

1 Title: Compete or rest? Willingness to compete hurt among adolescent elite athletes.

2 Running Head: Willingness to compete hurt among adolescent athletes

3 Abstract

4 Objective: Training and competing despite underlying health problems is a common social  
5 practice in sport. Adolescent elite athletes are particularly vulnerable to possible health  
6 consequences of this risky behavior due to their very sensitive developmental stage.  
7 Conceptualizing this phenomenon of playing hurt as sickness presenteeism, and taking the  
8 concept of absence/presence legitimacy into account, this paper analyzes the propensity of  
9 adolescent elite athletes to compete in the face of health problems. The central aim is to  
10 empirically identify characteristics of elite sport subcultures which affect athletes'  
11 willingness to compete hurt (WCH). Materials & Methods: Based on a comprehensive  
12 sample of 1138 German elite adolescent athletes from all Olympic sports (14-18 years), the  
13 paper applies classification tree analysis to analyze the social and individual determinants of  
14 the WCH. Results: Determinants on three hierarchical levels were identified, including type  
15 of sport, perceptions of social pressure, coach's leadership style and athletes' age. The group  
16 with the highest WCH were athletes from technical sports who have a coach with an  
17 autocratic leadership style. Second was athletes from ball games, and those in aesthetic and  
18 weight-dependent sports, aged between 17 and 18 years old. The lowest mean WCH-score,  
19 by some distance, occurred amongst the group of endurance and power sports athletes who  
20 experienced no direct social pressure to play hurt. Conclusions: The findings enhance our  
21 understanding of absence/presence legitimacy in highly competitive social contexts and  
22 contribute to the development of more effective target-group-specific health prevention  
23 programs for young athletes.

24 Keywords: Sickness presenteeism, playing hurt, culture of risk, elite sports, adolescent  
25 athletes

26 Training and competing despite underlying health problems is a common practice in  
27 competitive sport. It often accompanies the use of painkillers, disregard of medical advice, or  
28 hiding pain from coaches and teammates (Howe, 2001; Malcolm, 2006; Pinheiro, Pimenta,  
29 Resende, & Malcolm, 2014; Roderick, Waddington, & Parker, 2000; Thiel, Mayer, & Digel,  
30 2010). This phenomenon of playing hurt (Roderick et al., 2000) is not only associated with  
31 short-term effects (e.g. exacerbated medical conditions), but also with long-term  
32 consequences such as the development of chronic overuse injuries, irreversible physical  
33 damage or recurring traumatic injuries (Kujala, Orava, Parkkari, Kaprio, & Sarna, 2003;  
34 Waddington, 2000). Moreover, the consequences can negatively affect a successful sports  
35 career and hinder the ability to pursue an active lifestyle in later life. Adolescent elite athletes  
36 are particularly vulnerable to such short- and long-term consequences, as they have to cope  
37 with numerous physical, psychological and social changes during this very sensitive  
38 developmental stage. However, to the best of our knowledge, there are no studies addressing  
39 the problem of playing hurt which encompass a large scale representative sample of  
40 adolescent elite athletes across a range of sports.

41 Consequently, this paper analyzes the propensity of adolescent elite athletes to  
42 compete despite having a health problem. Particularly, the present study aims to identify  
43 specific groups of adolescent athletes who are willing to take the highest and lowest health  
44 risks in order to keep up their sports activity. As a consequence of identifying determinants of  
45 such high and low risk groups, it is possible to invoke strategies which will safeguard  
46 athletes' health and, in turn, enhance longer-term competitive performance. More specifically,  
47 such knowledge helps to better understand and improve return-to-play decision-making in  
48 elite sports.

## 49 **Theoretical Framework**

50 Training and competing despite having a health problem can be conceptualized as  
51 sickness presenteeism in sport organizations (Mayer & Thiel, 2016). Sickness presenteeism is  
52 generally defined as attending work while being ill (Aronsson, Gustafsson, & Dallner, 2000)  
53 and is synonymous with keeping up social functioning despite having a medical condition or  
54 feeling ill. In this regard, decisions about presenteeism and absenteeism are generally  
55 conceptualized as resulting from the dynamic interplay of a current health event, various  
56 personal factors, and the organizational structures of the workplace (Johns, 2010). According  
57 to previous sociological research, the action fields of adolescent, elite and professional sports  
58 have to be considered as specific workplaces (Mayer & Thiel, 2016; Roderick, 2006; Thiel et  
59 al., 2010). Like any regular worker, athletes are bound by contractual regulations and face  
60 various formal or informal role expectations and performance requirements. However, the  
61 elite sports workplace is also a special one, as excellent fitness and physical health are of  
62 extraordinary importance.

63 As outlined in the dynamic model of competing hurt in elite sport (Mayer & Thiel,  
64 2016), an athlete who experiences an acute, chronic or episodic health issue has to decide  
65 whether to show up for training, competition or other team events. In this regard, the  
66 characteristics of the work context influence presenteeism and absenteeism related decisions  
67 in two ways. First, situation specific expectations (e.g. the face-to-face order from a coach)  
68 can directly affect decision-making. Second, temporally outlasting expectations which result  
69 from the structure of the work context and other personal life circumstances can indirectly  
70 affect decision-making habits by shaping a persons' attitudes towards work. This includes an  
71 individual's absence/presence legitimacy, understood as the extent to which employees  
72 perceive presenteeism and absenteeism as acceptable work behavior (Addae, Johns, & Boies,  
73 2013; Harvey & Nicholson, 1999).

74           Based on this concept of absence/presence legitimacy, we argue that adolescent  
75 athletes develop a willingness to compete hurt (WCH). The WCH is defined as the extent to  
76 which an athlete perceives presenteeism and absenteeism as acceptable “work” behavior  
77 within their sports organization (Mayer & Thiel, 2016). Thus, legitimizing a lay-off with very  
78 mild subjective complaints would imply a low WCH while a high willingness would be  
79 associated with the neglect of more severe medical conditions in order to compete.  
80 Consequently, an individual athlete’s WCH represents an attitude and a highly relevant  
81 personal precondition to decision-making about pain, injury or illness related ‘work’ absence.  
82 As shown in a foregoing study of elite adult athletes (Mayer & Thiel, 2016), there is generally  
83 a high willingness to compete despite subjective complaints and minor health problems.  
84 However, there is evidence that different athlete types exist, who are either rigidly rest averse  
85 or conditionally willing to rest.

86           In relation to competing despite health issues, both adolescent elite athletes and their  
87 coaches face a dilemma. On the one hand, the need to constantly push athletic bodies to the  
88 limit means that injuries are relatively routine. Thus, the acceptance of health risks is  
89 prevalent in competitive sports (Pike & Maguire, 2003; Theberge, 2008) and evident amongst  
90 youth participants (Schubring & Thiel, 2014). These findings suggest that athletes act within a  
91 culture of risk (Nixon, 1993) that is is closely entangled with the norms and values of what  
92 has been termed the sport ethic (Hughes & Coakley, 1991); namely sacrifice for the game,  
93 seeking distinction, taking risks, and challenging limits. On the other hand, there is the need to  
94 take care of the athletes’ health, as performance is often predicated on unimpaired physical  
95 function (Nixon, 1996). This, for instance, explains why elite adolescent athletes might  
96 exhibit a healthier lifestyle in terms of lower prevalences in smoking or ever consumption of  
97 alcohol relative to their non-athletic peers (Diehl, Thiel, Zipfel, Mayer, & Schneider, 2014).  
98 Because elite adolescent athletes also need to succesfully cope with routine physical,  
99 psychological and social changes associated with youth transitions, this dilemma even

100 becomes a trilemma (Diehl et al., 2014). Adolescent athletes seem to respond to this trilemma  
101 of risking ones' health vs. securing ones' health vs. coping with youth typical development  
102 tasks in various ways. There are findings of contrast groups with different degrees of a  
103 general physical and psychosocial risk acceptance (Schnell, Mayer, Diehl, Zipfel, & Thiel,  
104 2014), varying prevalences of eating disorders (Giel, Hermann-Werner, Mayer, Diehl,  
105 Schneider, Thiel, & Zipfel, 2016) and increased rates of binge drinking (Diehl et al., 2014;  
106 Peretti-Watel, Guagliardo, Verger, Pruvost, Mignon, & Obadia, 2003). However, we do not  
107 yet know how this elite youth sport trilemma is transformed into the adolescent athletes'  
108 WCH and which factors predict higher and lower levels of such readiness for presenteeism in  
109 sports. This paper is the first to answer these questions.

#### 110 **Predictors of the Willingness to Compete Hurt**

111 It is reasonable to suppose that the WCH is primarily mediated by processes of  
112 socialization into the context of competitive sports and progressively shaped through social  
113 expectations within elite sport organizations (organizational factors) and/or an athlete's  
114 individual biography (individual factors).

115 Organizational factors: The essential *raison d'être* of elite sport organizations is the  
116 pursuit of high performance in competition. Irrespective of the sports discipline, this is not  
117 only a central goal for these organizations as entities but also for those members - coaches,  
118 managers, doctors, and athletes – who constitute what has been termed the “sportsnet”  
119 (Nixon, 1992). Moreover, presenteeism research illustrates that organization- and profession-  
120 specific absence/presence cultures play a major role in the collective avoidance of the sick  
121 role (Dew, Keefe, & Small, 2005). Absence/presence cultures generally represent a “set of  
122 shared understandings about absence legitimacy and the established custom and practice of  
123 employee absence and control” (Johns & Nicholson, 1982, p. 136). New workers acquire  
124 knowledge about legitimate causes for sick days, as well as knowledge about when they are

125 socially expected to continue to work. As shown in relation to handball and track & field,  
126 particular sports disciplines have specific presence/absence cultures that influence athletes'  
127 perceptions of absence legitimacy (Mayer & Thiel, 2016). Within their teams, injured athletes  
128 can feel socially pressured to compete and risk being stigmatized as soft or as malingerers  
129 (Malcolm & Sheard, 2002; Roderick, 2006; Roderick et al., 2000). Experiencing subtle or  
130 even direct social pressure to play hurt within their "sportsnet" can thus increase WCH. In this  
131 regard, the leadership style of the coach might also affect the way in which adolescent athletes  
132 perceive their health issues as legitimate reasons for absence. Finally, the extent of inclusion  
133 (Riedl, Borggreffe, & Cachay, 2010) into the adolescent elite sports organizations also needs  
134 to be considered. Legitimitization of training abeyance due to health issues might be affected  
135 when athletes leave their families to join a sports boarding school or when they spend more  
136 time within the sports network due to higher training loads and competition days. As the  
137 social constraints to compete increase with performance level, internationally performing  
138 athletes might well show a higher WCH when compared with those at lower performance or  
139 squad-levels.

140       Individual factors: As athletes become progressively socialized into competitive sports  
141 cultures during adolescence, age must be considered as a potential predictive factor. Indeed,  
142 age has been shown to be closely related to presenteeism in non-athlete populations  
143 (Aronsson & Gustafsson, 2005). Additionally there is evidence that females are less prone to  
144 presenteeism than males (Johns, 2010) and that perceptions of legitimate reasons for absences  
145 differ according to gender (Harvey & Nicholson, 1999). However, findings from sport  
146 contexts indicate almost no gender differences on risk acceptance (Nixon, 1996; Schnell et al.,  
147 2014) and perceived absence/presence legitimacy (Mayer & Thiel, 2016). In this regard, the  
148 effect of gender specific socialization processes during adolescence is not yet clear.

149

**150 Purpose**

151 The main purpose of the article is to investigate the WCH in a comprehensive sample  
152 of elite adolescent athletes competing in nearly all Olympic sports. In particular, we explore  
153 the question as to whether there exist subsets of young elite athletes with notably different  
154 WCH values and thus identify which groups of athletes are willing to take the highest and  
155 lowest health risks in order to maintain their sports activity. Covering a wide range of  
156 potential determinants, we also use classification tree analysis to identify the influence and  
157 interaction of organizational and individual factors.

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**Materials and Methods****161 Study Design**

162 The analysis is based upon data drawn from the German Young Olympic Athletes'  
163 Lifestyle and Health Management Study (GOAL Study), a multimethodical and  
164 interdisciplinary cooperative project funded by the Federal Institute of Sports Science (BISp),  
165 Germany, on behalf of the Federal Ministry of the Interior. The cross-sectional survey of all  
166 German elite adolescent athletes received ethical approval from the Medical Faculty ■  
167 ■ and was conducted by ■  
168 ■. As required by the ethics committee, written informed consent was received from  
169 each participant, allowing the inclusion of his or her data in the study.

170 Inclusion criteria for the athletes were: (a) engaging in one of the 54 Olympic sports  
171 (with respect to the 2010 Winter Olympics and 2012 Summer Olympics); (b) born between  
172 1992 and 1995; and (c) competing at one of the highest four national squad levels (in  
173 Germany from A, B, C to D/C squad) or a corresponding team level. The federation

174 responsible for Greco–Roman wrestling declined to participate and no athlete from either  
175 sailing or bobsledding met all the inclusion criteria, leaving a potential 1843 elite athletes  
176 from 51 sports included in the study. This population was contacted and asked to answer a  
177 self-administered questionnaire between February 2010 and January 2011. The only form of  
178 compensation for the participants was the opportunity to win one of 20 gift coupons (value:  
179 50€) for a bookstore. The overall questionnaire covered several health-related topics (e.g.  
180 risky health behaviors, attitudes towards risk, subjective health) and included general socio-  
181 demographic variables as well as measures to assess the specific social context of sports (e.g.  
182 sport discipline, squad-level). The response rate was 61.75% (n = 1138; 56.1% male, age  
183 range 14–18), a particularly high response rate for a survey of this type (Baruch, 1999). A  
184 nonresponder analysis of age and gender did not show any significant differences between  
185 those who did and did not respond (for further details of the overall design and contents of the  
186 study, see [REDACTED]).

## 187 **Measures**

188 Based on theoretical reflections as well as previous quantitative and qualitative  
189 research, four items addressing typical health events which could lead to competition  
190 cessation were included in the comprehensive questionnaire. Item selection was driven by  
191 identification of ambiguous health events with uncertain medical consequences when  
192 competing. In addition, the health events should represent different dimensions of health and  
193 be recognized as common health issues from an athletes point of view.

194 The items were worded as “I”-statements and referred to both the physical and  
195 psychosocial dimensions of health (e.g. “I abstain from competing if... I have a fevery  
196 cold...have joint pain without moving, ...have to take painkillers, ...do not feel physically  
197 resilient). The athletes were asked to assess the extent of their agreement with the statements  
198 on a five-point Likert response format ranging from “strongly disagree” to “strongly agree”.



199 These four items were then used to create a sum WCH score evaluating legitimate reasons for  
200 withdrawing from competition. Data were recoded by reversing scores so that higher values  
201 on the final sum scale (range 4-20) represent a higher WCH. As we conceptualized the WCH  
202 as a one dimensional, reflective construct to be measured through a multi-item reflective  
203 scale, we refer to Cronbach's alpha as a measure for internal consistency. Construct validity  
204 was addressed by consensual validation including experts from sports science, sports  
205 medicine and sports coaching as no other directly related measures existed for testing  
206 construct validity. The theoretically derived independent variables used in this study are  
207 summarized in Table 1. In addition to individual characteristics such as age and gender, we  
208 focused on potential sport organizational context factors such as type of sport, squad level,  
209 weekly training load, yearly competition days, attendance of a sports boarding school,  
210 leadership style of the coach and the perception of direct or indirect pressures to compete hurt.  
211 Space restrictions within the comprehensive health questionnaire and the lack of previously  
212 validated short-scales for some of the sport organizational context factors led to the inclusion  
213 of self-developed single-item measures. In order to assess the perception of direct pressure to  
214 compete hurt, an item with the following wording was developed: "I am competing hurt  
215 because I feel pressured by the ones from my sporting environment". The perceived indirect  
216 pressure to compete hurt was similarly assessed (wording: "I am competing hurt because I do  
217 not want to be called a wimp or weakling by my sporting peers"). For both measures, higher  
218 values on the five-point Likert response format represent a higher amount of perceived direct  
219 or indirect social pressure to compete hurt. Another single-item measure (nominal scale) was  
220 included to evaluate the leadership style of the coach. Considering the three major leadership  
221 styles (autocratic, democratic and laissez-faire) as established by Lewin, Lippit and White  
222 (1939), the exact wording of the variable is: "Which one of the following three statements fits  
223 best to the coach you spend most time with? In decision making situations... a)...my coach  
224 does mostly not allow any objection; b)...my coach is mostly willing to discuss the issue;

225 c)...my coach mostly let's things pass. As no other directly related measures exist for testing  
226 construct validity for perceived social pressure and no other (longer) instruments on  
227 leadership styles could be included in the questionnaire, the problem of construct validity was  
228 addressed by consensual validation including experts from sports science and sports coaching.

### 229 **Data Analysis**

230 In order to identify and characterize groups with higher or lower WCH we used  
231 classification tree analysis. This method is considered a promising research tool for the  
232 identification of at-risk populations in public health research and outreach (Lemon, Roy,  
233 Clark, Friedmann, & Rakowski, 2003) because it divides a sample population into different  
234 sub-populations based on the impact of predictors on the grouping variable. Compared to  
235 other multivariate methods, classification tree analyses have several advantages (see Camp &  
236 Slattery, 2002; Chen, Shih, Lin, Chen, & Lin, 2012). In addition to the ability to separate a  
237 population into subgroups whose members share common characteristics, simultaneous  
238 treatment of interactions among independent variables is possible. Moreover, the method is  
239 highly flexible, as it can handle a variety of variable types simultaneously (continuous,  
240 ordinal, or nominal) and does not require the stringent theoretical and distributional  
241 assumptions of more traditional methods (such as cluster analysis, discriminant analysis, and  
242 regression models).

243 The present classification tree analysis was performed via IBM SPSS 21 for Windows  
244 using the method of exhaustive CHAID. Exhaustive CHAID refers to a systematic algorithm  
245 to detect the strongest association between the target variable and independent variables. At  
246 each step, the independent variable with the strongest interaction with the dependent variable  
247 is chosen. The categories of each independent variable are merged if they are not significantly  
248 different with respect to the dependent variable. Each split in the decision tree is an optimal  
249 balance between sensitivity and specificity for predicting the outcome variable (Bühl, 2012;

250 SPSS Inc., n.d.). The starting point of the analysis is the so-called “root node” at the top of a  
251 tree model, which contains the whole data set of the target variable.

252         The WCH score was employed as the target variable, with its outcomes ranging from  
253 four to 20. If a node splits to form part of a new level, it is referred to as a “parent node.”  
254 Nodes splitting further from the parent node are termed “child nodes.” Each node at the end of  
255 a branch is labeled a “terminal node.” Terminal nodes represent the identified contrast groups.  
256 Nodes are represented by boxes including the mean value, standard deviation, absolute  
257 numbers, and percentage of the sample contained therein. Above each node, the name of the  
258 most significant predictor variable, the p-value, chi-squared value, and degrees of freedom are  
259 illustrated. The analysis incorporated different types of predictor variables, representing the  
260 aforementioned organizational and personal factors (see Table 1). For continuous dependent  
261 variables, data are automatically divided into approximate deciles and used as ordinal  
262 variables in the analysis (SPSS Inc., n.d.).

263         In order to “grow” the tree we chose the following parameters: a maximum tree depth  
264 of three, a minimum parent node size of 100, a minimum child node size of 30, and a  
265 significance threshold of 0.05 for splitting. Because the dependent variable is neither nominal  
266 nor ordinal, the misclassification risk is given by calculating the proportion of variance  
267 explained through the model using the risk estimators and the total variance of the root node  
268 (SPSS Inc., n.d.). Descriptive statistics, including means and standard deviations, were  
269 additionally performed for the four items pertaining to the WCH and for the predictor  
270 variables.

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## Results

### 275 Sample Distributions

276 Mean age of the adolescent elite athletes was 16.33 years and 56% of the total sample  
277 (N=1138) were male (see Table 1). According to the classification of Sundgot-Borgen and  
278 Torstveit (2004), most of them were engaged in ball games (36%), in endurance (20%),  
279 technical (13%) and weight dependent sports (11%). The weekly duration of sporting activity  
280 was 13.71 hours and the mean number of competition days during the previous season was  
281 40.81. One out of five athletes (18%) attended a sports related boarding school. The  
282 leadership style of the coach was described as democratic by 73% and as autocratic by 19% of  
283 athletes. Just over a third (36%) of the athletes stated that they experienced medium to high  
284 pressure from their “sportsnet” to play hurt, while 39% did not perceive any direct social  
285 pressure. More subtle forms of indirect social pressure like the fear of being called a  
286 weakling was perceived at a medium to high level by 16%.

### 287 Willingness to Compete Hurt

288 Descriptive analysis of the WCH items showed that athletes were most likely to  
289 consider it legitimate to rest when they have a fevery cold (M: 3.97, SD: 1.25, Mdn: 4) (see  
290 Table 2). The most illegitimate reason for competition withdrawal was deemed to be a lack of  
291 feeling physically resilient (M: 2.77, SD: 1.24, Mdn: 3). Overall, the young elite athletes also  
292 tended to perceive joint pain as a reasonable cause to abstain from competing (M: 2.90, SD:  
293 1.25, Mdn: 3). While no general tendency was observed in relation to the need to take  
294 painkillers (M: 3.05; SD: 1.43, Mdn: 3), 42.1% of all athletes considered it illegitimate to rest  
295 while taking pain medication. Looking at the distibutions also reveals that 16.4% would not  
296 perceive it legitimate to rest with a fevery cold and almost half of the athletes showed a high  
297 willingness to compete despite health problems such as joint pain (43.8%) or feeling not  
298 resilient (47.7%). The mean overall WCH score is 11.29 (SD: 3.71) on a scale between 4 and

299 20 (higher values represent a higher WCH). Reflecting the low number of included items and  
300 the narrow sample population, internal consistency is still acceptable (Cronbach's  
301  $\alpha=0.69$ ). This score was used for the identification of high and low risk groups using  
302 classification tree analysis.

### 303 **Contrasting Groups for WCH**

304 On the basis of the most significant factors, which split the data set, the tree model  
305 depicted in Figure 1 was generated. The tree model demonstrates that the WCH is predicted  
306 by four interacting factors on three different levels. The variable with the strongest influence  
307 on the WCH was the type of sport (level 1). Directly perceived pressure and leadership style  
308 of the coach had the second strongest influence (level 2), but only for athletes in a particular  
309 group of sports. For example, the leadership style of the coach was only a significant factor in  
310 technical sports. Age was the next best predictor, indicating a significantly higher WCH in  
311 older athletes (level 3). However, the tree model indicates that age is only a significant factor  
312 when athletes are from aesthetic, ball games or weight dependent sports and when athletes  
313 experienced very low direct pressure to play hurt from their sportsnet. All the other variables,  
314 for example gender or squad level, had no significant influence on WCH. The proportion of  
315 variance explained by the classification tree model is 19.7%, which indicates that there are  
316 additional influencing variables that were not included in our study.

317 Twelve different contrast groups with specific WCH scores and characteristics were  
318 identified according to the terminal nodes (Table 3). Comparison of the contrast group mean  
319 WCH-scores (cf. Table 3) indicates that five out of the 12 contrast groups have below average  
320 scores. In addition to the type of sports, four of the five below average contrast groups were  
321 characterized by either no or low direct social pressure to compete and by a young age. The  
322 two groups with the highest and the two groups with the lowest overall WCH were as follows.

- 323 • The group with the highest WCH-score (14.73), consists of athletes from technical sports  
324 working under a coach with an autocratic leadership style. In total, 3.40% of the study  
325 participants belong to this group (node 8).
- 326 • The group with the second highest WCH-score (12.98) consists of athletes from ball games  
327 and aesthetic and weight-categorized sports, but only those aged 17 and 18 and who  
328 experienced low direct social pressure to play hurt. Overall, 4% of the study participants  
329 belong to this group (node 17).
- 330 • The group with the second lowest WCH-score (9.39) consists of aesthetic, ball games and  
331 weight dependent sports athletes, who perceive no direct social pressure to play hurt and  
332 who are aged 14 and 15 (group size 4.6%, node 13).
- 333 • The lowest mean WCH-score, by some distance (8.35), was detected amongst athletes in  
334 endurance and power sports, and who experienced no direct social pressure to compete  
335 hurt. In total, 12.2% of the study participants belong to this low risk group for playing hurt  
336 (node 10).

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## Discussion

340 The main purpose of the study was to analyze elite adolescent athletes' willingness to  
341 compete hurt (WCH) based on a comprehensive sample representative of the spectrum of  
342 Olympic sports. Compared to previous studies, this is the first to directly address the issue of  
343 presenteeism in youth sports, and the first to predict athlete groups with varying degrees of  
344 presence/absence legitimacy using classification tree analysis. Classification tree analysis  
345 enables us to better understand the simultaneous interaction of different factors which  
346 influence the WCH. In contrast to more conventional methods of regression analysis, the

347 modelling of multilevel interactions and simultaneous inclusion of more independent  
348 variables is a major advantage (Camp & Slattery, 2002; Chen et al., 2012).

349         The descriptive analysis shows that adolescent athletes clearly differentiate between  
350 the legitimacy to rest according to particular kinds of underlying health problems. This  
351 finding is in line with observations in adult elite sports (Mayer & Thiel, 2016) and with  
352 research addressing the legitimacy of various minor health conditions in normal work  
353 contexts (Harvey & Nicholson, 1999). Two further findings are of considerable practical  
354 importance. Firstly, in view of the health risks of competing while using e.g. common  
355 nonsteroidal anti-inflammatory drugs (Van Wijck, Lenaerts, Van Bijnen, Boonen, Van Loon,  
356 Dejong, & Buurman, 2012), it is alarming that 42.1% of athletes considered it illegitimate to  
357 rest while receiving medication. Secondly, in light of the short and long-term health risks  
358 involved in practicing high-intensity sports while having acute infectious diseases (Scharhag  
359 & Meyer, 2014), it is of considerable concern that 16.4% are averse to resting when suffering  
360 from a fevery cold. Conversely, the descriptive results also show that more than half of the  
361 young athletes seem to have internalized a more cautious approach to playing hurt, and that  
362 they are far more willing than older elite athletes to withdraw from competition when feeling  
363 unwell (Mayer & Thiel, 2016).

364         Although the study population is a very specific one, classification tree analysis  
365 revealed contrast groups with a varying propensity to take health risks in favor of competing.  
366 The group to which an athlete belonged was determined by several interacting factors on three  
367 different levels, including: type of sports; perception of direct social pressure to play hurt;  
368 leadership style of the coach; and athletes' age. Generally, these findings correspond with our  
369 theoretical assumptions about the influence of distinct presence cultures and the degree of  
370 socialization into the elite sports system. However, it was further revealed that these factors  
371 only play a role in certain instances. Overall, the type of sports predefines the range of the

372 WCH-score, while the other factors contribute to its specific location within this range.  
373 Athletes from technical sports, for example, have a higher acceptance of possible health risks  
374 compared to their peers from endurance, power or antigravitation sports. Even athletes from  
375 technical sports, whose WCH is slightly lower when having a non-autocratic coach, express  
376 higher values than the athlete groups from endurance, power or antigravitation sports.

377         The centrality of the sport discipline can be explained by differences in “adjustment  
378 latitude” (Johansson, Hultin, Moller, Hallqvist, & Kjellberg, 2012). In endurance sports for  
379 example, having a cold or feeling unwell reduces work ability and severely inhibits high  
380 performance. In power sports, due to the often maximal strains to the athlete’s body, it is also  
381 impossible to realize top performance whilst in pain or functionally impaired. In technical  
382 sports or ball games, in contrast, it is more likely that an athlete might still deliver the  
383 requested performance or contribute to the overall team performance while experiencing dis-  
384 ease. Thus, our study supports the argument that the extent of taking health risks in sports is  
385 shaped by sport-specific performance norms and constraints which differently mediate what  
386 has broadly been defined as the ‘culture of risk’ in sports (Giel et al., 2016; Liston,  
387 McDowell, Malcolm, Scott, & Waddington, 2016; Mayer & Thiel, 2016; Schnell et al., 2014).

388         However, our results emphasize that in addition to the sport-specific culture, a climate  
389 of pressure within the athletes’ particular sportsnet further increases the extent of perceived  
390 absence legitimacy. Particularly in endurance and power sports we can see a higher WCH  
391 amongst athletes experiencing greater social pressure. This is also true for ball games,  
392 aesthetic and weight dependent sports, where age is an additional mediating factor. The  
393 younger the athletes within these sport disciplines, the less pressure to play they perceive, the  
394 easier is it for them to legitimize a break from competition. The findings about the general  
395 influence of social pressure is in line with Nixon’s (1992) network-theoretical assumptions  
396 and observations within professional soccer and rugby clubs (Howe, 2001; Roderick, 2006).



397 Given that older athletes who exhibit greater WCH are less eager to rest only in particular  
398 sport-discipline-social-pressure-constellations, we assume that in these cases socialization  
399 processes are particularly important; such as a stronger orientation to the fundamental values  
400 of elite sports (the sports ethic) or decreased influence of family and other non-sports related  
401 social environments (Riedl et al., 2010). As age does not prove to be a relevant factor in older  
402 athlete populations (Mayer & Thiel, 2016), we suppose that such socialization processes into  
403 the elite sports cultures of risk are mostly completed by late adolescence.

404 Factors in the classification tree analysis that have no significant influence on the  
405 extent of the WCH are also of interest. In contrast to general presenteeism research (Johns,  
406 2010), we found no significant influence of gender. Moreover, this result is in line with other  
407 quantitative findings addressing risk attitudes in competitive athletes (Nixon, 1996; Schnell et  
408 al., 2014). Thus, it can be hypothesized, a gender specific development of absence legitimacy  
409 is neutralized because highly specialized groups of elite athletes adopt the same fundamental  
410 values and structural principles within sport organizations, regardless of gender.

411 This study has several limitations. First, the study has the typical limitations of cross-  
412 sectional survey studies that rely on self-reported variables. Second, it is not yet clear how the  
413 extent of WCH relates to an increased risk for developing serious long-term health problems.  
414 Moreover, as being overly cautious can also negatively affect sports careers, it is not clear to  
415 what degree a certain willingness for presenteeism is functional, for example for keeping up  
416 squad memberships or securing one's position within a team. Third, the relatively low level of  
417 internal consistency is a limitation as well, which should be addressed in further development  
418 of the WCH-measure. Fourth, the self-developed single-item measures for leadership style of  
419 the coach, direct and indirect perceived social pressure to compete hurt were not previously  
420 validated and psychometrically tested. These restrictions need to be cautiously considered  
421 when interpreting the results and drawing practical conclusions. However, the results also

422 indicate that future endeavors should focus on developing validated and psychometrically  
423 tested (short) scales for aspects of social interaction such as perceived social pressure or  
424 leadership styles. Fifth, statistical analysis indicates that some potential influencing variables  
425 have yet to be identified. Sixth, our study only addressed the athletes' perspective. The extent  
426 to which coaches' expectations about playing hurt, and their perceptions of pressurizing  
427 athletes differ from their athletes', is yet to be addressed.

428         Future research should focus on longitudinal studies analyzing the relationship  
429 between long-term health developments and changing WCH across the sports career. This  
430 includes finding out at what point, and in which specific sports careers, it is  
431 beneficial/harmful to take particular risks. Such longitudinal studies should also include  
432 adolescent athletes from different nations, cultures and lower performance levels. It is also  
433 necessary that the present study is replicated with other samples of elite athletes in order to  
434 confirm the predictive capacity of the model. For a better explanation of the variance in  
435 WCH, other psychosocial measures should be included in future studies, such as exercise  
436 addiction, self-conceptions of health, health locus of control, self-efficacy, social integration  
437 or social status. A more holistic analysis would also include the coaches' perspective, and in  
438 particular their influence on the organizational norms of playing hurt and on the development  
439 of individual athletes' representations of health and healthy lifestyles.

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### **Conclusions**

443         Analyzing sickness presenteeism among adolescent elite athletes contributes to our  
444 understanding of how health problems are managed within the highly competitive sports  
445 context in general and during this sensitive developmental stage in particular. The  
446 identification and characterization of high and low risk groups for playing hurt is of practical

447 use for return-to-play decision-making (Shrier, Matheson, Boudier-Reveret, & Steele, 2015).  
448 Coaches and medical staff should reflect which athletes are more willing to play hurt than  
449 others, and consider this in all kinds of fitness and return-to-play decisions. Predominantly,  
450 those working within technical sports need to be aware of their ethical responsibility both in  
451 general and for adolescent athletes. Doctors and coaches who work within ball, aesthetic and  
452 weight-categorized sports need to be particularly careful when addressing issues about how to  
453 deal with minor health problems, as these athletes have a heightened sensitivity to the social  
454 expectations to play hurt. This is also true for endurance and power sports, where a social  
455 climate of pressure very likely results in an increased willingness to take pronounced health  
456 risks. In conclusion, excessive social pressure within the sports network needs to be targeted  
457 by establishing health-oriented decision-making regulations and athlete-focused  
458 communication strategies.

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591 Table 1

592 Sample distribution by independent variables

<b>Individual characteristics</b>	<b>Subcategory</b>	<b>Absolute (N)</b>	<b>%</b>	<b>M (SD)</b>
		1138		16.33 (1.10)
Age	14yrs/15yrs/16yrs	67/201/319	6/18/28	-
	17yrs/18yrs	393/158	35/14	-
Gender	Females	500	56	-
	Males	638	44	-
<b>Sport organizational context</b>				
Type of sport	Technical/Aesthetic/Antigravitation	143/46/41	13/4/3	-
	Endurance/Endurance-high power	222/79	20/7	-
	Weight dependent/Ball games/Power	125/407/71	11/36/6	-
Squad level	A-Squad (highest)/B-Squad	45/36	4/3	
	C-Squad/DC-Squad (lowest)	492/490	43/43	
Weekly training load (hours)		1109	-	13.71 (5.37)
Competition days during last season		957	-	40.81 (30.76)
Sports boarding school	Yes	201	18	-
	No	609	54	-
Leadership style of coach	Autocratic	204	19	-
	Democratic	791	73	-
	Laissez-Faire	82	8	-
Perception of direct pressure applied from sportsnet		1131	-	2.12 (1.18)
	No/Low	447/281	39/25	
	Medium/Elevated & High	222/181	20/16	
Perception of indirect pressure applied from sportsnet		1135	-	1.57 (0.95)
	No/Low	751/205	66/18	
	Medium/Elevated & High	110/69	10/6	

593

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595 Table 2

596 Willingness to compete hurt

Score	Subcategory	N	%	M (SD) / Mdn
Willingness to compete hurt (4-20)		1138	-	11.29 (3.71)
<b>Items: I refuse to compete, if I...</b>				
		1134	-	2.77 (1.24) / 3.0
...do not feel physically resilient	Strongly disagree / Disagree / More or less agree / Agree / Strongly agree		9/23/20/31/17	-
		1130	-	2.9 (1.25) / 3.0
...have joint pain without moving	Strongly disagree / Disagree / More or less agree / Agree / Strongly agree		12/24/20/30/14	-
		1127	-	3.05 (1.43) / 3.0
...have to take painkillers	Strongly disagree / Disagree / More or less agree / Agree / Strongly agree		23/18/17/25/17	-
		1134	-	3.97 (1.25) / 4.0
...have a fevery cold	Strongly disagree / Disagree / More or less agree / Agree / Strongly agree		47/27/10/9/7	-

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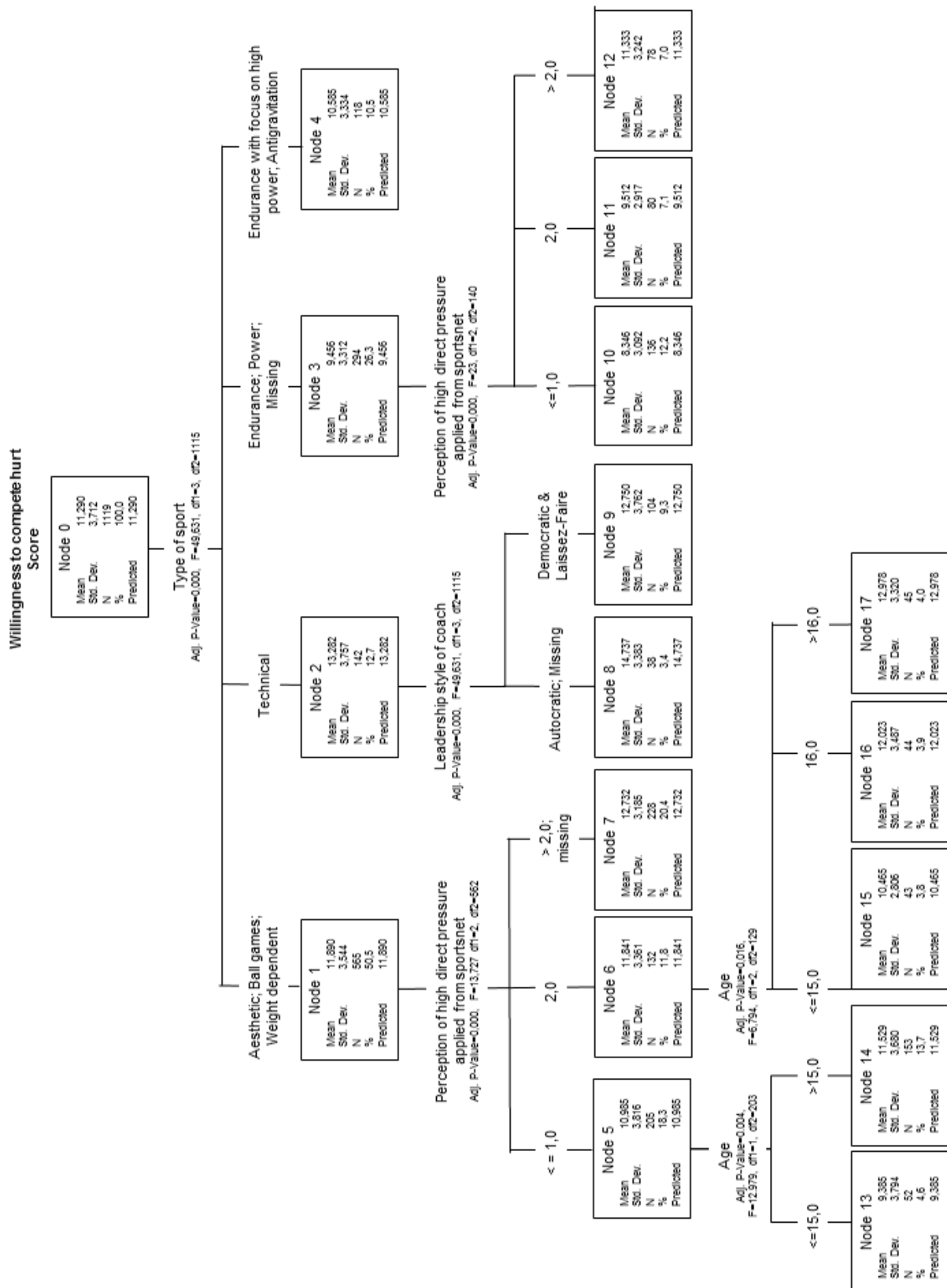
600 Table 3

601 Classification Tree Analyses of WCH: Gains Chart

<b>Knot</b>	<b>Description</b>	<b>N</b>	<b>Size (%)</b>	<b>WCH Mean (SD)</b>
8	Sportsgroup (Technical sports), autocratic leadership style of coach	38	3.4	14.73 (3.38)
17	Sportsgroup (Aesthetic, Ball games, Weight dependent), low direct social pressure to play hurt, aged 17 & 18	45	4.0	12.98 (3.32)
9	Sportsgroup (Technical sports), democratic or laissez-faire leadership style of coach	104	9.3	12.75 (3.76)
7	Sportsgroup (Aesthetic, Ball games, Weight dependent), medium-high direct social pressure to play hurt	228	20.4	12,73 (3.18)
16	Sportsgroup (Aesthetic, Ball games, Weight dependent), low direct social pressure to play hurt, aged 15 & 16	44	3.9	12.023 (3.49)
14	Sportsgroup (Aesthetic, Ball games, Weight dependent), no direct social pressure to play hurt, aged 16 -18	153	13.7	11.53 (3.68)
12	Sportsgroup (Endurance, Power & Missing), medium-high direct social pressure to play hurt	78	7.0	11.33 (3.24)
4	Sportsgroup (Endurance with focus on high power, Antigravitation)	118	10.5	10.60 (3.33)
15	Sportsgroup (Aesthetic, Ball games, Weight dependent), low direct social pressure to play hurt, aged 14	43	3.8	10.47 (2.81)
11	Sportsgroup (Endurance, Power & Missing), low direct social pressure to play hurt	80	7.1	9.51 (2.92)
13	Sportsgroup (Aesthetic, Ball games, Weight dependent), no direct social pressure to play hurt, aged 14 & 15	52	4.6	9.39 (3.79)
10	Sportsgroup (Endurance, Power & Missing), no direct social pressure to play hurt	136	12.2	8.35 (3.09)

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603



604 Figure 1. Classification Tree of Predictors Associated with WCH