

# Opioid Use in Athletes: A Systematic Review

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**Context:** The opioid epidemic has been well-documented in the general population, but the literature pertaining to opioid use and misuse in the athletic population remains limited.

**Objectives:** The objectives of this study were to seek answers to the following questions: (1) what are the rates of opioid use and misuse among athletes, (2) do these rates differ compared with the nonathletic population, and (3) are there specific subgroups of the athletic population (eg, based on sport, level of play) who may be at higher risk?

**Data Sources:** The Embase, MEDLINE, and PubMed were used for the literature search.

**Study Selection:** Records were screened in duplicate for studies reporting rates of opioid use among athletes. All study designs were included.

**Study Design:** Systematic review.

**Level of Evidence:** Level 4.

**Data Extraction:** Data regarding rates of opioid use, medication types, prescription patterns, and predictors of future opioid use were collected. Study quality was assessed using the Methodological Index for Non-Randomized Studies (MINORS) criteria for clinical studies and 5 key domains previously identified for survey studies.

**Results:** A total of 11 studies were eligible for inclusion (N = 226,256 athletes). Studies included survey studies and retrospective observational designs. Opioid use among professional athletes at any given time, as reported in 2 different studies, ranged from 4.4% to 4.7%, while opioid use over a National Football League career was 52%. High school athletes had lifetime opioid use rates of 28% to 46%. Risk factors associated with opioid use included Caucasian race, contact sports (hockey, football, wrestling), postretirement unemployment, and undiagnosed concussion. Use of opioids while playing predicted use of opioids in retirement.

**Conclusion:** Overall, opioid use is prevalent among athletes, and use during a playing career predicts postretirement use. This issue exists even at the high school level, with similar rates to professional athletes. Further higher quality observational studies are needed to better define patterns of opioid use in athletes.

**Keywords:** opioids; narcotics; athletes

The opioid crisis in North America has been well-documented in both the scientific literature<sup>24</sup> and the popular media.<sup>8</sup> It is difficult to overstate the scale of the problem; the Centers for Disease Control and Prevention has declared it an “epidemic,”<sup>5</sup> and the Government of Canada has declared the issue a “public health emergency.”<sup>10</sup> Approximately 140 people die every day from an opioid overdose in Canada and the United States,<sup>5,10</sup> translating to over 70,000 deaths annually, a number that continues to climb.<sup>19</sup>

Prescription opioids are often described as being responsible for the “first wave” of the opioid crisis<sup>5</sup> and are hypothesized to act as a potential “gateway” to opioid abuse and the use of illicit opioids.<sup>16</sup> Illicit drugs are those defined as those banned by international drug control treaties.<sup>12</sup> Athletes are at risk for musculoskeletal injury, and “playing through pain” has become normalized and often expected of high-level athletes.<sup>3</sup> These factors, as well as professional athletes seeking to maximize earning potential over relatively short careers, place elite

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athletes at risk of opioid overuse and misuse. Opioid use is defined as the use of opiates as prescribed by a healthcare provider. Opioid misuse captures use outside of prescription parameters, but not reaching the threshold for dependency, addiction, or recreational use, which all fall under “abuse.”<sup>5</sup> A number of recent studies have provided empirical evidence that opioid use is a significant concern among athletes, including, most concerning, at the high school level.<sup>7,9,22,28</sup>

Despite athletes being at high risk for opioid use and misuse, the literature on opioid use among elite athletes is scarce. Thus, the aim of this study was to systematically review the available literature on opioid use in athletes. Specifically, we aimed to answer the following questions: (1) what are the rates of opioid use and misuse among athletes, (2) do these rates differ compared with the nonathletic population, and (3) are there specific subgroups of the athletic population (eg, based on sport, level of play), who may be at higher risk?

## METHODS

### Protocol and Registration

A protocol was developed for this systematic review prior to article screening, which contained relevant background literature, the search strategy, and inclusion and exclusion criteria. This study was conducted in adherence with the Cochrane Handbook for Systematic Reviews of Interventions<sup>13</sup> and reported according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.<sup>15</sup>

### Eligibility Criteria

Studies included were of levels 1 through 4 evidence, including conference abstracts, that reported on opioid use in athletes. No restrictions were placed on date or language of publication. Studies were excluded if they included athletes but did not stratify results by involvement in sports.

### Information Sources and Search

The electronic databases MEDLINE, PubMed, and Embase were searched on April 8, 2019. Search terms were kept intentionally broad to capture all available literature and were as follows: *opioid*, *opiate*, *pain medication*, *athlete*, and *sport*. The full search strategy for each database is available in Appendix 1 (available in the online version of this article).

### Study Selection

The studies were screened in duplicate by 2 reviewers in 3 stages: title, abstract, and full text. Any discrepancies at the title and abstract stages were resolved by automatic inclusion in the next stage. Any discrepancies at the full-text stage were resolved through consensus and discussion with a senior author as needed.

### Data Collection Process

Data were extracted into a Microsoft Excel spreadsheet (Microsoft) and audited by an independent author for accuracy.

### Data Items

Data collected included study characteristics, sample size, sports included, level of play, data sources, rates of opioid use, and adverse events associated with opioid use.

### Risk of Bias in Individual Studies

Risk of bias for clinical studies was assessed using the Methodological Index for Non-Randomized Studies (MINORS) criteria. The MINORS score consists of 8 items for non-comparative studies and an additional 4 items for comparative studies, with each item scored from 0 to 2, for maximum scores of 16 and 24, respectively.<sup>21</sup> Higher scores indicate better methodological quality. No established cutoffs exist to interpret MINORS scores, but scores closer to the maximum are preferable. Risk of bias for survey studies was performed based on the items suggested by Agarwal et al,<sup>1</sup> who identified 5 key items to assess risk of bias in a survey study.

### Summary Measures

Given the expected low quality of evidence, no meta-analysis was planned or performed. Basic demographic data are represented descriptively, and individual study results are described qualitatively and with descriptive statistics where appropriate. Means are presented  $\pm$  SD for normally distributed data, and medians presented with interquartile range for nonnormally distributed data. Odds ratios (ORs) and 95% CIs are also presented where appropriate.

## RESULTS

### Study Selection

The initial search resulted in 1371 results. Ultimately, 11 studies met the eligibility criteria for inclusion in this systematic review<sup>4,7,11,17,20,23,25-29</sup> (Figure 1).

### Study Characteristics

The 11 included studies were published between 1998 and 2018. The majority of studies<sup>4,7,11,21,23-27</sup> were performed in the United States ( $n = 9$ ; 82%), with the remaining studies performed in Croatia<sup>18</sup> and Brazil/Switzerland<sup>15</sup> ( $n = 1$  each; 9%). Nine studies were available in full text,<sup>4,7,17,20,25-29</sup> while 2 were available only as abstracts.<sup>11,23</sup> One study was a prospective longitudinal survey study,<sup>28</sup> 4 studies were retrospective database or chart review studies,<sup>4,11,15,21</sup> and 6 studies were retrospective survey studies.<sup>7,20,26-29</sup> A total of 226,256 athletes were included, ranging in level from high school to professional athletes (Table 1).

### Risk of Bias Within Studies

Only 2 studies were eligible for assessment by MINORS criteria, one<sup>4</sup> with a score of 8 out of 16 and the other<sup>17</sup> with a score 10 out of 16. Among the 7 survey studies, overall risk of bias was quite low. Every study rated as low risk of bias on at least 3 of 5 domains, with 31 out of 35 (89%) assessments being deemed as

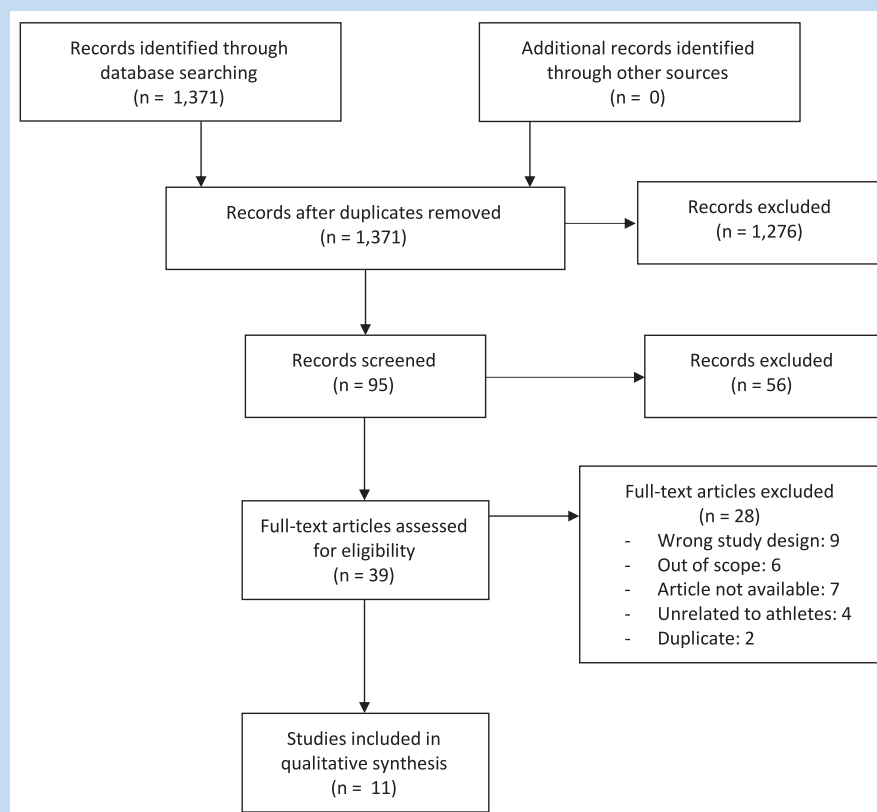


Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram.<sup>13</sup>

low risk of bias. Figure 2 includes the detailed risk of bias assessment for survey studies.

## Results of Individual Studies

The sports evaluated in the included studies were baseball (Major League Baseball [MLB]),<sup>4</sup> football (National Football League [NFL]),<sup>7</sup> futsal (World Cup),<sup>17</sup> and dance.<sup>20</sup> The remaining studies included a wide range of sports. Boren and Erickson<sup>4</sup> evaluated causes of death among MLB athletes and identified 4 cases of death due to opioid overdose between 1889 and 1995.<sup>4</sup> Pedrinelli et al<sup>17</sup> demonstrated that 4.4% of athletes competing at the Fédération Internationale de Football Association Futsal (FIFA) World Cup were being prescribed opioids. This is consistent with the findings of Sekulic et al,<sup>20</sup> who surveyed professional and amateur dancers, finding that 4.7% had used opioids in the past.

Cottler et al<sup>7</sup> surveyed 644 retired NFL athletes about their opioid use during and after their NFL careers. They found that 52% of athletes had used prescription opioids during their NFL career, of whom 71% had misused them. At the time of survey, those who had used opioids during their NFL career were much more likely to have used opioids in the past 30 days compared with those who had not used opioids during their career (26.2% vs 7.1%; OR, 4.6; 95% CI, 2.8-7.6;  $P < 0.0001$ ). Overall rate of opioid use in the past 30 days was 17.1%, while rate of misuse was 7.0%. Risk factors for

opioid use while playing in the NFL included Caucasian race, offensive lineman, having had any injury while in the NFL, undiagnosed concussion, and having had a career-ending injury. Risk factors for continued opioid use in retirement were as follows: unemployed status, back injury while in the NFL, 3 or more injuries while in the NFL, undiagnosed concussion, and alcohol abuse.<sup>7</sup>

Six studies assessed opioid use among high school athletes.<sup>11,25-29</sup> Rates of having ever used opioids ranged from 28.4% to 46.4%, based on data from 2009 to 2013.<sup>27,28</sup> Athletes participating in wrestling and football were at significantly higher risk of nonmedical use of opioids compared with other sports.<sup>29</sup> One study found that having participated in high school sports was a predictor of opioid use and misuse while in college.<sup>27</sup> Lifetime heroin use among high school students ranged from 0.9% to 1.5%,<sup>25,26</sup> with involvement in ice hockey and wrestling being significantly associated with heroin use.<sup>26</sup> Encouragingly, however, the rates of heroin use had declined between 1997 and 2014, and daily sport participation was actually found to be protective against heroin use, though this relationship is not necessarily causal.<sup>25</sup>

## DISCUSSION

The key finding of this systematic review is that there is a lack of high-quality literature available on the topic of opioid use

Table 1. Characteristics of included studies

Authors	Year	Country	Type of Study	Level of Evidence	Number of Patients/Athletes Studied	Sport/Level of Athletes
Boren and Erickson <sup>4</sup>	1998	USA	Retrospective review (of death certificates)	4	All professional baseball players from 1889-1995	MLB baseball
Cottler et al <sup>7</sup>	2011	USA	Phone interview survey (retrospective)	4	644	NFL football
Grieb et al <sup>11</sup>	2017	USA	Retrospective case series	4	14,172	All levels
Pedrinelli et al <sup>17</sup>	2015	Brazil/Switzerland	Retrospective review of official team doctor documents	4	1064	World Cup Futsal
Sekulic et al <sup>20</sup>	2008	Croatia	Retrospective survey	4	43	Dancers (90% amateur)
Twark <sup>23</sup>	2018	USA	Retrospective chart review	4	5	Collegiate or above
Veliz et al <sup>28</sup>	2014	USA	Longitudinal survey (prospective)	3	1540 students (68% response rate, 83% retention)	Middle/high school athletes (Southeast Michigan)
Veliz et al <sup>29</sup>	2013	USA	Retrospective survey study	4	13,636	8th/10th grade students
Veliz et al <sup>27</sup>	2015	USA	Retrospective survey study	4	3442	University students who played interscholastic high school sports
Veliz et al <sup>25</sup>	2016	USA	Retrospective survey study	4	191,682	N/A
Veliz et al <sup>26</sup>	2017	USA	Retrospective survey study	4	Not described	12th grade students, competitive sports

MLB, Major League Baseball; N/A, not applicable; NFL, National Football League.

and misuse in athletes. Nonetheless, this review has identified that opioid use is an issue among athletes, with concerning high rates of use among high school athletes. In addition, opioid use at each sequential level of competition (ie, high school, college, professional) seems to predict future opioid use and misuse. Furthermore, these effects extend into retirement

and can be exacerbated by other difficulties common in retired professional athletes (eg, unemployment). Contact sports (eg, ice hockey, football, wrestling) are most commonly found to be predictors of opioid use and misuse.

The finding that one-quarter to one-half of high school athletes have used nonprescription opioids is perhaps the most

Author	Title	Year	Representativeness of the Sample	Adequacy of Response Rate	Missing Data	Pilot Testing	Established Validity
Cottler et al.	Injury, Pain, and Prescription Opioid Use Among Former National Football League (NFL) Players	2011	Definitely Yes	Probably No	Probably Yes	Definitely Yes	Probably No
Sekulic et al.	Substance Use in Dance Sport	2008	Probably No	Definitely Yes	Definitely Yes	Definitely Yes	Definitely No
Veliz et al.	Painfully Obvious: A Longitudinal Examination of Medical Use and Misuse of Opioid Medications Among Adolescent Sports Participants	2014	Definitely Yes	Definitely Yes	Definitely Yes	Definitely Yes	Definitely Yes
Veliz et al.	Playing Through Pain: Sports Participation and Nonmedical Use of Opioid Medications Among Adolescents	2013	Definitely Yes	Definitely Yes	Definitely Yes	Definitely Yes	Definitely Yes
Veliz et al.	Opioid Use Among Interscholastic Sports Participants: An Exploratory Study From A Sample Of College Students	2015	Definitely Yes	Definitely Yes	Definitely Yes	Definitely Yes	Definitely Yes
Veliz et al.	Nonmedical Prescription Opioid and Heroin Use Among Adolescents Who Engage in Sports and Exercise	2016	Definitely Yes	Definitely Yes	Definitely Yes	Definitely Yes	Definitely Yes
Veliz et al.	Nonmedical use of prescription opioids and heroin use among adolescents involved in competitive sports	2017	Definitely Yes	Definitely Yes	Definitely Yes	Definitely Yes	Definitely Yes

Figure 2. Risk of bias across survey studies.

important and concerning finding of this review. Given the increasing attention and publicity associated with promising young athletes, the pressure to perform at a high level from an early age has reached unprecedented levels. Accordingly, concerns with early sports specialization and overuse injuries in recent years have been well documented.<sup>14,31</sup> The fact that the rates of opioid use among high school athletes approaches those of NFL athletes is a disturbing finding. While opioid use and misuse is a concern at any level, high school athletes who are not playing for a salary and whose athletic future is uncertain are in a much more vulnerable position.

The ongoing opioid crisis in North America continues to claim lives, and efforts aimed at reversing the trend are under way.<sup>16</sup> Sports medicine physicians who treat athletes need to be aware of their role in this effort. Athletes have long been celebrated for their ability to battle through pain and injury, dating back to ancient Roman gladiators and Greek Olympians.<sup>2</sup> More recent examples include Curt Schilling pitching in Game 6 of the 2004 World Series as blood from a percutaneous tendon repair soaked his sock, and Kirk Gibson coming in to Game 6 of the 1998 World Series to hit a homerun despite bilateral leg injuries that had kept him out of the game initially. Operating in this environment, it is not difficult to see why athletes may be motivated to fight through injuries at all costs, particularly when a big game or a championship is on the line. Thus, it is important for treating physicians to understand and recognize risk factors identified in this systematic review, such as contact sport involvement, and to have a high index of suspicion for opioid use and misuse among athletes.

Sufficiently treating an athlete's pain while limiting the risk of adverse events is a challenging task. Narcotics have been on the "prohibited list" from the World Anti-Doping Agency since the list was created in 1967.<sup>30</sup> A treating physician must strike a balance between treating the athlete's pain appropriately while cautiously monitoring for and identifying any patterns of use or misuse. In the professional sports context, the athlete's income and the team's need for the athlete's services are external pressures that may play into the desire for or against the use of analgesia and expedited return to play. Clearly, given that the rates of use among high school athletes are similar, these influences do not fully explain the reasons behind athletes' opioid use.

The strengths of this study include rigorous methodology and strict adherence to Cochrane and PRISMA guidelines. As well, it addresses a topic of great public interest in a population that is not often considered when it comes to opioid use. Finally, it identifies certain sports and positions that may put athletes at higher risk of developing opioid use and/or misuse, which can help inform both clinical practice and generate hypotheses for future studies.

This study is primarily limited by the quality of evidence available. No studies above level 3 were eligible for inclusion. Thus, it was not possible to pool data or perform a meta-analysis. In addition, the studies varied greatly in their methodology and sources of information used, which makes it difficult to compare rates of opioid use and misuse directly between studies.

Future studies should focus on high-quality and prospective designs to help further elucidate the issue of opioid use in athletes and assess for any temporal trends. Furthermore, it is important to understand prescription and access patterns—where are adolescents and young adults accessing opioids, whether from their family doctor, team doctor, trainers, or family members? Prospective cohort and mixed methods studies may be of most value in this context, helping to establish true prevalence of opioid use and abuse among athletes.

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