# Skin in the game – Erroneous beliefs and emotional involvement as correlates of athletes' sports betting behavior and problems

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**FULL-LENGTH REPORT**

## ABSTRACT

*Background and aims:* The sports betting market has been growing rapidly over the last years, as have reports of problematic gambling behavior associated with betting. Due to the well-documented gambling problems of famous athletes and the betting supportive nature of many sports-related environments, athletes have been highlighted as a potential group at-risk for problematic sports betting. However, there currently remains a lack of research on individual-level athlete-specific risk-factors or mechanisms that might contribute to the development and perpetuation of betting-related problems. Here, we examine the influence of two potential risk-factors on sports betting behavior and problems: erroneous beliefs and athletes' emotional involvement. *Methods:* 201 athletes with different levels of expertise completed a newly developed scale to assess both factors. Participants were sampled from the general German population, predominantly male (83.08%) and on average 29.52 (SD = 11.05) years old. We use principal components analysis to detect patterns of covariation, potentially due to the proposed underlying latent factors, and regression analyses to test associations of these factors with betting behavior and problems. *Results:* We find that athletes' emotional involvement was strongly associated with betting problems whereas erroneous beliefs were not. However, distorted cognitions/ beliefs were associated with higher volumes and more frequent betting activities. *Discussion and Conclusions:* This might contribute to betting problems in the long run. These results highlight athletes' emotional involvement and erroneous beliefs as potential targets for future intervention and prevention efforts.

Sports betting is an ever-growing business with rapidly increasing numbers of bettors and company turnover worldwide (Winters & Derevensky, 2019). Recent technological advances and the increasing incorporation of structural characteristics usually found in electronic gambling machines (Newall, Russell, & Hing, 2021) have even resulted in sports betting becoming the most prevalent form of online gambling worldwide (Statista, 2018). Accompanying these developments and expansive trend, more and more treatment seeking gamblers report sports betting as their principal gambling activity, which has seen sports betting develop into a major public health concern (Parke & Parke, 2019).

Simultaneously, several high-profile athletes from different sports – like former England international footballers Andros Townsend and Wayne Rooney, probably the best basketball player of all time, Michael Jordan (among having other gambling problems), and boxer Floyd "Money" Mayweather - have reportedly suffered from problematic sports betting. However, their struggles documented in mass media also point towards a potentially wider problem. Recent research has not only reported elevated levels of sports betting behavior but also betting related problems in athletes (e.g., Nowak, 2018; Ellenbogen, Jacobs, Derevensky, Gupta, & Paskus, 2008; Grall-Bronnec et al., 2016; Vinberg, Durbeej, & Rosendahl, 2020).

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Understanding sports betting behavior and problems through a socio-ecological framework of individual-, social network-, community- and societal-levels of influence (Wardle, Reith, Langham, & Rogers, 2019), athletes combine several important general risk factors as well as some factors specific to sports fandom. While overall, young adult males appear to be the most at-risk group (Russell, Hing, & Browne, 2019), research has also highlighted several specific risk factors for those with a strong interest in sports (i.e., athletes and fans). Highlighting individual-level psychosocial factors, feelings of added loyalty towards one's favorite team/player, competition among peers and the demonstration of knowledge as well as feelings of competence have been found as potential drivers of betting behavior (Gordon, Gurrieri, & Chapman, 2015). Perceived elements of skill could thus enhance one's subjective social standing/acceptance and ego (Raymen & Smith, 2020) but also increase excitement (Jenkinson, Lacy-Vawdon, & Carroll, 2018). Additionally, sports bettors have been found to increase their excitement by placing a bet on a game they are watching, because they simply "enjoy a punt" (Jenkinson et al., 2018). It has thus been argued that a strong interest in sports and some features of sports fandom (e.g., identifying with an athlete or team; game related excitement; domain specific knowledge about sports) might increase individual vulnerability to sports betting related problems (Deans, Thomas, Daube, & Derevensky, 2016; Lopez-Gonzalez, Estévez, & Griffiths, 2017).

While athletes might share most of these risk factors (i.e., they most certainly have an interest in the sport they are engaged in and potentially also admire athletes/teams representing world class), they have also been brought into focus as a potential high-risk group with specific distinguishable risk factors by different researchers (e.g., Derevensky et al., 2019; Grall-Bronnec et al., 2016; Weiss & Loubier, 2010). On an individual level, they have been hypothesized to be at an elevated risk for problematic betting due to a general tendency for taking risks and competing with others (Curry & Jiobu, 1995). While the perceived influence of sports specific knowledge on betting outcomes has been reported to be high in fans, too, athletes have additionally been reported to prefer allegedly skill-based forms of gambling (Weiss & Loubier, 2010). This preference has in turn been associated with strong gambling related cognitive distortions in general (Myrseth, Brunborg, & Eidem, 2010) and hints towards an even stronger influence of distorted cognitions in athletes (Derevensky et al., 2019). On an contextual level, research has highlighted the availability of betting venues (Curry & Jiobu, 1995) and more generally high levels of social acceptability of sports betting in athletic environments (for a review: Derevensky et al., 2019) as potentially contributing to the development and perpetuation of betting-related problems. These different factors emphasize the strong individual and contextual relationship between active sports participation and sports betting behavior – over and above the effects of fandom. In turn, this could lead to (former) athletes betting more on sports than fans (Winters & Derevensky, 2019), being more likely to bet on the sport they have played (Weiss & Loubier, 2010) and showing higher prevalence rates for betting-related problems (e.g., Ellenbogen et al., 2008; Grall-Bronnec et al., 2016; Nowak, 2018; Vinberg et al., 2020).

Summarizing these findings, two important clusters of individual-level psychosocial risk factors for sports betting related problems in athletes have been suggested to be distinguishable from more general risk factors (Russell et al., 2019) as well as potentially exceeding the influence of those specific to fans. Both could thus contribute to the development and perpetuation of betting related problems. Firstly, athletes' multilayered emotional involvement has been reported to be an important driver of sports betting. That is, fandom of players/teams, identification with one's sport and players/teams involved, involvement with peers as well as the excitement when watching sports in general is considered exerting an influence (Winters & Derevensky, 2019). Secondly, the perceived influence of domain specific knowledge has been reported to not only contribute to feelings of competency, but also drive actual betting behavior because of expected earnings and perceived higher chances of winning based on one's sports-specific knowledge (Derevensky et al., 2019). However, this perceived influence of knowledge has not only been shown to be false (Khazaal et al., 2012), but also represent the result of distorted cognitions and erroneous beliefs (Cantinotti, Ladouceur, & Jacques, 2004). On the one hand, higher knowledge is not related to a higher probability of winning – here, athletes fall for an illusion of control and overconfidence. On the other hand, athletes might overestimate their ability to predict match outcomes based on information on a team's past performances – this closely resembles the gambler's fallacy.

Likewise, cognitive distortions and erroneous beliefs have been shown to be important predictors of behavior and problems alike across different forms of gambling. They have been argued to play a key role in the development and perpetuation of gambling behavior and influence gambling severity. Medium and robust effect sizes have been reported for different cognitions and beliefs across different types of gambling (for a review: Goodie & Fortune, 2013). Typical distorted cognitions/erroneous beliefs can include different forms of gambling related expectancies, beliefs about predictive control, distorted reframing/interpretation of gambling outcomes, experience and attribution of near-misses and an illusion of control. Although these cognitions and beliefs are not considered diagnostic criteria, they have still been targeted by different interventions and in clinical treatment (Goodie & Fortune, 2013). However, no central process behind the different distortions and beliefs has been identified. Instead, a variety of distinguishable gambling type specific beliefs can be reported – some of them found more regularly and similar in their manifestations across several types of gambling (e.g. gambler's fallacy, cf. Kahneman & Tversky, 1972). In a recent review Goodie and Fortune (2013) accordingly argue that broader identification and assessment of specific beliefs related to each type of gambling can add value to clinical treatment and entry points for prevention (e.g., defining target groups at specific

risk). Regarding sports betting specific beliefs and cognitions, recent research suggests that established scales like the Gamblers' Beliefs Questionnaire (GBQ, Steenbergh, Meyers, May, & Whelan, 2002) might not be valid as the luck/perseverance and illusion of control-subscales were highly correlated ($r = 0.87$) instead of representing distinguishable latent constructs (Russell et al., 2019).

In spite of this growing evidence base for the importance of erroneous beliefs/distorted cognitions and emotional involvement in the development and perpetuation of sports betting problems on the one hand and elevated rates of problem gambling driven by facilitating sports-related environments (e.g., availability, social norms etc.) in athletes on the other hand, these two streams of research have yet to be connected. This is especially surprising considering the emphasis sport betting related advertisements have put on emotional involvement as well as potential monetary gains based on domain-specific knowledge (Lopez-Gonzalez, Guerrero-Solé, Estévez, & Griffiths, 2018).

## AIMS OF THE PRESENT RESEARCH

The present research thus aims to explore the influence of sports betting-specific cognitive distortions/erroneous beliefs and emotional involvement with sports on betting behavior and problems alike. Both factors are assumed to play a central role in the evaluation of athletes as a group at risk for sports betting related problems.

Specifically, we hypothesize that higher rates of emotional involvement and cognitive distortions/erroneous beliefs are associated with increased betting behavior (number of bets, amount spent; research question 1) as well as symptom experience during the past 12 months (status as problem gambler, number of symptoms, symptom occurrence; research question 2) in athletes.

## METHODS

### Overview

To test whether erroneous beliefs/cognitive distortions and emotional involvement are associated with betting related symptoms as well as behavioral outcomes (e.g. betting frequency, wagered amount) in athletes, we conducted a cross-sectional online study.

### Sampling

A total sample of 641 athletes or former athletes was recruited from the general population of North Rhine-Westphalia with a special focus of our advertisement efforts on the German Sport University Cologne, Germany, in late 2017. From the total sample, 201 athletes met all inclusion criteria. Inclusion criteria were as follows: Participants had to be at least 18 years old, be able to respond to the online questionnaire in German, have bet money on sports events during the last 12 months and report intermediate or higher levels of expertise in a given sport.

Participants had a mean age of 29.52 (SD = 11.05), were mostly male (83.08%) and reported high socio-economic status (33.83% had completed at least a bachelor's degree, 34.83% earning more than 2000 Euro per month). 47.26% of participants (had) competed on a regional level (intermediate expertise), 32.84% on a supra-regional level (higher expertise) and 11.94 % even on a national level (highest expertise, cf. Swann, Moran, & Piggott, 2015). 53.73% of participants mostly bet on games of their main type of sport. Participants were additionally asked to rate how often (0 = "never" to 100 = "very often") they had gambled at a casino (M = 7.12; SD = 16.16), an online casino (M = 8.65; SD = 21.89), a lottery (M = 17.23; SD = 29.40), using electronic gambling machines (M = 10.54; SD = 23.35), playing cards (M = 11.74; SD = 20.20) or playing other types of skill-games (M = 9.64; SD = 19.63) during the last 12 months.

### Measures

***Item development.*** To date, no scales exist to assess the specific influence of erroneous beliefs, cognitive distortions and emotional involvement on sports betting behavior. However, several scales have been developed and validated to accurately assess erroneous beliefs and cognitive distortions across many other different forms of gambling. Thus, we took several steps to develop new items for this study (the final item list in German and English can be found in the supplementary materials; for details on all other preliminary items, please contact the authors). First, we created a preliminary list of 33 items, loosely based on the widely used GBQ (Steenbergh et al., 2002) and the Gambling Cognitions Inventory (GCI; McInnes, Hodgins, & Holub, 2014). Here, we tried to not only incorporate both underlying factors of the GBQ (luck/perseverance, illusion of control) and the skill/attitude factor of the GCI, biased memory processes (Items 7 and 8), but to explicitly highlight the assumption of the importance of domain specific knowledge within these statements. We also included items addressing the framing of near-misses (Items 9 and 10) as well as the vast amount of options and ways to customize bets (Items 2, 6 and 18), as these might also contribute to the illusion of control – especially when connected to assumed domain knowledge. To additionally address the potential key role of emotional involvement in shaping sports betting behavior, we added domain specific statements (e.g., "Betting on my team even increases my hopes and fears!").

We then asked two expert practitioners working with treatment seeking sports bettors in Cologne, Germany, to provide feedback and help reduce any redundancies. This process resulted in the 18-item list we provided participants with (all German and English item wordings can be found in the Supplementary Materials). All items were worded as statements and participants rated their agreement on a

visual analog scale ranging from "not at all" (0) to "absolutely" (100; numeric values were not presented).

***Outcome variables.*** Bets per week and monthly expenses on sports betting were assessed as behavioral outcomes. We asked participants how many bets on sports they had placed per week on average during the last 12 months, with options on an 8-point scale ranging from "never" to "30 or more". Additionally, participants were asked to specify how much money they had spent on average per month during the last 12 months. Here, participants replied to an open question with only numerical values accepted. It's important to note here, that participants were explicitly asked to only include money they had directly invested and exclude all respent winnings or prizes. In addition to these self-reported behavioral outcomes, we assessed the number of DSM-V criteria (gambling disorder), occurrence of at least one DSM-V criterion as well as experiencing more than three DSM-V criteria (cut-off value for problematic/pathological gambling) during the last 12 months. To assess these nine criteria, we rephrased the original German DSM-V items and instead asked regarding their sports betting e.g., "Thinking about the last 12 months, have you felt the need to increase the amounts of money in order to achieve the desired excitement?" with participants stating "yes", "no" or "I don't know". This approach is in line with recent research and enables us to use the same cut-off values for problematic and pathological gambling used in other studies and the DSM-V (although the DSM-V additionally allows to specify current severity as "mild", "moderate", "severe"). Additionally, Goodie and Fortune (2013) in a recent review suggested to not only use screening instruments for gambling problems like the South Oaks Gambling Screen (SOGS, Lesieur & Blume, 1987) but to rely on diagnostic criteria instead. This approach offers several benefits as for example a higher degree of classification accuracy (Lakey, Goodie, Lance, Stinchfield, & Winters, 2007) – which could be especially important when generalizing findings to potential intervention or treatment groups.

## Analysis

We used principal components analysis (PCA) to detect patterns of covariation between different items which might be due to underlying latent factors, e.g., erroneous thoughts/cognitive distortions and emotional involvement (Table 1).

We then used the composite score for each scale as predictors of problematic/pathological gambling, occurrence of at least one diagnostic criterion during the last 12 months (logistic regression respectively), number of criteria experienced during the last 12 months, average bets placed per week during last 12 months and average money spent per month (linear regression respectively). Each criterion was predicted in a separate model and we corrected for multiple testing (Bonferroni) with a resulting $\alpha$ of 0.01. We used the same dataset for the PCA as well as the prediction of gambling problems and behavior.

All analyses were conducted using R (Version 3.6.1; R Core Team, 2018) and the R-package *psych* (Version 1.8.10; Revelle, 2018).

*Table 1.* Summary of principal components analysis with oblimin rotation for 18 items (N = 201)

| Item | Pattern matrix | | Structure matrix | | |
|---|---|---|---|---|---|
| | Cognitive component | Involvement component | Cognitive component | Involvement component | Communalities |
| *Item 1* | *0.47* | *0.43* | *0.64* | *0.62* | *0.57* |
| Item 2 | 0.80 | | 0.79 | 0.29 | 0.63 |
| *Item 3* | *0.50* | *0.30* | *0.62* | *0.49* | *0.45* |
| Item 4 | 0.67 | 0.22 | 0.76 | 0.48 | 0.61 |
| Item 5 | 0.64 | 0.20 | 0.72 | 0.45 | 0.55 |
| Item 6 | 0.71 | | 0.72 | 0.31 | 0.52 |
| Item 7 | 0.63 | | 0.57 | | 0.34 |
| Item 8 | 0.55 | | 0.57 | 0.28 | 0.33 |
| *Item 9* | *0.45* | *0.31* | *0.57* | *0.48* | *0.41* |
| *Item 10* | *0.42* | *0.31* | *0.54* | *0.48* | *0.38* |
| Item 11 | 0.57 | | 0.64 | 0.41 | 0.44 |
| Item 12 | 0.82 | | 0.84 | 0.37 | 0.71 |
| Item 13 | | 0.58 | 0.41 | 0.65 | 0.46 |
| Item 14 | 0.20 | 0.69 | 0.47 | 0.77 | 0.62 |
| Item 15 | | 0.81 | 0.24 | 0.78 | 0.62 |
| Item 16 | | 0.70 | | 0.63 | 0.42 |
| Item 17 | 0.29 | 0.53 | 0.50 | 0.64 | 0.49 |
| Item 18 | 0.88 | −0.29 | 0.77 | | 0.66 |
| Eigenvalue | 7.47 | 1.74 | | | |
| % of variance | 32.78 | 18.42 | | | |

*Note*: N = 201. Participants responded to the items on visual analog scales ranging from "*not at all*" (0) to "*absolutely*" (100; numeric values were not presented). Factor loadings < 0.2 are suppressed. Italic depicts items not retained in the reduced scales.
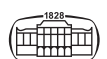
## Ethics

The current study was approved by the Ethics board of the German Sport University Cologne (February 2016) in compliance with the principles of the Declaration of Helsinki 1975 as a part of a proposal for the "Aktionsplan gegen Sucht" (Action plan against addiction) by the Ministry for Health, Equalities, Care and Ageing of the State of North Rhine-Westphalia, Germany.

## RESULTS

### Principal components analysis

A principal components analysis (PCA) with oblique rotation ("oblimin") was conducted on the 18 pre-selected items (as described in the methods section). The Kaiser-Meyer-Olkin (KMO) measure supported sampling adequacy (KMO = 0.90) with all KMO values for the individual items above 0.72. Between item correlations sufficiently large enough for PCA were indicated by the results of Barlett's test of sphericity, $\chi 2$ (153) = 1770.49, $P < 0.001$. To determine how many components to extract that account for more variance than is expected by chance (based on multiple sets of random data), we used parallel analysis. As Fig. 1 depicts, the scree-plot was rather ambiguous and the eigenvalue of the potential third component falls slightly below the average value for the corresponding components in the random data sets and should thus be excluded. Thus, we also explored a three-component solution (oblique rotation) but

as the third component only consisted of two items and rendered interpreting the pattern matrix difficult, we settled for the suggested two-component solution. As no a priori theoretical reasoning suggested both factors to not be correlated, we then used oblique rotation that resulted in a more interpretable solution. Based on the resulting pattern matrix, we selected items that strongly resembled simple structure by meeting the following criteria: a) loading of above 0.45 on one component and b) lesser cross-loadings than 0.30 on the other component (see e.g. Brown, 2015). A second principal component analysis, conducted on this reduced set of items, revealed that the two-component solution accounted for 54.17% of the variance (component 1: 35.00%, component 2: 19.17%).

Component 1 consisted of nine items aiming to capture erroneous beliefs and cognitive distortions and was thus labeled "cognitive component". Component 2 consisted of five items aiming to capture different aspects of emotional involvement and was thus labeled "involvement component". While component 1 indicated nearly excellent internal consistency ($\alpha = 0.89$), component 2 yielded at least acceptable levels ($\alpha = 0.76$). However, this might be due to the lower number of items forming component 2.

### Composite scores

We created composite scores for both components by taking the mean of all item-values per participant. We did not include weighting for each item (DiStefano, Zhu, & Mindrila, 2009). Both composite score-distributions resemble a normal distribution, with "involvement"-scores slightly left-
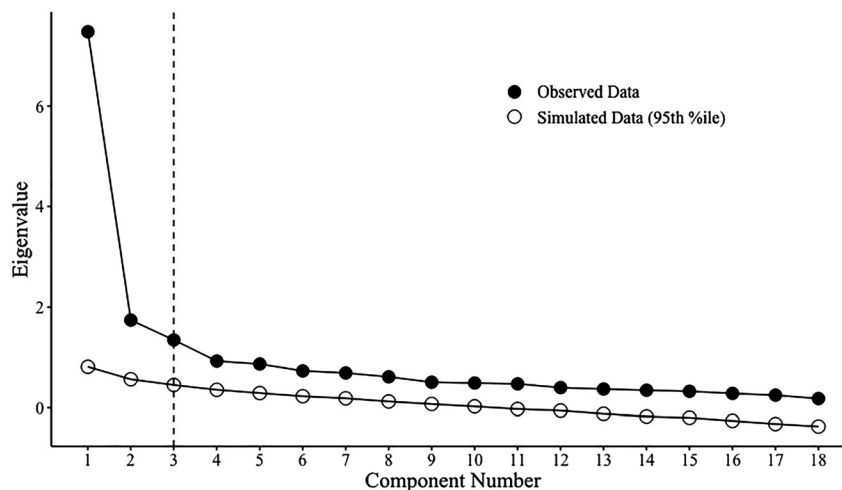


Fig. 1. Scree plot with vertical line depicting suggested maximum number of components. To create this plot, we adapted R-code provided by (Sakaluk & Short, 2017)

Table 2. Descriptive statistics for the reduced two-factor solution ("cognitive component", "involvement component"; N = 201)

| Factor | No. of items | M (SD) | Skewness | Kurtosis | Cronbach's $\alpha$ |
|---|---|---|---|---|---|
| Cognitive Comp. | 9 | 39.87 (23.57) | 0.19 | −0.76 | 0.89 |
| Involvement Comp. | 5 | 48.31 (21.84) | −0.28 | −0.48 | 0.76 |

Note: M and SD represent mean and standard deviation, respectively.

and "cognitive"-scores slightly right-skewed (Table 2; additional visualizations can be found in the supplements).

## Predicting gambling behavior

Addressing research question 1, we had hypothesized that participants' betting behavior was associated with their erroneous beliefs/cognitive distortions and their emotional involvement. However, only participants' erroneous beliefs/cognitive distortions were significantly associated with the number of bets per week (with emotional evolvement not significant due to Bonferroni correcting) and average

*Table 3.* Summary of logistic regression models: Parameter estimates, standard errors, odds ratios with confidence intervals of each covariate

| Predictor | Parameter Estimate (SE) | Odds Ratio (95% CI) |
|---|---|---|
| Model 1: | | |
| **Intercept** | **−5.107*** (0.830)** | |
| Cognitive Comp. | 0.019 (0.011) | 1.02 (0.99, 1.04) |
| **Involvement Comp.** | **0.047*** (0.014)** | **1.05 (1.02, 1.08)** |
| Model 2: | | |
| **Intercept** | **−2.566*** (0.474)** | |
| **Cognitive Comp.** | **0.021** (0.008)** | **1.02 (1.01, 1.04)** |
| **Involvement Comp.** | **0.027** (0.009)** | **1.03 (1.01, 1.05)** |

*Note:* Model 1: Logistic regression model predicting problem gambling (DSM-V); Model 2: Logistic regression model predicting symptom (DSM-V) occurrence during past 12 months.
* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, bold: $P < 0.05$.

monthly expenses. While a one-point higher cognition-scale value was associated with on average 0.03 more bets per week, it was also associated with spending 6.68 Euros more per week on average.

## Predicting gambling problems

Addressing research question 2, we had hypothesized that participants dichotomized status as non-problem or problem/pathological gamblers was associated with their erroneous beliefs/cognitive distortions and their emotional involvement. Tables 3 and 4 show that only participants emotional involvement was significantly associated with problem/pathological gambling ($\beta = 0.05$, $P < 0.01$, OR = 1.05) and the number of criteria experienced ($\beta = 0.04$, $P < 0.01$). However, when looking at experience of any criterion during the past 12 months, we find that erroneous beliefs/cognitive distortions as well as emotional involvement both are significantly associated (Table 3). The stronger effect emotional involvement exerts on gambling problems becomes even more apparent when taking the concurrent effect sizes into account.

## DISCUSSION

The present research aimed to explore the influence of sports betting-specific cognitive distortions/erroneous beliefs and emotional involvement on sports betting behavior (number of bets, amount spent) and problems (status as problem gambler, number of symptoms, symptom occurrence) alike.

*Table 4.* Summary of linear regression models: Parameter estimates, confidence intervals and fit statistics

| Predictor | b | b 95% CI (LL, UL) | beta | beta 95% CI (LL, UL) | Fit |
|---|---|---|---|---|---|
| Model 1: | | | | | |
| **Intercept** | **−1.045**** | **(−1.77, −0.32)** | | | |
| Cognitive Comp. | 0.016* | (0.00, 0.03) | 0.164 | (0.02, 0.31) | |
| **Involvement Comp.** | **0.037****** | **(0.02, 0.05)** | **0.350** | **(0.20, 0.50)** | |
| | | | | | $R^2 = 0.211$** |
| | | | | | 95% CI (0.11, 0.30) |
| Model 2: | | | | | |
| Intercept | 0.653 | (−0.37, 1.68) | | | |
| **Cognitive Comp.** | **0.031**** | **(0.01, 0.05)** | **0.231** | **(0.08, 0.39)** | |
| Involvement Comp. | 0.029* | (0.01, 0.05) | 0.203 | (0.05, 0.36) | |
| | | | | | $R^2 = 0.145$** |
| | | | | | 95% CI (0.06, 0.23) |
| Model 3: | | | | | |
| Intercept | −101.081 | (−270.48, 68.32) | | | |
| **Cognitive Comp.** | **6.683**** | **(3.28, 10.09)** | **0.311** | **(0.15, 0.47)** | |
| Involvement Comp. | 0.509 | (−3.17, 4.18) | 0.022 | (−0.14, 0.18) | |
| | | | | | $R^2 = 0.104$** |
| | | | | | 95% CI (0.03, 0.18) |

*Note:* Model 1: linear regression model predicting number of symptoms (DSM-V) during past 12 months; Model 2: linear regression model predicting average number of bets per week; Model 3: linear regression model predicting average monthly expenses on sports betting during past 12 months. A significant *b*-weight indicates the beta-weight is also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.
* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, bold: $P < 0.05$.
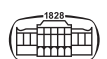
In general, athlete participants reported high levels of emotional involvement when connecting betting and sports. On an item-level, the increased excitement is less connected to the act of betting itself (e.g., Items 13 and 17) than to the event connected with the bet (i.e., betting on live events, betting on one's favorite team/player). This is in line with previous research on non-athletes highlighting team/player-loyalty (Gordon et al., 2015) and watching games live (Jenkinson et al., 2018) as important factors driving betting-related excitement. In support of our first hypothesis, these higher rates of emotional involvement were associated with sports betting related problems. Specifically, stronger involvement was associated with problem gambling, the experience of any DSM-V criteria during the last 12 months as well as the number of experienced criteria. These findings expand on previous research that had characterized emotional involvement as typical for sports bettors (Gordon et al., 2015; Jenkinson et al., 2018; Raymen & Smith, 2020) but not yet relevant for psychopathology. Here, we not only show associations with status as problem gambler and symptom experience in general, but rather a linear association of criteria experienced and strength of emotional involvement. Comparing these findings with other recent research on sports betting-specific risk factors in non-athlete samples (e.g. Russell et al., 2019, finding no significant associations in multivariate models), this might indicate first evidence for athletes as a group at risk: Russell et al. (2019) reported that while the expected excitement as well as sports involvement were associated with gambling problems in bivariate models, they were not when included in a multivariate (and additional penalized) model. This difference between the two groups points towards emotional involvement as a potential entry point for future interventions and treatment when targeting athletes.

As gambling problems and gambling behaviors have been reported to be only moderately correlated ($r$ between 0.34 and 0.61; Cowie et al., 2017), examining just one of both does not paint the full picture. Interestingly, in the present study athletes' emotional involvement was not associated with betting behavior outcomes. This might be due to the strong similarities several of the items of the involvement component show with the DSM-V criteria. While these criteria only implicitly integrate concrete gambling behavior, they put a more explicit focus on regulatory and affective aspects – both are strongly represented in our scale, too.

Athlete participants not only report high levels of emotional involvement, but also high levels of sports betting related erroneous beliefs and cognitive distortions. On an item-level, we found strong support for the various beliefs and distortions we presented. While we find less support for customization options contributing to perceived control over the outcome, we find stronger support for the assumed importance of domain specific knowledge. Additionally, participants viewed sports betting outcomes as less random than gambling outcomes and reported potentially distorted memory processes (Items 7 and 8). In support of our second hypothesis, these stronger

erroneous beliefs/cognitive distortions were associated with more bets per week as well as higher monthly expenses. This is in line with research across different forms of gambling (Cowie et al., 2017) and expands these to the specific sports betting context. Cowie et al. (2017) however report an important distinction: While Luck/Chance-related distortions were associated with gambling behavior as well as problems, Skill/Attitude-related distortions were only associated with gambling behavior. The authors interpret these findings as in line with research suggesting games of skill to bring about persistent behavior (Dickerson, 1993), hypothesizing that higher perceived control over the game could result in higher perceived control of one's gambling and thus more gambling behavior. Following this line of thought, we hypothesize that this perceived control over one's gambling could also result in less reported problem gambling. Interestingly, in the present research erroneous beliefs/cognitive distortions were neither associated with problem gambling nor the experience of any DSM-V criteria during the last 12 months or the number of experienced criteria. While this is in stark contrast to recent efforts by Russell et al. (2019) who reported not-sports specific beliefs/distortions (assessed with the GBQ) to be associated with sports betting problems – even in a penalized multivariate model including a diverse set of predictors – it might be interpreted as supporting the position highlighted before (Cowie et al., 2017).

To summarize these findings, we show that specifically assessing sports betting related cognitions and beliefs could add value to the understanding of related problems (and behavior, as key aspect of the continuous and manifold underlying process) and their development in athletes. Here, the present research expands on previous efforts reporting sports betting specific risk factors in non-athlete samples (Russell et al., 2019), efforts on athlete-specific risk factors (e.g., Derevensky et al., 2019; Grall-Bronnec et al., 2016; Weiss & Loubier, 2010) as well as work on different types of cognitive distortions and their influence on gambling problems and behavior (Cowie et al., 2017). By specifically targeting these cognitions and beliefs as well as athletes' emotional involvement, this approach might add entry points for clinical treatment as well as prevention efforts and policy decisions.

## Limitations

However, the present research has some limitations. Looking only at athletes without comparing them to non-athletes, our findings can only serve as a first hint towards declaring athletes as a group at risk because of their emotional involvement and distorted cognitions/erroneous beliefs. Future research should address these questions, especially in the light of current advertising practices (Lopez-Gonzalez et al., 2018). To classify participants as problematic/pathological gamblers, we used DSM-V criteria. However, it has been argued that these criteria might be a better fit in clinical samples and additionally lack the continuous scale of

problem severity the Problem Gambling Severity Index offers (Currie, Hodgins, & Casey, 2013). From a methodological standpoint, several limitations should be highlighted. Survey-based research mostly relies on self-report, thus, behavioral outcomes are potentially biased. Additionally, we created new scales to assess emotional involvement and cognitive distortions/erroneous beliefs. Although they are associated with the focal outcomes and results are in line with existing research, both sub-scales are in need of additional validation and generalizable information on their psychometric properties. Additionally, some of the items (e.g., Item 2) could be rephrased and more closely aligned with conceptions of distorted cognitions – this would lend additional validity to all following claims. The preliminary nature of both scales is further based on the rather small sample size. Although more than ten participants per item included in the PCA completed the survey, a larger and more diverse sample could substantiate generalization of findings. Although young males with higher education have been repeatedly reported as risk group, also including more non-male athletes and participants from lower SES groups should benefit the course. This also means, that the findings reported above can in no way be generalized across genders. Especially in light of mixed results on female athletes' gambling behavior and problems (Nelson et al., 2007; Vinberg et al., 2020) we caution against any undue generalization.

## Implications

In spite of these limitations, the present research also shows some potential. We find that both subscales help to expand on previous findings as they are associated with betting related problems as well as behavior in athletes. This is especially relevant in the light of recent findings suggesting that established general gambling related cognitive distortion scales like the GBQ might not be valid in the context of sports betting (Russell et al., 2019) and more general requests to identify specific beliefs/cognitions related to each type of gambling (Goodie & Fortune, 2013). Accordingly, we adopted a sports betting specific perspective, highlighting specific entry points for future treatment as well as prevention efforts and policy decisions.

## SUPPLEMENTARY MATERIAL

Supplementary data to this article can be found online at https://doi.org/10.1556/2006.2021.00034.

All data and analysis scripts that support the findings of this study will be made available upon publication at https://osf.io/rns7g/

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