay, R. E. (2018). Identifying at-risk profiles and protective factors for problem gambling: A longitudinal study across adolescence and early adulthood. *Psychology of Addictive Behaviors*, 32(3), 373. <https://doi.org/10.1037/adb0000356>
- Askari, M. S., Rutherford, C. G., Mauro, P. M., Kreski, N. T., & Keyes, K. M. (2021). Structure and trends of externalizing and internalizing psychiatric symptoms and gender differences among adolescents in the us from 1991 to 2018. *Social Psychiatry and Psychiatric Epidemiology*, 57, 737–748.
- Blaszczynski, A., & Nower, L. (2002). A pathways model of problem and pathological gambling. *Addiction*, 97(5), 487–499. <https://doi.org/10.1046/j.1360-0443.2002.00015.x>
- Brennan, L. M., & Shaw, D. S. (2013). Revisiting data related to the age of onset and developmental course of female conduct problems. *Clinical Child and Family Psychology Review*, 16(1), 35–58. <https://doi.org/10.1007/s10567-012-0125-8>
- Brezing, C., Derevensky, J. L., & Potenza, M. N. (2010). Non-substance-addictive behaviors in youth: Pathological gambling and problematic internet use. *Child and Adolescent Psychiatric Clinics of North America*, 19(3), 625–641.
- Cerdá, M., Sagdeo, A., & Galea, S. (2008). Comorbid forms of psychopathology: Key patterns and future research directions. *Epidemiologic Reviews*, 30(1), 155–177. <https://doi.org/10.1093/epirev/mxn003>
- Colder, C. R., Chassin, L., Lee, M. R., & Villalta, I. K. (2010). Developmental perspectives: Affect and adolescent substance use. In J. Kassel (Ed.), *Substance abuse and emotion* (pp. 109–135). American Psychological Association.
- Colder, C. R., Scalco, M., Trucco, E. M., Read, J. P., Lengua, L. J., Wieczorek, W. F., & Hawk, L. W. (2013). Prospective associations of internalizing and externalizing problems and their co-occurrence with early adolescent substance use. *Journal of Abnormal Child Psychology*, 41(4), 667–677.
- Derevensky, J., Sklar, A., Gupta, R., & Messerlian, C. (2010). An empirical study examining the impact of gambling advertisements on adolescent gambling attitudes and behaviors. *International Journal of Mental Health and Addiction*, 8(1), 21–34.
- Dowling, N. A., Merkouris, S. S., Greenwood, C. J., Oldenhof, E., Toumbourou, J. W., & Youssef, G. J. (2017). Early risk and protective factors for problem gambling: A systematic review and meta-analysis of longitudinal studies. *Clinical Psychology Review*, 51, 109–124. <https://doi.org/10.1016/j.cpr.2016.10.008>
- Dussault, F., Brendgen, M., Vitaro, F., Wanner, B., & Tremblay, R. E. (2011). Longitudinal links between impulsivity, gambling problems and depressive symptoms: A transactional model from adolescence to early adulthood. *Journal of Child Psychology and Psychiatry*, 52(2), 130–138.
- Eme, R. F. (1992). Selective females affliction in the developmental disorders of childhood: A literature review. *Journal of Clinical Child Psychology*, 21(4), 354–364.
- Fanti, K. A., & Henrich, C. C. (2010). Trajectories of pure and co-occurring internalizing and externalizing problems from age 2 to age 12: Findings from the national institute of child health and human development study of early child care. *Developmental Psychology*, 46(5), 1159. <https://doi.org/10.1037/a0020659>
- Fergusson, D. M., John Horwood, L., & Ridder, E. M. (2005). Show me the child at seven: The consequences of conduct problems in childhood for psychosocial functioning in adulthood. *Journal of Child Psychology and Psychiatry*, 46(8), 837–849.
- Fisher, S. (1992). Measuring pathological gambling in children: The case of fruit machines in the UK. *Journal of Gambling Studies*, 8(3), 263–285.
- Gupta, R., Nower, L., Derevensky, J. L., Blaszczynski, A., Faregh, N., & Temcheff, C. (2013). Problem gambling in adolescents: An examination of the pathways model. *Journal of Gambling Studies*, 29(3), 575–588. <https://doi.org/10.1007/s10899-012-9322-0>
- Hussong, A. M., Ennett, S. T., Cox, M. J., & Haroon, M. (2017). A systematic review of the unique prospective association of negative affect symptoms and adolescent substance use controlling for externalizing symptoms. *Psychology of Addictive Behaviors*, 31(2), 137.
- Hussong, A. M., Jones, D. J., Stein, G. L., Baucom, D. H., & Boeding, S. (2011). An internalizing pathway to alcohol use and disorder. *Psychology of Addictive Behaviors*, 25(3), 390.
- IBM Corp. (2017). *Spss version 25.0*. IBM Corp.



- Infurna, F. J., & Grimm, K. J. (2018). The use of growth mixture modeling for studying resilience to major life stressors in adulthood and old age: Lessons for class size and identification and model selection. *The Journals of Gerontology: Series B*, 73(1), 148–159.
- Jacobs, D. F. (2004). Youth gambling in North America. In J.L. Derevensky & R. Gupta (Eds.), *Gambling problems in youth: Theoretical and applied perspectives* (pp. 1–24). Springer.
- Johansson, A., Grant, J. E., Kim, S. W., Odlaug, B. L., & Gøtestam, K. G. (2009). Risk factors for problematic gambling: A critical literature review. *Journal of Gambling Studies*, 25(1), 67–92. <https://doi.org/10.1007/s10899-008-9088-6>
- Kessler, R. C., Hwang, I., LaBrie, R., Petukhova, M., Sampson, N. A., Winters, K. C., & Shaffer, H. J. (2008). Dsm-iv pathological gambling in the national comorbidity survey replication. *Psychological Medicine*, 38(9), 1351–1360. <https://doi.org/10.1017/S0033291708002900>
- Khantzian, E. J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry*, 4(5), 231–244.
- King, D., Delfabbro, P., & Griffiths, M. (2010). The convergence of gambling and digital media: Implications for gambling in young people. *Journal of Gambling Studies*, 26(2), 175–187. <https://doi.org/10.1007/s10899-009-9153-9>
- King, D. L., Russell, A., & Hing, N. (2020). Adolescent land-based and internet gambling: Australian and international prevalence rates and measurement issues. *Current Addiction Reports*, 7(2), 137–148.
- Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford Publications.
- Lewinsohn, P. M., Rohde, P., & Seeley, J. R. (1995). Adolescent psychopathology: Iii. The clinical consequences of comorbidity. *Journal of the American Academy of Child & Adolescent Psychiatry*, 34(4), 510–519. <https://doi.org/10.1097/00004583-199504000-00018>
- Little, R. J. A., & Rubin, D. B. (2019). *Statistical analysis with missing data* (Vol. 793). Wiley.
- Lo, Y., Mendell, N. R., & Rubin, D. B. (2001). Testing the number of components in a normal mixture. *Biometrika*, 88(3), 767–778.
- Loeber, R., Stouthamer-Loeber, M., & Raskin White, H. (1999). Developmental aspects of delinquency and internalizing problems and their association with persistent juvenile substance use between ages 7 and 18. *Journal of Clinical Child Psychology*, 28(3), 322–332.
- Maslowsky, J., Schulenberg, J. E., & Zucker, R. A. (2014). Influence of conduct problems and depressive symptomatology on adolescent substance use: Developmentally proximal versus distal effects. *Developmental Psychology*, 50(4), 1179.
- Mason, W. A., Hitchings, J. E., & Spoth, R. L. (2008). The interaction of conduct problems and depressed mood in relation to adolescent substance involvement and peer substance use. *Drug and Alcohol Dependence*, 96(3), 233–248.
- McHugh, M. L. (2013). The chi-square test of independence. *Biochemia Medica*, 23(2), 143–149. <https://doi.org/10.11613/bm.2013.018>
- Mojtabai, R., Olfson, M., & Han, B. (2016). National trends in the prevalence and treatment of depression in adolescents and young adults. *Pediatrics*. <https://doi.org/10.1542/peds.2016-1878>
- Molinaro, S., Benedetti, E., Scalese, M., Bastiani, L., Fortunato, L., Cerrai, S., Canale, N., Chomynova, P., Elekes, Z., & Feijão, F. (2018). Prevalence of youth gambling and potential influence of substance use and other risk factors throughout 33 european countries: First results from the 2015 espad study. *Addiction*, 113(10), 1862–1873.
- Muthén, L. K., & Muthén, B. O. (2017). *Mplus users guide* (8th ed.). Muthén & Muthén.
- Nower, L., Martins, S. S., Lin, K. H., & Blanco, C. (2013). Subtypes of disordered gamblers: Results from the national epidemiologic survey on alcohol and related conditions. *Addiction*, 108(4), 789–798.
- Rahman, A. S., Pilver, C. E., Desai, R. A., Steinberg, M. A., Rugle, L., Krishnan-Sarin, S., & Potenza, M. N. (2012). The relationship between age of gambling onset and adolescent problematic gambling severity. *Journal of Psychiatric Research*, 46(5), 675–683.
- Richard, J., Fletcher, E., Boutin, S., Derevensky, J., & Temcheff, C. (2020). Conduct problems and depressive symptoms in association with problem gambling and gaming: A systematic review. *Journal of Behavioral Addictions*, 9(3), 497–533. <https://doi.org/10.1556/2006.2020.00045>
- Richard, J., Temcheff, C., Fletcher, E., Lemieux, A., Derevensky, J., & Déry, M. (2022). Externalizing and internalizing trajectories to adolescent gambling: A longitudinal study. *International Gambling Studies*. <https://doi.org/10.1080/14459795.2022.2154378>
- Sideli, L., La Barbera, D., Montana, S., Sartorio, C. R., Seminerio, F., Corso, M., Giunta, S., Mannino, G., & La Cascia, C. (2018). Pathological gambling in adolescence: A narrative review. *Mediterranean Journal of Clinical Psychology*. <https://doi.org/10.6092/2282-1619/2018.6.1738>
- Traoré, I., Pica, L., Camirand, H., Cazale, L., Berthelot, M., Plante, N., & Courtemanche, R. (2015). *Enquête québécoise sur le tabac, l'alcool, la drogue et le jeu chez les élèves du secondaire, 2013: Évolution des comportements au cours des 15 dernières années*. Institut de la statistique du Québec.

- Veselka, L., Wijesingha, R., Leatherdale, S. T., Turner, N. E., & Elton-Marshall, T. (2018). Factors associated with social casino gaming among adolescents across game types. *BMC Public Health*, *18*(1), 1–15.
- Winters, K. C., Stinchfield, R. D., Botzet, A., & Anderson, N. (2002). A prospective study of youth gambling behaviors. *Psychology of Addictive Behaviors*, *16*(1), 3. <https://doi.org/10.1037//0893-164x.16.1.3>
- Yakovenko, I., & Hodgins, D. C. (2018). A scoping review of co-morbidity in individuals with disordered gambling. *International Gambling Studies*, *18*(1), 143–172.
- Zucker, R. A., Heitzeg, M. M., & Nigg, J. T. (2011). Parsing the undercontrol–disinhibition pathway to substance use disorders: A multilevel developmental problem. *Child Development Perspectives*, *5*(4), 248–255.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

Authors and Affiliations

Émilie Fletcher^{1,2}  · Jérémie Richard^{1,2} · Stéphanie Boutin^{3,4} · Annie Lemieux^{4,5} · Michèle Déry^{4,5} · Jeffrey Derevensky^{1,2} · Caroline Temcheff^{1,2,4,5} 

¹ Department of Educational and Counselling Psychology, McGill University, 3724 McTavish Street, Montreal, QC H3A 1Y2, Canada

² International Centre for Youth Gambling Problems and High-Risk Behaviors, McGill University, Montreal, QC, Canada

³ Département de Psychologie, Université du Québec à Montréal, Montreal, QC, Canada

⁴ Groupe de recherche et d'intervention sur les adaptations sociales de l'enfance (GRISE), Université de Sherbrooke, Sherbrooke, QC, Canada

⁵ Département de Psychoéducation, Université de Sherbrooke, Sherbrooke, QC, Canada