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Perfectionism Predicts Injury in Junior Athletes:
Preliminary Evidence from a Prospective Study

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Abstract

According to the stress-injury model (Williams & Andersen, 1998), personality factors predisposing athletes to elevated levels of stress may increase the risk of injury. As perfectionism has been associated with chronic stress, it may be one such personality factor. So far, however, no study has investigated the relationships between perfectionism and injury utilising a prospective design. Therefore, the present study examined perfectionistic strivings, perfectionistic concerns, and injury in 80 junior athletes from team and individual sports (mean age 17.1 years, range 16-19 years) over 10 months of active training. The results of logistic regression analyses showed that perfectionism positively predicted injury, but only perfectionistic concerns emerged as a significant positive predictor. The likelihood of sustaining an injury was increased by over 2 times for each 1 *SD* increase in perfectionistic concerns. The findings suggest that perfectionistic concerns may be a possible factor predisposing athletes to an increased risk of injury.

Keywords: perfectionistic strivings, perfectionistic concerns, injury, junior athletes, longitudinal study

Introduction

Injury is a serious negative outcome that can occur as the result of participation in sport (Ekstrand, Hägglund, & Waldén, 2011). Injury has a number of cognitive, affective, behavioural, and financial implications for athletes (e.g., Hagger, Chatzisarantis, Griffin, & Thatcher, 2005; Hallén, & Ekstrand, 2014; Wiese-Bjornstal, 2010). As such, sport scientists have sought to identify factors that may predispose athletes to an increased risk of injury with a view to reducing this risk (see Bahr & Krosshaug, 2005). Whereas extensive research exists on physiological, nutritional, and biomechanical factors, few studies have examined the role of personality factors (see Forsdyke, Smith, Jones, & Gledhill, 2016). The extant research, however, suggests that personality factors are important (see Ivarsson et al., in press, for a review). One personality factor that scholars have suggested may play an important role in injury is perfectionism (e.g., Williams & Andersen, 1998). This assertion is supported by previous retrospective research in gymnasts and dancers that has shown perfectionism to be related to injury (Krasnow, Mainwaring, & Kerr, 1999). However, no study has yet investigated the relationship between perfectionism and injury in athletes employing a prospective design. Therefore, the aim of the present study was to provide a first prospective investigation of multidimensional perfectionism and injury in junior athletes.

Perfectionism

Perfectionism is a personality disposition characterised by striving for flawlessness and setting exceedingly high standards of performance accompanied by tendencies for overly critical evaluations of one's behaviour (Flett & Hewitt, 2002). However, perfectionism has various aspects, and there are different dimensions of perfectionism with different characteristics. Therefore, perfectionism is best conceptualized as a multidimensional disposition (Frost, Marten, Lahart, & Rosenblate, 1990; Hewitt & Flett, 1991; see Enns & Cox, 2002, for a review).

According to the two-factor model of perfectionism (Stoeber & Otto, 2006), two higher-order dimensions should be differentiated: *perfectionistic strivings* which capture perfectionist personal standards and a self-oriented striving for perfection and *perfectionistic concerns* which capture concern over mistakes, feelings of discrepancy between one's standards and performance, and negative reactions to imperfection (see Stoeber & Otto, 2006, for a review).

Differentiating perfectionistic strivings and perfectionistic concerns is important when investigating perfectionism in sport because the two dimensions show different, often opposite, patterns of relationships with psychological processes and outcomes. Perfectionistic concerns are consistently associated with negative processes and outcomes (e.g., maladaptive coping, negative affect), whereas perfectionistic strivings are often associated with positive processes and outcomes (e.g., adaptive coping, positive affect) or inversely with negative processes and outcomes. The latter is particularly evident when the overlap between perfectionistic strivings and perfectionistic concerns is controlled for and perfectionistic strivings' unique relationships are examined (Gotwals, Stoeber, Dunn, & Stoll, 2012; Stoeber, 2011). Controlling for the overlap between the two dimensions is also important for perfectionistic concerns because the associations with negative processes and outcomes emerge more clearly when the overlap with perfectionistic strivings is controlled (Stoeber & Gaudreau, 2017).

Perfectionism and Injury

Injuries occur in all sports and at all levels. Research suggests that junior athletes may be particularly at risk (e.g., Frisch, Croisier, Urhausen, Seil, & Theisen, 2009; Renshaw & Goodwin, 2016). Importantly, there is increasing evidence highlighting the importance of psychological factors in contributing to the risk of injury in junior athletes (e.g., Ivarsson, Johnson, Andersen, Fallby, & Altemyr, 2015; Steffen, Pensgaard, & Bahr, 2009; Wadey, Evans, Hanton, & Neil, 2012).

According to Williams and Andersen's (1998) stress-injury model, personality factors that exacerbate the stress response (cause individuals to appraise a situation as more stressful) can cause greater physiological activation and attentional disruptions for the athlete increasing the likelihood of injury. Thus, the severity of the resulting stress response provides the mechanism for the associated injury risk. The stress-injury model has received empirical support from studies investigating personality factors and injury. For example, a recent meta-analysis provided evidence for a relationship between stress and injury ($\beta = .27$) and for a relationship between personality and stress ($\beta = .14$; Ivarsson et al., in press). Furthermore, the diathesis-stress model of perfectionism (Hewitt & Flett, 1993, 2002) posits that perfectionism is a vulnerability factor putting people at risk of chronic stress. Moreover, athletes high in perfectionistic concerns may be at an even higher risk of stress (Flett & Hewitt, 2005). As such, perfectionistic concerns may be related to injury risk via stress. Further evidence for a theoretical and empirical link between perfectionism and injury comes from research on training distress (a proxy of overtraining syndrome). First, there are research findings suggesting that training distress increases the risk of injury (e.g., Foster, 1998). Second, there are findings suggesting that athletes high in perfectionistic concerns train harder and for longer than athletes low in perfectionistic concerns (Madigan, Stoeber, & Passfield, 2017). Consequently, perfectionistic concerns can be expected to be related to injury risk via stress and training distress as shown in our theoretical model (Figure 1). According to this model, perfectionism could be a personality factor predisposing athletes to injury.

So far, however, only one study has investigated this possibility. Using a retrospective design, Krasnow et al. (1999) examined gymnasts and dancers, and found a significant positive correlation between concern over mistakes (a key indicator of perfectionistic concerns) and the number of self-reported injuries. Retrospective designs, however, have a number of limitations.

In particular, it is difficult to establish a temporal (or causal) link between variables. Moreover, retrospective self-reports can be affected by recall bias (Euser, Zoccali, Jager, & Dekker, 2009).

A prospective approach can overcome the limitations of retrospective designs. Support for the utility of a prospective approach in research on perfectionism and injury comes from the dance domain. Liederbach and Compagno (2001), investigating dancers over a two-year period, found that levels of perfectionism were higher in injured than non-injured dancers. However, this study conceptualized perfectionism as a one-dimensional disposition (measured with the Eating Disorder Inventory-2; Garner, 1991). Consequently, it is unclear which dimensions of perfectionism—perfectionistic strivings, perfectionistic concerns, or both—were responsible for this relationship (cf. Sherry, Hewitt, Besser, McGee, & Flett, 2004). Moreover, although the study by Liederbach and Compagno (2001) provides prospective evidence for the role of perfectionism in injury, it is unclear whether the findings of a study on dancers would generalize to athletic populations who likely experience different stressors relating to the exertion of training and competing (Hanton, Fletcher, & Coughlan, 2005).

The Present Study

Against this background, the aim of the present study was to provide a first prospective investigation of the relationships between multidimensional perfectionism and injury in junior athletes over a 10-month period of active training. Based on the combination of two theoretical models—the stress-injury model (Williams & Andersen, 1998) and the diathesis-stress model of perfectionism (Hewitt & Flett, 1993, 2002)—and empirical findings linking perfectionistic concerns to training distress (Madigan et al., 2017) and perfectionism to retrospectively reported injury (Krasnow et al., 1999), we expected that perfectionistic concerns would be a positive predictor of injury (cf. Figure 1). In contrast, we had no clear expectations for perfectionistic strivings. Whereas the diathesis-stress model of perfectionism posits that perfectionistic strivings

are associated with stress, the majority of studies investigating perfectionism and stress found only perfectionistic concerns to predict stress, but not perfectionistic strivings (e.g., Prud'homme et al., 2017). Likewise, Madigan et al.'s (2017) study found only perfectionistic concerns to predict training distress, not perfectionistic strivings. Still, our analyses included perfectionistic strivings to give a comprehensive account of perfectionism and examine the unique effects of perfectionistic concerns (Stoeber & Gaudreau, 2017).

Method

Participants

A sample of 80 junior athletes (65 male, 15 female) was recruited at a sports academy to participate in the present study. As part of the United Kingdom's further education system, sports academies aim to recruit and develop promising junior athletes. Academy athletes are provided with a professional coaching environment while they study alongside their sporting commitments. They are selected based on their ability by taking part in competitive performance in trials to enter the academy and regularly compete at a regional, national, or international level. Participants' mean age was 17.1 years ($SD = 0.6$; range = 16-19 years). Participants were involved in a range of sports (25 in soccer, 19 in basketball, 18 in athletics, 13 in rugby, and 5 in other sports [e.g., cricket, swimming]) and trained on average 10.3 hours per week ($SD = 4.9$).

Procedure

A university ethics committee approved the study. Informed consent was obtained from all participants. In addition, parental consent was obtained from participants below the age of 18 years. Questionnaires were distributed during training in the presence of the first author. A trained physiotherapist (the fourth author) recorded all injury data entering into a computer database the date of the injury occurrence as well as the type of injury. Participants were administered questionnaires in September (2015) and injury was recorded for a period of 10

months (until May 2016). During this period, all participants were in regular seasonal training and competition. We chose this period to allow us to capture an entire season for as many athletes as possible.

Measures

Perfectionism. To measure perfectionism, we followed a multi-measure approach (Stoeber & Madigan, 2016) and used four subscales from two multidimensional measures of perfectionism in sport: the Sport Multidimensional Perfectionism Scale (SMPS; Dunn et al., 2006) and the Multidimensional Inventory of Perfectionism in Sport (MIPS; Stoeber, Otto, Pescheck, Becker, & Stoll, 2007). To measure perfectionistic strivings, we used two indicators: the 7-item SMPS subscale capturing personal standards (e.g. “I have extremely high goals for myself in my sport”) and the 5-item MIPS subscale capturing striving for perfection (“I strive to be as perfect as possible”), and then standardised the scale scores before combining them to measure perfectionistic strivings (cf. Madigan, Stoeber, & Passfield, 2015). To measure perfectionistic concerns, we also used two indicators, the 8-item SMPS subscale capturing concern over mistakes (“People will probably think less of me if I make mistakes in competition”) and the 5-item MIPS subscale capturing negative reactions to imperfection (“I feel extremely stressed if everything does not go perfectly”), and again standardised the scale scores before combining them to measure perfectionistic concerns. The four subscales have demonstrated reliability and validity in previous studies (e.g., Madigan, 2016; Stoeber, Stoll, Salmi, & Tiikkaja, 2009). Moreover, both are reliable and valid indicators of perfectionistic strivings and perfectionistic concerns (e.g., Gotwals et al., 2012; Stoeber & Madigan, 2016). Participants were asked to indicate to what degree each statement characterised their attitudes in their sport responding on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*).

Injury. Following recommendations by Clarsen and Bahr (2014), we chose to define

injury specifically for the present study's context and population. As such, an athlete was defined as injured if the athlete required medical treatment and missed at least one training session or competition (see Ivarsson, Johnson, & Podlog, 2013). Of the 80 athletes, 38 experienced no injury, 24 one injury, 14 two injuries, and 4 three injuries over the course of the study. Of these injuries, 52 were traumatic and 12 were non-traumatic. For the present study, because we were interested in determining whether perfectionism predicted injury, we treated injury as a dichotomous variable (i.e., injured: 1 = yes, 0 = no; e.g., Hegedus et al., 2016; see also Devantier, 2011).¹

Data Screening

First, we inspected the data for missing values. Because very few item responses were missing ($i = 11$), missing responses were replaced with the mean of the item responses of the corresponding scale (ipsatised item replacement; Graham, Cumsille, & Elek-Fisk, 2003). Next we computed Cronbach's alphas for our variables which were all satisfactory (see Table 1). Following recommendations by Tabachnick and Fidell (2007), data were screened for multivariate outliers. No participant showed a Mahalanobis distance larger than the critical value of $\chi^2(3) = 16.27, p < .001$.

Results

Descriptive Statistics and Correlations

First, we inspected the bivariate correlations between all variables (see Table 1). As in previous research (e.g., Madigan et al., 2017), the dimensions of perfectionism showed a large

¹Additional analyses showed that results were the same when the number of injuries was used in the correlation and regression analyses.

significant positive correlation with each other.² Furthermore, perfectionistic concerns showed a significant positive correlation with injury that approached medium size, but perfectionistic strivings did not (showing a small nonsignificant positive correlation). Next, we computed partial correlations to control for the overlap between perfectionistic strivings and concerns and examine the two dimensions' unique relationships with injury (cf. Stoeber & Gaudreau, 2017). Results showed that perfectionistic concerns continued to show a significant positive correlation approaching medium size with injury when perfectionistic strivings were controlled, whereas the correlation between perfectionistic strivings and injury was reduced near zero (see again Table 1).

Logistic Regression Analyses

Finally, we conducted a logistic regression analysis (Pampel, 2000) to examine how perfectionism predicted the likelihood of becoming injured over the 10 months of the study. For this, we entered perfectionistic strivings and perfectionistic concerns simultaneously into the regression (see Table 2). Results showed that the model explained 11% of the variance in injury. As expected, perfectionistic concerns significantly predicted injury, whereas residual perfectionistic strivings did not. Moreover, the analysis suggested that the likelihood (odds ratio) of sustaining an injury was increased by over 2 times for each 1 *SD* increase in perfectionistic concerns, whereas perfectionistic strivings played no role in the perfectionism–injury relationship (see again Table 2).

Discussion

²Following Cohen (1992), correlations with absolute values of .10, .30, and .50 are regarded as small, medium-sized, and large.

The aim of the present study was to investigate the relationships between perfectionism and injury in junior athletes, differentiating perfectionistic strivings and perfectionistic concerns. Providing the first prospective investigation of these relationships, we found that perfectionism positively predicted injury, but only perfectionistic concerns emerged as a significant positive predictor. As to the size of this effect, the findings suggest that the likelihood of sustaining an injury was increased by over 2 times for each 1 *SD* increase in perfectionistic concerns.

This is the first study to show that perfectionism predicts injury in athletes over time. These findings are supported by those of previous research employing a retrospective design (Krasnow et al., 1999). The use of a prospective design in the present study, however, eliminates response bias and allows the elucidation of temporal precedence (Euser et al., 2009). As such, the present study provides stronger evidence for the role of perfectionism in injury. Furthermore, the findings reiterate the importance of personality variables in injury risk (see Ivarsson et al., in press).

The present study suggests perfectionism may be a factor predisposing athletes to injury. However, only perfectionistic concerns emerged as a significant predictor. This dovetails with previous research in sport that suggests the concerns dimension of perfectionism is associated with outcomes that are considered maladaptive (see Jowett, Mallinson, & Hill, 2016). Whereas the bivariate correlations showed that perfectionistic strivings had a small positive relationship with injury, the relationship was nonsignificant. More importantly, once the significant overlap with perfectionistic concerns was statistically controlled ($r = .60$), perfectionistic strivings then showed a negative near-zero relationship with injury. This is in contrast to the findings for perfectionistic concerns, as the positive relationship with injury held for perfectionistic concerns and residual perfectionistic concerns (i.e., when the overlap with perfectionistic strivings was controlled; Stoeber & Gaudreau, 2017). In addition, the present findings corroborate previous

research that finds that perfectionistic strivings are not always associated with maladaptive outcomes (and are often associated with positive outcomes; see Gotwals et al., 2012; Stoeber, 2011).

If we were to compare any two athletes from the present sample, the athlete with higher perfectionistic concerns would show a higher risk of injury than the athlete with lower perfectionistic concerns. Moreover, if we were to compare two athletes who had the same level of perfectionistic strivings, the athlete with higher perfectionistic concerns would still show a higher risk of injury than the athlete with lower perfectionistic concerns. Controlling for the overlap between perfectionistic strivings and perfectionistic concern is like holding perfectionistic strivings constant, and this allows us to examine the unique relationships of perfectionistic concerns (see Stoeber & Gaudreau, 2017, for details). Thus, we can conclude that both perfectionistic concerns and residual perfectionistic concerns appear to be important within the perfectionism-injury relationship.

What, then, may explain why perfectionistic concerns predict injury? Our theoretical model (Figure 1) suggests two pathways by which perfectionistic concerns may predispose athletes to injury. The first pathway is based on the stress-injury model (Williams & Andersen, 1998). According to this model, the likelihood of injury is increased when athletes are exposed to stress and that this relationship is moderated by personality factors (i.e., personal factors that predispose athletes to increased stress responses). Previous research utilising the diathesis-stress model of perfectionism (Hewitt & Flett, 1993, 2002) has demonstrated that perfectionism is associated with chronic stress, and this stress in turn may provide a mechanism for increased injury risk. Further support for this assertion comes from research suggesting that only the perfectionistic concerns dimension of perfectionism is associated with maladaptive strategies for coping with stress (Hill, Hall, & Appleton, 2010). The second pathway proposed in our

theoretical model of perfectionistic concerns and injury is training distress (a proxy of overtraining syndrome). Previous research has shown that perfectionistic concerns predict increases in training distress over time (Madigan et al., 2017). As such, the perfectionistic athletes in the current study may have “overtrained,” that is, trained harder and for longer than the non-perfectionistic athletes, making them more susceptible to an increased risk of injury (cf. Ekstrand et al., 2011). Future research is required to test the mediational pathways in our theoretical model (Figure 1) and explore if stress and/or overtraining are responsible for the relationships we found in the present study.

Furthermore, it is important to note that we currently do not know the relative importance of perfectionism in predicting injury when examined alongside other personality factors (cf. Ivarsson et al., in press). However, it could be expected that perfectionism may be a relatively important factor. This is for two reasons. First, perfectionism appears to be a characteristic that is common in athletes (e.g., Flett & Hewitt, 2005). Second, perfectionism predicts several other important outcomes in sport such as performance (e.g., Stoeber, Uphill, & Hotham, 2009). Nonetheless, future research is required to explore the relative importance of perfectionism in the personality-injury relationship. It should, however, also be noted that even small effects can be important when they accumulate over time (cf. Prentice & Miller, 1992).

Limitations and Future Research

The present study had a number of limitations. First, whereas our sample size was in line with previous research (e.g., Laux, Krumm, Diers, & Flor, 2015), it may be considered relatively small. As such, we may have been unable to detect smaller meaningful effects. Therefore, future research should aim to recruit larger samples and reinvestigate these relationships to determine if smaller effects exist. Second, our study focused on a sample comprised exclusively of junior athletes. Future studies should therefore examine whether the findings generalise to other

populations (e.g., adults). Third, our study had a greater proportion of male athletes. As such, future research should reinvestigate the perfectionism–injury relationship employing samples with a greater proportion of female athletes. Finally, our study included athletes from both team and individual sports. Future research is required to determine if the type of sport an athlete competes in affects the perfectionism–injury relationship.

Conclusion

The present study contributes to our understanding of the relationships between multidimensional perfectionism and injury, being the first to identify perfectionistic concerns as a potential factor predisposing athletes to an increased risk of injury over time. Based on the present findings, we recommend that coaches and support staff looking to monitor risk factors for injury, monitor athletes' levels of perfectionistic concerns as one such potential factor (see Stoeber & Madigan, 2016, for an effective way to do this).

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Table 1

Descriptive Statistics, Cronbach's Alphas, Bivariate and Partial Correlations

Variable	1	2	3
1. Perfectionistic strivings			-.02
2. Perfectionistic concerns	.59***		.25*
3. Injury	.16	.29**	
<i>M</i>	-0.01	0.00	—
<i>SD</i>	0.92	0.92	—
Cronbach's alpha	.79	.81	—

Note. $N = 80$. Injury was coded 1 = yes, 0 = no. Bivariate correlations are reported below the diagonal, partial correlations above the diagonal (see Column 3).

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2

Logistic Regression Predicting Injury

	Injury (yes/no)		
	Nagelkerke R^2	B	OR (95% CI)
Perfectionism	.114*		
Perfectionistic strivings		-.060	0.95 (0.50-1.77)
Perfectionistic concerns		.734*	2.08 (1.06-4.09)

Note. $N = 80$. OR = odds ratio, CI = confidence interval.

* $p < .05$.

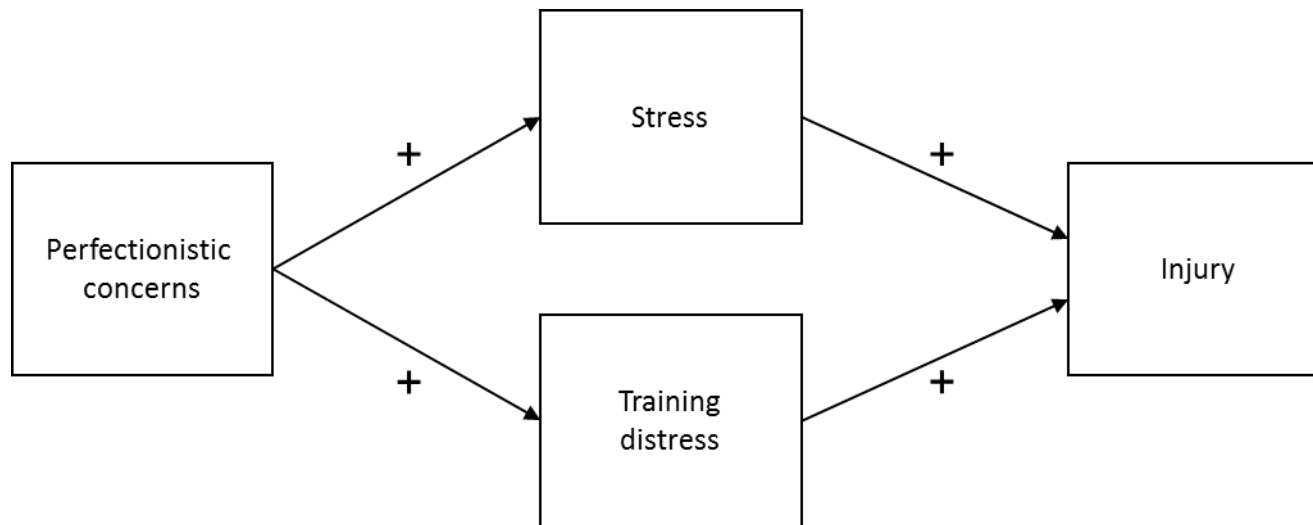


Figure 1. Theoretical model of the relationship between perfectionistic concerns and injury and potential pathways.