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An Examination of WHOOP Fitness Band Usage in College Athletics

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Abstract

Wearable technology is novice and beneficial in its ability to retrieve real-time data with minimal hindrance to the performance and mobility of its users. WHOOP fitness band captures physiological metrics and turns them into three metrics: Strain, sleep, and recovery. These metrics allow for personalized monitoring of training metrics to help guide workload. WHOOP bands were distributed to 56 Division II collegiate athletes participating in three sports: Softball (15), women's Lacrosse (15), and Baseball (25). Women's Lacrosse indicated a negative correlation between the hours of sleep players received the day before a game and their respiratory rate during their game (r = -0.55) and a positive correlation between the hours of exercise the day before a game and the respiratory between hours of sleep the day before and respiratory rate the day of the game (r = -0.46) and a moderate negative correlation between hours of exercise the day before a game and the respiratory rate the day of the game (r = -0.55). Baseball indicated a negative correlation between sleep quality the night before the game and duration of exercise the day of the game (r = -0.61). Our examination of performance metrics for three Division II athletic teams using WHOOP fitness straps found that variables differed between teams. Coaches can use WHOOP fitness bands to assist in training and recovering by monitoring pre-game training load, intensity, and sleep.

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INTRODUCTION

Wearable smartwatches and fitness trackers have tremendously grown in commercial popularity within the last two decades (Braun-Trocchio et al., 2022). It is no secret that wearable technology companies continually add and utilize more sensors in their devices (Ringuet-Riot et al., 2013). More sensors allow for more data points to be collected, and hypothetically, this would allow users to gain more knowledge about their activities, physiological responses, and what these responses mean. While an influx of information is presented to the user, difficulties arise as users try to discern information beyond their scope of understanding.

WHOOP is an American wearable technology company that captures many physiological metrics, including heart rate variability (Labs, 2022; Støve & Hansen, 2022; Verma, 2021). By collecting these physiological actors, WHOOP turns them into three metrics: Strain, sleep, and recovery. WHOOP strain score measures and quantifies cardiovascular and muscular exertion placed on the body using volume and intensity of loan placed on the body. Sleep score is calculated by monitoring time in bed, hours asleep, sleep need, sleep performance, wake events, sleep efficiency, and stages of sleep. Lastly, the recovery score is calculated using heart rate variability, resting heart rate, sleep performance, and respiratory rate (Labs, 2023; Miller et al., 2021).

These metrics may allow coaches to personalize training that helps guide their players' load, rest, and recovery. Disturbed sleep patterns could hinder recovery after training or competition (Romyn et al., 2016) and affect recovery. Recovery may be an essential measuring factor when predicting and improving the athlete's performance (Jacob & Hong, 2021). Metrics are recorded 24 hours a day to provide more insight into physiology during activity, after activity, post-activity, or recovery (Labs, 2023).

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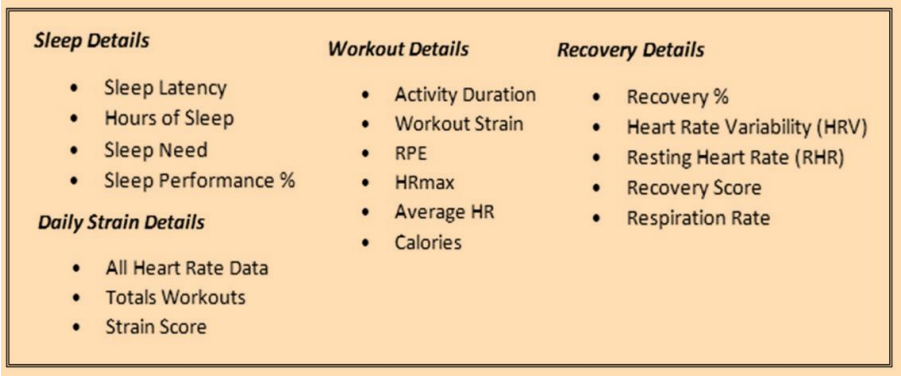
Given this, WHOOP has the potential to provide athletes and their coaches with access to data and performance metrics related to their individual Strain, recovery, and sleep. Current research and practices on WHOOP best usage in formal athletics programs have been limited, and results have varied from study to study (C. R. Bellenger et al., 2022; Brull, 2022; Gerardi, 2023; Nordstrom, 2023). This study aims to understand how WHOOP bands may be best used in college athletics.

METHOD

WHOOP bands were distributed to 56 Division II collegiate athletes participating in three sports: Softball(15), women's Lacrosse (15), and Baseball (25). Over six months,student-athletes were added to team-specific dashboards so coaches could access their team data. Athletes provided written informed consent to include their identified data, and the Human Research Ethics Committee approved the retrospective analysis of these identified data.

The data was gathered with the assistance of WHOOP by weekly usage reposts on all participants from recovery, Strain, and sleep into a customized Microsoft Excel spreadsheet. The data collected by WHOOP was used to assist in performance planning for their respective teams. Data measurements were composed of four main categories: "Daily Strain Details," "Recovery Details," "Workout Details," and "Sleep Details." For each week (i.e., Monday to Sunday) during the six-month research period, the mean daily Strain was calculated for each athlete to reflect the weekly training load. The mean weekly training load was calculated for each athlete over the 16-week recording period. Subsequently, individual weekly training loads were calculated as a percentage of the 16-week mean training load, such that each training week for each athlete could be presented as a percentage of the mean weekly training load during the recording period.

Figure 1. Performance Indicators



This research team analyzed the player data using Python 3.0 coding language to build a script to automate data cleaning and mining. Additionally, the script ran multiple Pearson correlation analyses that could reference the data based on the recorded date. Special attention was paid to the day before a game, the day of the game, and the day after a game. The selection of dates was specific to each team and their competition schedule to include the day before, day of, and day after competition for each day of competition for each sport. The data was run through the Google Collaborate IDE, which allowed for dynamic data analysis, updated daily.

RESULTS AND DISCUSSION

Women's Lacrosse

Regarding the Women's Lacrosse team, a moderate negative correlation was found between the hours of sleep players received the day before a game and their respiratory rate during their game ($r = -0.55$). The data presented trends that show that shorter sleep time the night before a game is associated with a higher respiratory rate the day of the game. The findings suggest players should increase pre-game sleep by an average of one hour.

A strong positive correlation was found between the hours of exercise the day before a game and the respiratory rate the day of the game ($r = 0.64$). The data presented trends that show that

longer hours of exercise are associated with a higher respiratory rate. The findings suggest players limit their training the day before a game to one hour to ensure proper recovery.

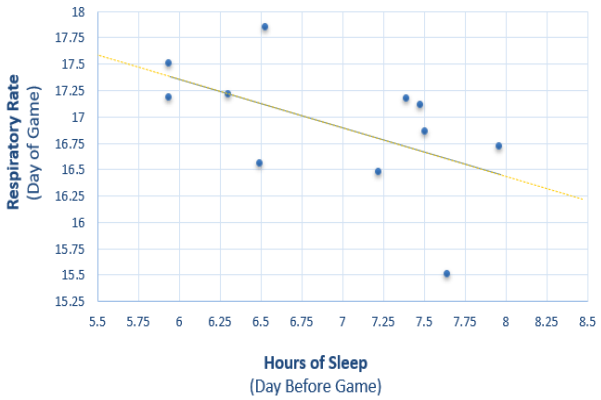


Figure 2. Correlation of hours of sleep the day before a game and respiratory rate the day of the game (r = -0.55) in women's Lacrosse

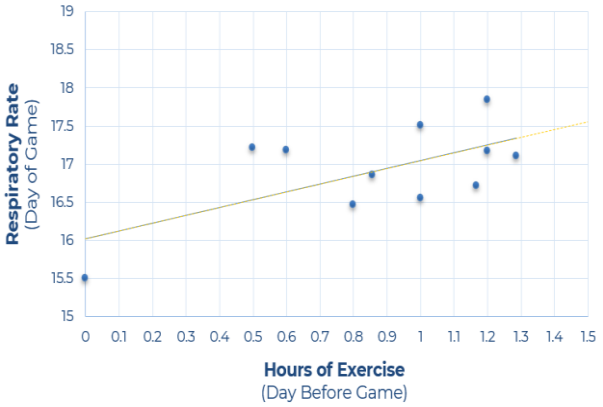


Figure 3. Correlation of hours of exercise the day before the game and respiratory rate the day of the game (r = 0.64) in Woman's Lacrosse

Softball

When looking at the Softball team, a medium negative correlation was found between hours of sleep the day before and respiratory rate the day of the game (r = -0.46). Like the women's lacrosse team, data indicates that shorter sleep time the night before a game is associated with a higher respiratory rate the day of the game. The findings suggest softball players needed at least seven hours of sleep the day before a game to aid recovery.

Additionally, there was a moderate negative correlation between hours of exercise the day before a game and the respiratory rate the day of the game (r = -0.55). The data shows trends that some physical activity aids in proper recovery. The findings suggest that players include at least one hour of physical activity before a game to help recover.

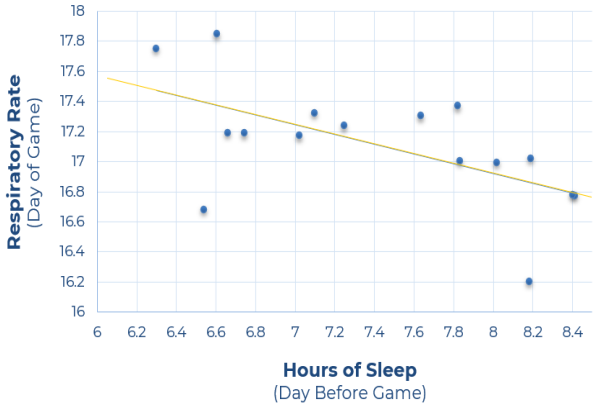


Figure 4. Correlation of hours of sleep the day before the game and respiratory rate the day of the game (r = -0.46) in Softball

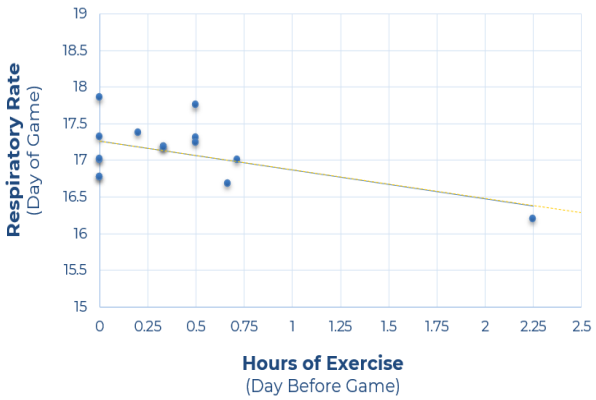


Figure 5. Correlation of hours of exercise the day before the game and respiratory rate the day of the game (r = -0.55) in Softball

Baseball

Regarding Baseball, there was a negative correlation between sleep quality the night before the game and duration of exercise the day of the game (r = -0.61). This indicates that while players slept enough through the night before games, sleep quality needs improvement.

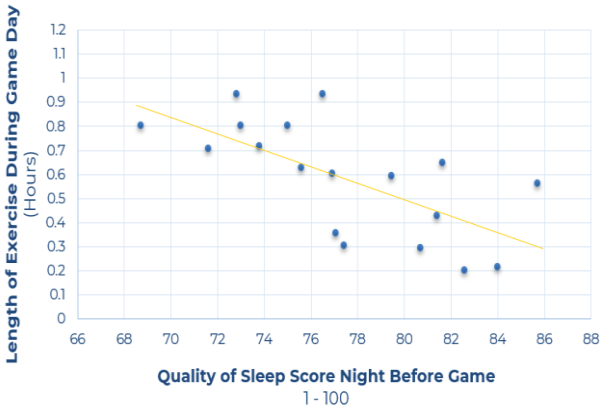


Figure 6. Correlation of quality the night before the game and respiratory rate the day of the game (r = -0.61) of Baseball

Discussion

Respiratory rate is one of the many vital metrics the WHOOP strap measures. While averaged metrics such as daily heart rate reserved or heart rate variability can fluctuate without many indications of physiological conditions, an increase in respiratory rate is generally associated with the indication of pathological conditions and stressors (Nicolò et al., 2020). Higher respiratory rates of the women's Lacrosse (r = -0.64) and softball athletes (r = -0.55) may indicate susceptibility to exercise-induced respiratory and muscle fatigue during competition. Additional increases may be caused by mental and emotional stress (Nicolò et al., 2017).

Studies have shown that sleep plays a crucial role in athletic performance, with adequate sleep being associated with improved cognitive function, reaction time, and overall physical performance (J. et al. et al., 2019). The moderate negative correlation found between the hours of sleep the night before a game and the respiratory rate during the game for both the women's Lacrosse (r = 0.55) and softball teams (r = 0.46) aligns with the understanding that shorter sleep time can lead to increased respiratory rate and decreased athletic performance (Walsh et al., 2021).

Similarly, recent research has highlighted the importance of exercise and recovery in optimizing athletic performance (Sekiguchi et al., 2019; K. C. Vitale et al., 2019). The strong positive correlation (r = -0.64) observed between the hours of exercise the day before a game and the respiratory rate during the game for the women's lacrosse team is supported by studies demonstrating the impact of exercise on respiratory rate and fatigue levels (Tramontin et al., 2022). Excessive exercise without adequate recovery can lead to increased fatigue, decreased performance, and higher respiratory rates (Ansdell et al., 2020; Nicolò et al., 2020).

The negative correlation between sleep quality the night before a game and the baseball team's exercise duration on the day of the game also aligns with existing research. Poor sleep quality has been associated with decreased athletic performance and increased fatigue levels (Lastella et al., 2015). By highlighting the importance of sleep quality with exercise duration, the study emphasizes the need for athletes to prioritize both sleep quantity and quality for optimal performance.

Exercise length and timing the day before games are sensitive variables. While studies support that physical activity helps aid sleep quality, long, high-intensity, late-evening physical activity may delay the beginning of recovery during sleep (Frimpong et al., 2021). In turn, a lack of physical recovery may play a role in the athlete having a higher respiratory rate the following day (Chandrasekaran et al., 2020; Charest & Grandner, 2020). Additional sleep time is recommended to counter the delay in the recovery process.

Further research is required to understand the needs of individual collegiate athletes and collegiate athletic teams. Technologists and physiologists should work closely with athletes and coaches to develop actionable tasks that work for the team within the structure of existing training programs created by the coaches.

Additionally, as wrist-worn fitness technology advances, we suggest companies such as WHOOP incorporate a method to track competition and recurring stressful events such as tests or interviews. The day of, or the days surrounding high-pressure activities, may cause an increase in stressors and fatigue levels, which in turn affect physiological metrics tracked by the wearable. Incorporating this method would allow WHOOP to make proactive suggestions to stabilize metrics sensitive to mental or emotional change.

CONCLUSION

Using the WHOOP fitness band as a sports coach tool offers significant benefits for athletes and their coaches, supported by research evidence. This research study examined the data collected from 56 Division II collegiate athletes across three sports: Softball, women's Lacrosse, and Baseball, and the analysis of the data using the WHOOP band provided valuable insights into the relationship between sleep, exercise, and respiratory rate, and their impact on athletic performance.

The findings of this study contribute to the growing body of evidence supporting the use of wearable fitness technology, such as the WHOOP band, in sports coaching (King & McDonald, 2021; Sekiguchi et al., 2019; Taber et al., 2021). By providing real-time data on critical physiological metrics, including respiratory rate, wearable devices enable coaches to make data-driven decisions and tailor training programs to individual athletes' needs (C. Bellenger et al., 2021). This personalized approach to training has been shown to enhance performance, reduce the risk of injuries, and optimize recovery (Born et al., 2013; Bourdon et al., 2017).

In conclusion, using the WHOOP fitness band as a sports coach tool offers valuable insights into an athlete's physiological responses, supported by previous research. By leveraging the data collected by the WHOOP band, coaches can make informed decisions that optimize training load, rest, and recovery, ultimately enhancing athletic performance and overall well-being. The integration of wearable technology in sports coaching holds immense potential for improving athletic outcomes and should continue to be explored in future research and development endeavors.

AUTHOR CONTRIBUTION STATEMENT

VR led the writing of the manuscript and participated in data analysis. MEA developed the training program, coordinated the research lab, and collected data. All authors read and approved the final draft article.

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