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# To rest or to compete? A 4-week cohort study of analgesic use and willingness to compete hurt in Danish youth elite athletes

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ABSTRACT

*Objectives:* To assess the association between analgesic use and willingness to compete hurt (WCH) in Danish youth elite athletes, and to explore factors associated with such willingness.
*Design:* 4-week prospective cohort study.
*Methods:* 592 Danish youth elite athletes (15–20 years) completed a baseline questionnaire assessing demographic information, sport history, and WCH, and provided weekly reports on analgesic use for 4 weeks via text messages. Analgesic use was categorized as no use (0 weeks) or use across 1, 2, 3, or 4 weeks, and as the total number of days with analgesic use. Multinomial logistic regression and zero-inflated negative binomial regression analyses estimated the association between analgesic use and WCH. Linear backward stepwise regression analysis was used to identify factors associated with WCH.
*Results:* Overall, risk of analgesic use increased significantly with increasing WCH scores (relative risk ratios ranging from 1.06 (95% CI 1.0 to 1.12%) to 1.34% (95% CI 1.15 to 1.57)). The incidence rate of analgesic use increased significantly with increasing WCH scores (incidence rate ratio 1.09 (95% CI 1.04 to 1.14)). Associations between the investigated possible antecedent factors and WCH were weak and not considered practically important ($R^2 =$ 0.05 or lower).
*Conclusions:* Higher WCH scores were associated with increasing risk of analgesic use, irrespective of the underlying reason for the use, in Danish youth elite athletes, suggesting that analgesics may be an ingrained part of a sport-specific culture of risk acceptance. Future studies should include measures of culture, norms, and social interaction to better explain the variance in WCH.


## Practical implications

- Analgesics may be an ingrained part of a sport-specific culture of risk acceptance, and the factors impacting sport-related use of analgesics may be present already at the youth level.
- Due to an association between analgesic use and willingness to compete hurt, youth elite athletes may be educated about the potential health-related consequences associated with masking signs of injury and pain.
- Coaches and sport medicine professionals should adhere to international guidelines and enforce inclusive, sustainable, and enjoyable participation at all levels of athletic achievement.

## 1. Introduction

The incidence of health problems, such as injuries and illness, is high in youth sports[1–3] and their impact on athlete health and development has received increasing attention in recent years.[4] International guidelines have been developed on youth athletic development emphasizing inclusive, sustainable, and enjoyable participation at all levels of athletic achievement.[4] Yet, competitive youth sports are increasingly characterized by a culture of risk, including pain normalization and risk

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glorification, increasing professionalism, and psychological stressors from internal and external performance expectations.[4–7] Consequently, studies report that competing despite underlying health problems is common among youth athletes.[8–10]

Ignoring health problems and delaying withdrawal from athletic competition may be associated with both short-term adverse events by acutely exacerbating symptoms, and long-term adverse events by potentially leading to persistent pain, disability, and recurring injuries.[11–13] Furthermore, a recent systematic review reported that analgesic use is common in youth athletes, and that a significant proportion of such use may be to mask pain and injury in relation to training and competition.[14] Yet, only few studies have tried to identify subgroups of youth elite athletes from various sports who engage in risk-taking behaviors by competing despite underlying health problems.[8] Further, it remains unknown whether this practice, also known as willingness to compete hurt (WCH), is associated with higher use of analgesics.

The aim of this study was to assess the association between use of analgesics and WCH in Danish youth elite athletes. In addition, we aimed to explore if any individual and sport-related factors, including gender, age, sport discipline, age at sport debut, age at sport specialization, participation in more than one sport, weekly sport exposure hours, competition level, and baseline injury were associated with WCH.

## 2. Methods

### 2.1. Design

In this cohort study we used data from the analgESic uSE iN youTh ellte AthLetes (ESSENTIAL) cohort investigating analgesic use in Danish youth elite athletes (link to protocol: https://osf.io/k5spz/). As the study only includes self-reported information, the Regional Scientific Ethics Committee of the region of Southern Denmark waived the need for ethical approval (case number 20202000-176). The project was approved by The Danish Data Protection Agency via University of Southern Denmark Research and Innovation Office (case number 11.642). The STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guideline was followed in the reporting of the study.[15]

### 2.2. Participants and recruitment

Participants were recruited from 24 high schools offering dual-career programs in collaboration with sport federations or Team Denmark (i.e., state funded organization responsible for the overall planning of elite sports). These schools were identified from a list of a total of 30 schools provided by representatives from Team Denmark. These high schools, varying in size, geographical location, and type of education program, constitute regular high schools with the possibility for young athletes to combine their sport with an education.

Participants were eligible for inclusion if they: (1) were considered youth elite athletes, (2) were between 15 and 20 years of age, (3) were able to read, speak, and understand Danish, and (4) could receive and respond to text messages using Short Message Services (SMS). As there is currently no international consensus on the classification of youth sport participation levels, athletes were considered *elite* if they were approved by Team Denmark or any local/regional sport talent development program. Participants were enrolled gradually during on-site visits at the 24 high schools by the first author between August and October 2022.

### 2.3. Data collection

The participants completed a baseline questionnaire assessing demographic information, sport history, and WCH using an electronic questionnaire accessible via a QR code, from which mobile phone numbers were obtained to prospectively collect data using a SMS system (www.sms-track.com). Every Sunday for 4 weeks, participants received between 1 and 3 standardized questions on their use of analgesics in the preceding 7 days. If a participant did not respond, reminder text messages were sent 24 and 72 h after receiving the first SMS. Participants not replying for three consecutive weeks were contacted by phone.

### 2.4. Outcomes

#### 2.4.1. Willingness to Compete Hurt (WCH)

The WCH scale is a self-administered instrument used to evaluate athletes' attitudes toward abstaining from competing due to common health events. WCH consists of four statements:

1) I abstain from competing if I do not feel physically resilient
2) I abstain from competing if I have joint pain without moving
3) I abstain from competing if I must use pain killers
4) I abstain from competing if I have a fever or cold.

Athletes were asked to assess their extent of agreement with each statement on a 5-point Likert scale ranging from strongly disagree (1 point) to strongly agree (5 points). As recommended, scores were reversed so that higher values on the aggregate score (range 4–20) represented higher willingness to compete hurt. The development, validity, and reliability of the WCH scale have been documented by Mayer et al.[8] WCH data was collected at baseline.

#### 2.4.2. Analgesic use

As no validated questionnaires on analgesic use in youth elite athletes were identified, the questionnaire was specifically developed for the cohort study to measure self-reported weekly use of analgesics. The development and content validation of the questionnaire were performed following the guidelines by Patrick et al.[16,17] and the COSMIN guidelines for developing and validating patient-reported outcome measurement instruments.[18] First, the construct to be measured, context of use, and the population of interest were defined, and a literature search was conducted to identify components of analgesic use in youth athletes and existing survey tools. Next, a conceptual model was identified, and a hypothesized conceptual framework was created to identify overarching concepts, hypothesized domains, and candidate item content. Based on the hypothesized conceptual framework, two interview guides were developed, and interviews were performed with three researchers and 7 members of the target population (i.e., youth elite athletes aged 15–20 years). The interview data was analyzed, and a questionnaire draft was developed. Subsequently, the questionnaire was pilot tested using one-to-one cognitive interviewing in another group of youth elite athletes ($n = 7$). Weekly analgesic use in the preceding 7 days was assessed with 1–3 standardized questions. The first question was '*How many days in the previous 7 days did you use analgesics*?' Answer options included 0, 1, 2, 3, 4, 5, 6, or 7 days. To avoid inconsistent replies, a gate-keeper logic was applied, so if a participant replied '0 days', the questionnaire was finalized. If a participant replied 1–7 days of use, participants received two further questions on reasons for use and types of analgesic used (Supplementary Table 1).

#### 2.4.3. Predictors of WCH

Potential predictors of WCH were chosen based on previous publications[8,19,20] as well as the theoretical framework of *Culture of risk*.[21] The degree of socialization into the elite sport environment is assumed to be a determinant of risk acceptance and WCH.[21] In this context, sport-specific structural indicators (i.e., performance level, duration of socialization, participation in more than one sport, and sport exposure hours) should be examined. As a systematic review found that youth sport specialization is associated with an increased risk of sport-related injuries,[20] and playing through pain and injury is considered a main feature of the risk acceptance culture,[21] the presence of baseline injury was examined. As previous studies have described how particular sport disciplines have specific risk acceptance cultures

that influence athletes' perceptions of pain and injury,[8,22] type of sport was included as a potential predictor. Finally, age and gender were included as contradicting findings have been reported on the effect of these variables on WCH.[8,19,21,23]

### 2.5. Statistics

Demographic variables for continuous variables were presented as mean ± SD or median (interquartile range), depending on their distribution, and as frequency and percentage distribution for categorical variables. Descriptive analyses of the WCH items and weekly prevalence of analgesic use were presented as frequency and percentage distributions.

To assess the association between WCH (continuous exposure variable) and use of analgesics, two analyses were performed. First, a multinomial logistic regression analysis was performed with analgesic use as a categorical outcome variable (i.e., no use of analgesics in any weeks, use in 1 week, use across 2 weeks, use across 3 weeks, and use across 4 four weeks). The results were summarized as relative risk ratios (RRR) with 95% confidence intervals (95% CI) (0 weeks used as reference category). The Cuzick test for trend was performed. Based on the multinomial regression analysis, the predicted probabilities of each level of the outcome variable (number of weeks with analgesic use) per one-point increase in WCH score were visualized in graph. Second, a zero-inflated negative binomial regression analysis was performed with analgesic use as a count outcome variable (i.e., the total number of days with analgesic use across all 4 weeks [possible range 0–28 days]). The results were summarized as incidence ratios (IRR) with 95% CI. Overdispersion was tested using a likelihood ratio test comparing the model fit of a Poisson regression analysis to a negative binomial regression analysis. For these two analyses (i.e., multinomial and zero-inflated negative binomial regression), three models are presented: 1) a crude model (described above), adjusted model (including age, gender and BMI as covariates), and fully adjusted model (including age, gender, BMI, type of sport, age at sport debut, age at sport specialization, weekly sport exposure hours, participation in more than one sport, and competition level as covariates). Additionally, to test whether the association between WCH and analgesic use was modified by gender, interaction terms were included in the multinomial and zero-inflated negative binomial regression analyses.

To explore individual and sport-related factors associated with WCH, a linear backward stepwise regression analysis was used to assess the association between WCH scores (continuous outcome variable) and gender, age, sport discipline (i.e., endurance sport [reference category], technical sport, team sport), age at sport debut, age at sport specialization, participation in more than one sport, weekly sport exposure hours, competition level (i.e., regional [reference category], national, international), and baseline injury. First, all candidate variables were included in the model and the least significant variable was removed by backward elimination using a cutoff of $p < 0.1$. The results were summarized as regression coefficients with 95% confidence intervals and p-values. $R^2$ and adjusted $R^2$ were examined to describe how well the model explained the overall variance. Prior to performing the linear backward stepwise regression and zero-inflated negative binomial regression analyses, collinearity was investigated by calculating variance inflating factors (VIFs) for all independent variables. As collinearity among predictors does not inflate coefficient standard errors in the same way in non-linear models (i.e., zero-inflated negative binomial regression), the VIF statistics output does not allow for meaningful interpretation. As such, potential collinearity in the zero-inflated negative binomial regression analysis was investigated by running the model as a linear model (despite being a count outcome). The level of collinearity was considered unproblematic if individual VIFs were <10 and the mean VIF was <4.[24] Only participants with full data available on analgesic use were included in the analysis. The statistical analyses were performed in Stata version 17 (StataCorp 2021, College Station, TX, USA).

## 3. Results

### 3.1. Participants

In total, 735 youth elite athletes completed the baseline questionnaire and were included in the ESSENTIAL cohort. Of the 735 participants, 22 dropped out during the first four weeks of the study without providing any prospective data. One hundred and twenty-one participants had incomplete data on analgesic use in at least one week and were excluded, leaving 592 participants (81%) available for this study. Participants represented 43 different sports, had a mean (SD) age of 17.1 (1.1) years, and 43% of them were female (Table 1). Sport disciplines were categorized into three major categories in accordance with a previous study (i.e., team sports, endurance sports, and technical sports) (Supplementary Table 2).[2] Baseline characteristics of included participants were similar to those lost to follow-up or excluded (Supplementary Table 3). In general, a higher proportion of participants with missing data (i.e., excluded in analyses) reported using analgesics across the 4 weeks compared to participants with full data available (Supplementary Table 4A). There was no consistent pattern in frequency of use between participants with missing data and participants with full data available (Supplementary Table 4B).

### 3.2. WCH scores and analgesic use

More than half of youth elite athletes perceived it unnecessary to abstain from competing when not feeling physically resilient (65%), when having to use analgesics (68%), or having a fever or cold (55%). The reason considered most valid for abstaining from competing was experiencing joint pain without moving (32%) (Supplementary Table 5). The mean overall WCH score was 14.2 (SD 3.2) (range 4–20; higher scores indicating higher WCH).

The 1-week prevalence of analgesic use during the 4 weeks ranged from 24.0% (95% CI 20.6 to 27.6) to 29.7% (95% CI 26.1 to 33.6) (males 17.6–23.3%; females 29.6–38.1%). In total, 268 (45.2%), 149 (25.2%), 88 (14.9%), 61 (10.3%), and 26 (4.4%) used analgesics across 0, 1, 2, 3, and 4 weeks, respectively. The 4-week prevalence of analgesic use (i.e., analgesic use at least once in the past 4 weeks) was 54.7% (95% CI 50.6 to 58.8). The most common reasons for analgesic use were to treat pain not associated with sport, to treat pain/injury after sport participation, and to treat pain/injury prior to sport participation. The most used analgesic drugs were paracetamol, NSAIDs, and topical gels (Supplementary Table 6).

**Table 1**
Participant baseline characteristics.

| | Participants (n = 592) |
|---|---|
| Age, mean (SD): years | 17.1 (1.1) |
| Female, n (%) | 257 (43%) |
| BMI, mean (SD) | 21.9 (2.8) |
| Weekly sport exposure, median (IQR): hours | 15 (12–20) |
| Type of sport, n (%) | |
| Team sport | 275 (46.4) |
| Endurance sport | 117 (19.8) |
| Technical sport | 200 (33.8) |
| Competition level, n (%) | |
| Regional | 42 (7.1) |
| National | 277 (46.8) |
| International | 273 (46.1) |
| Age at sports debut, mean (SD): years | 7.5 (3.2) |
| Age at sports specialization, mean (SD): years[a] | 13.0 (2.3) |
| Current participation in more than one type of sport, (%) | |
| Yes | 50 (8.5) |
| No | 542 (91.5) |
| Sport-related injury at baseline, n (%) | |
| Yes | 319 (53.5) |
| No | 273 (46.5) |

[a] Missing n = 2.

**Table 2**
Results from regression analyses (n = 592) showing the association between WCH and number of weeks with analgesic use (top) and WCH and number of days with analgesic use (bottom).

| | Crude | Adjusted[a] | Fully adjusted[b] | Test for trend |
|---|---|---|---|---|
| WCH and number of weeks with analgesic use (RRR with 95% CI) | | | | |
| 0 weeks (reference) | | | | |
| 1 week | 1.07 (1.0 to 1.14) p = 0.04 | 1.07 (1.0 to 1.14) p = 0.05 | 1.06 (1.0 to 1.12) p = 0.05 | |
| 2 weeks | 1.06 (0.98 to 1.14) p = 0.16 | 1.06 (0.97 to 1.14) p = 1.18 | 1.07 (0.98 to 1.16) p = 0.11 | (p ≤ 0.001, z-value = 4.16, std. error = 21.00). |
| 3 weeks | 1.15 (1.05 to 1.26) p = 0.003 | 1.15 (1.05 to 1.27) p = 0.003 | 1.16 (1.05 to 1.27) p = 0.005 | |
| 4 weeks | 1.34 (1.16 to 1.55) p ≤ 0.001 | 1.35 (1.16 to 1.56) p ≤ 0.001 | 1.34 (1.15 to 1.57) p ≤ 0.001 | |
| WCH and number of days with analgesic use (IRR with 95% CI) | | | | |
| | 1.08 (1.04 to 1.13) p ≤ 0.001 | 1.09 (1.04 to 1.13)p ≤ 0.001 | 1.09 (1.04 to 1.14) p ≤ 0.001 | N/A |

[a] Adjusted for age, gender, and BMI.
[b] Adjusted for age, gender, BMI, type of sport, age at sport debut, age at specialization, weekly sport exposure hours, participation in more than one sport, and competition level.

### 3.3. Association between analgesic use and WCH

The results from the multinomial and zero-inflated negative binomial regression analyses are presented in Table 2. The analyses showed no evidence of moderation by gender and the results were, therefore, collapsed across gender (p-values ranging from 0.11 to 1.00 across levels of the exposure variable). Compared to no analgesic use, the relative risk of using analgesics for 1 week increased statistically significantly per one-point increase in WCH score (RRR 1.06 (95% CI 1.0 to 1.12)). Similarly, the relative risk of using analgesics across three and four weeks increased statistically significantly with increasing WCH scores (RRR 1.16 (95% CI 1.05 to 1.27) and 1.34 (95% CI 1.15 to 1.57), respectively). Test for trend for the association between WCH and prevalence of analgesic use was statistically significant (p ≤ 0.001, z-value = 4.16, std. error = 21.00). The predicted probabilities of not using analgesics decreased with increasing WCH scores. Contrarily, the predicted probabilities of using analgesics for 1 week, 3 weeks, and 4 weeks increased with increasing WCH scores (Fig. 1). The incidence rate of analgesic use increased statistically significantly per one-point increase in WCH scores (IRR 1.09 (95% CI 1.04 to 1.14)). Adjusting for age, gender, BMI, type of sport, age at sports debut, age at specialization, weekly sport exposure hours, participation in more than one sport, and competition level did not change the estimates (Table 2). No collinearity was detected between the independent variables included in the zero-inflated negative binomial regression analysis.

### 3.4. Factors associated with WCH

Only age at sports debut, baseline injury, and type of sport were significantly associated with WCH (Supplementary Table 7). Overall, the adjusted $R^2$ value indicated that the variables included in the regression analysis only explained 7% of the variability in WCH scores, which was mainly explained by participation in team sports being associated with higher WCH scores. No collinearity was detected between the independent variables included in the regression analysis.

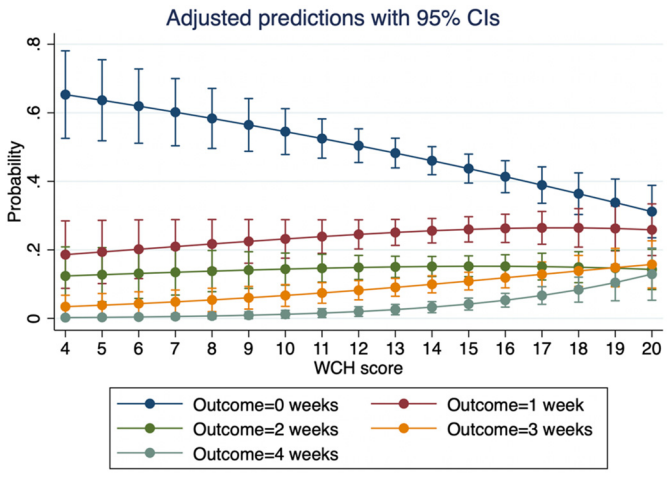


**Fig. 1.** Predicted probabilities with 95% CI of each level of the outcome variable per one-point increase in WCH score.

## 4. Discussion

This study assessed the association between WCH and use of analgesics and identified factors associated with WCH in Danish youth elite athletes. Overall, the risk and incidence rate of analgesic use increased significantly with increasing WCH scores. Associations between the investigated possible antecedent factors and WCH were weak and not considered practically important.

Despite indications of widespread use of analgesics in youth sports,[14] no studies have specifically assessed how analgesics may be a potential coping strategy for youth elite athletes to compete despite underlying health problems. A cross-sectional study of 775 senior elite athletes found that analgesics use was a common strategy for injured athletes to compete in an important match, to train during an important period, to qualify for a match/final, and keep a position on the team.[25] Overall, we found increasing risk and increasing incidence rate of analgesic use with increasing WCH scores, and the descriptive analysis of WCH items revealed that having to take analgesics was considered the least valid reason for abstaining from competing. These findings indicate, firstly, that analgesics may be an ingrained part of a sport-specific culture of risk acceptance, and secondly, that factors impacting sport-related use of analgesics are present already at the youth level.

No important associations between the investigated factors and WCH were observed. This is in contrast to the findings of two studies including German senior and youth elite athletes, both reporting an association between type of sport and WCH.[8] It has been proposed that the extent of risk-taking behaviors in sports is shaped by sport-specific performance constraints and norms, which differently mediate the characteristics of the *culture of risk*.[8,21] For example, compared to athletes from technical or endurance sports, team sport athletes may to a larger extent be affected by fear of letting the team down, pressure from teammates, and low player availability.[10] However, in our study, the association between type of sport and WCH was negligible, suggesting that while differences may exist in how risk-acceptance is mediated across different types of sport, the resulting effect on the participating youth elite athletes' attitudes toward competing with underlying health problems is invariant across sport types. In addition to type of sport, Mayer et al.[8] found that WCH was mainly predicted by an autocratic coach leadership style and perceived social pressure. This agrees with previous studies showing that injured youth athletes experience pressure to keep playing from coaches, parents, and other athletes,[5,6,10] and conforms with Nixon's theoretical framework of *Culture of Risk*, highlighting the importance of cultural influences on athletes' acceptance of sport-related pain and injury.[21]

WCH scores were not influenced by gender, thus supporting previous findings indicating no gender-specific differences in risk acceptance

or perceived absence legitimacy in youth elite athletes.[8,19] Similarly, age at sport specialization was not significantly associated with WCH. Similar findings were reported by Schnell et al.[19] and indicate that socialization into the sport-specific risk culture starts earlier than at progression to the youth elite level. This notion is supported by research showing that key elements of *culture of risk* are not confined to professional or elite-level sports, but that they are also characteristics of non-elite sports environments.[26,27] The remaining variables including age, participation in more than one sport, weekly sport exposure hours, and competition level were also not related to WCH, suggesting that risk acceptance largely is independent of sport-specific or general sociodemographic variables and may to a larger extent be impacted by psychosocial factors.

Approximately half of the included athletes reported having used analgesics at least once in the preceding 4 weeks. This percentage is comparable to that of Scandinavian non-athlete adolescents which has been estimated to range between 33 and 70% for females and 25 and 50% for males.[28] A previous systematic review on the use of analgesics in adolescents showed that the prevalence of analgesic use ranged from 8 to 75% across settings and assessment time-points (e.g., 1-week prevalence, 3-month prevalence). Using studies with school-based samples only, the prevalence of analgesic use was lower (8–42%).[29] However, large variations in sampling strategy, participant age, and methods of estimating analgesic use, hinder direct comparisons between youth athletes and non-athletes.

### 4.1. Limitations

This study has limitations. Although the WCH instrument was based on theoretical reflections, consensual validation among experts and researchers, as well as qualitative and quantitative research,[8] its development did not comply fully with internationally accepted standards for developing and validating patient-reported outcome measures. Additionally, the WCH instrument has not formally been translated or validated in a Danish athlete population. However, as all items address commonly occurring health problems, bias resulting from lack of cross-cultural validation may be considered low. All reasons for analgesic use were included in the analyses, although some may not have been specific to sport participation. However, as the WCH questionnaire includes items relating to illness (i.e., having a fever or cold) and general well-being (i.e., not feeling physically resilient), sufficient agreement between the constructs measured in the WCH questionnaire and the ones measured in the analgesic use questionnaire may be assumed. Furthermore, a previous systematic review reported that youth athletes may use analgesics to block symptoms from illness, including headaches and fever, to allow for sport participation,[14] further limiting our ability to stratify reasons for analgesic use into sport-related use and non-sport related use. In this study, we labeled the participants in dual-career programs as 'youth elite', as these athletes are considered by the national sports federation and Team Denmark as the most promising youth athletes (i.e., squad for national teams) based on several sport specific criteria. But we acknowledge that this does not necessarily imply that these youth athletes will progress to the senior elite level. A limited number of variables were available for the analysis of factors associated with WCH. As previous qualitative and quantitative studies suggest that aspects of cultures, norms, and social interaction may be important factors in determining an athlete's perception and acceptance of injury and illness,[8,19] including such measures would have provided greater and more nuanced insights. In 3 out of 4 weeks, a higher proportion of participants with missing data (i.e., excluded in analyses) reported using analgesics compared to participants with full data available. While this may indicate presence of non-response bias, only few participants had missing data across all 4 weeks.

Finally, it remains unknown whether any systematic differences exist between high school offering dual-career programs and high schools that do not. However, due to the high number of included high schools with large variations in geographical location, size, and type of education programs, we argue that any potential differences may be random rather than systematic.

## 5. Conclusion

Higher *willingness to compete hurt* scores were associated with increasing risks and incidence rates of analgesic use, irrespective of the underlying reason, for the use in Danish youth elite athletes, suggesting that analgesics may be an integrated part of a sport-specific culture of risk acceptance. Associations between the investigated possible antecedent factors and WCH were weak and not considered practically important ($R^2 = 0.05$ or lower). Further qualitative and quantitative research including measures of culture, norms, and social interaction are needed to better explain the variance in WCH.

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The funding sources had no role in the collection, analysis or interpretation of the data, and had no rights in approving or disapproving publication of the finished manuscript.

## Confirmation of Ethical Compliance

As the study only includes self-reported information, the Regional Scientific Ethics Committee of the region of Southern Denmark waived the need for ethical approval (case number 20202000–176). The project was approved by The Danish Data Protection Agency via University of Southern Denmark's Research and Innovation Office (case number 11.642).

## CRediT authorship contribution statement

**Julie Rønne Pedersen:** Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Project administration, Funding acquisition. **Merete Møller:** Conceptualization, Methodology, Writing – review & editing, Supervision, Funding acquisition. **Louise Kamuk Storm:** Conceptualization, Methodology, Writing – review & editing, Supervision, Funding acquisition. **Bart Koes:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Nikos Ntoumanis:** Conceptualization, Methodology, Writing – review & editing. **Jonas Bloch Thorlund:** Conceptualization, Methodology, Writing – review & editing, Supervision, Funding acquisition.

## Declaration of Interest Statement

JBT has been PI on a research grant by Pfizer outside the submitted work (completed in 2022). The remaining authors declare no conflicts of interest.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jsams.2023.08.181.

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