Paul Michelman: 00:00  When you examine the record-breaking season of the 2018 Houston Astros pitching staff, what stands out are the incredible individual weapons: Gerrit Cole’s 100 mile-an-hour fastball; Justin Verlander’s disappearing slider; Lance McCullers’ knee-buckling curveball. Features like those make it easy to see how the ‘Stros set the all-time record for strikeouts in a season. But the best weapon on the staff might just belong to a 34th-round draft pick named Josh James and it’s something that even you and I could hope to acquire: a good night’s sleep.

Ben Shields: 01:44  Four years ago, James was a minnow in the vast ocean of minor league baseball with one unique characteristic: he was an exceptional snorer. He sawed wood so loudly that his roommate in Single-A complained and eventually, James sought out medical treatment. James, who had been suffering from fatigue and diminished velocity, learned the root of his problems was sleep apnea, a condition that affects breathing and stops the afflicted from sleeping soundly. Finally getting the help he needed—and thus free from the laziness and lethargy caused by his condition—James started hitting 92 on the gun again, then 95, then 100. His newfound arm strength helped him shoot through the minors and all the way to the show, where his 29 strikeouts in 23 innings earned him a spot on the postseason roster. For Josh James, all it took to get his career back on track was a healthy mix of fastball, changeup and eight hours of shut-eye.

Ben Shields: 02:56  In Counterpoints, we look beyond the data in search of what the data reveals...
The idea that sleep matters is not exactly controversial. Science has proven that proper rest has benefits to both our mental and physical well-being and in both the short term and the long term. But some of the particulars have remained open to debate. Does everyone benefit equally from the same amount of sleep? And how exactly does one measure its specific impact on performance, athletic or otherwise? After all, if you’re going to convince a young athlete to give up party time or practice time to grab some extra z’s, you’d better have some serious data to make your case.

Which brings us to Kristen Holmes, Vice-President of Performance Optimization at Whoop and former head coach of the Princeton Field Hockey team, where her team won the National Championship in 2012. Now, if you’re not familiar with Whoop, it is a wearable device and a platform that tracks performance and recovery for individual athletes and teams. Sleep is a major factor for Whoop and a focus of Kristen’s, in particular.

Kristen, it's great to have you on the show.

Thanks. It's great to be here, Ben.

You know, you’re coming on to argue, I think, a really interesting thesis which is sleep is the greatest legal advantage in sports. So based on the work that you’re doing at Whoop, what data do you have to support this thesis and I guess as a secondary question, how are you even measuring sleep at Whoop in the first place? So can you kind of give us a sense of both the measurement as well as the data aspect to defend this thesis?

For sure, so you know, before maybe I head into Whoop, let me just kind of give you some of the research that exists beyond kind of what we've done at Whoop. You know, if you're getting less than six hours of sleep, your time to physical exhaustion is going to drop by up to 30%, right, so I think that in itself is a really important data point, as we think about sleep and the correlation to physical performance. You know, the ability of your lungs to expire CO2 and inhale oxygen decreases; the lower your peak muscular strength, a lower vertical jump height, lower your peak running speed. The less you sleep, your stability muscles fail earlier when you're not getting enough sleep. One study showed, gosh, I think it’s like a 60% increase in probability of injury comparing people who get nine hours of sleep a night to those who get six.
Kristen Holmes: 05:31 So, you know, there's just a linear relationship between, you know, injuries and sleep. At Whoop, how we, how we kind of think about it is, you know, it's really, you know, how much time you're spending in bed, right, does not always equate to how much sleep you're actually getting and I think that's one of the biggest things when athletes come on the platform is like, "Gosh, you know, I spent seven-and-a-half hours in bed, but you know, Whoop is only telling me I got five-and-a-half hours," and duration is important, but quality is also really important and that's a big piece of the education is to kind of help athletes understand, you know, how do I optimize the time that I am actually spending in bed.

Ben Shields: 06:10 So when you think about some of the athletes that you have worked with at Whoop, what are you seeing in the data where when an athlete gets more sleep, their performance improves? Do you have any specific examples of when this increase in sleep has led to better performance based on your work at Whoop?

Kristen Holmes: 06:31 Yeah. So, you know, I should, I should mention that when athletes first come on the platform—and I just did a quick kind of look at, at our hockey, baseball, football and basketball athletes, um, and you know, I just kind of looked at, uh, the male population—their first three weeks on the platform, they were averaging less than six-and-a-half hours, um, in terms of time in bed and you know, that age group needs to be spending somewhere between, you know, nine-to-10 hours in bed if they're really interested in kind of regenerating in an optimal way both physically and mentally. So I think just understanding that, you know, when athletes first come on the platform, they're, they're not spending enough time in bed to really leverage their genetic potential and kind of the skills and expertise that they have. They might be so talented that they're still able to operate at a, at a high level just because they've got talent.

Kristen Holmes: 07:21 But in terms of optimizing their potential, they are missing the mark and we absolutely see this in the data. You know, once athletes start to spend more time in bed, dedicating more time to sleep, we do see a very strong correlation between their recovery, which is a summary statistic that encompasses a few different metrics and it's, and we've seen this to be predictive of an athlete's performance. So this includes kind of resting heart rate, heart rate variability and then measures of sleep quality and duration sufficiency. So, you know, when you think about your potential for performance, your potentials kind of adapt in a, in a, in an optimal way to your environment mentally and
physically. This recovery kind of score that we have at Whoop is, is predictive, um, and we've been able to kind of play that out across, you know, many different sports.

Ben Shields: 08:12 Let's get into that because one of the questions I do have is whether these benefits of sleep are applicable to all sports. So maybe let's talk about some of those specific examples that you have to kind of round out your discussion of the thesis here.

Kristen Holmes: 08:28 Yeah. So we did a, um, one of the largest physiological studies ever performed in sports with, um, was with major league baseball. Um, I think we have 230 athletes in that study and what we're able to show is that all pitchers showed a positive correlation between our Whoop recovery, um—which again is the sleep performance, heart rate variability, resting heart rate, and kind of an algorithm that pulls all three of those, those metrics together—and pitch velocity. So the higher recovery, the higher adjusted fastball velocity. So very simply, the higher the recovery, okay, the faster the athletes are able to, um, the pitchers were able to throw the ball. Um, and in all hitters, we showed a positive correlation between Whoop recovery and exit velocity, um, so I guess the time off, a ball off the bat essentially, so that was, I think a pretty eye-opening. Um, so to the extent that you can kind of prioritize recovery and sleep in the days leading up to a game and really get yourself positioned with a high recovery, you're simply going to be a more effective, more efficient, better capable athlete.

Ben Shields: 09:37 A fascinating look at baseball. How about some of the work that you've done in hockey, as well?

Kristen Holmes: 09:43 Yeah, so we've just recently have some really cool datasets with ice hockey, kind of looking at both internal and external load and player efficiency. And one of the things that we're able to see is when you know an athlete's, you know, they're basically they're overall just more efficient when they're more recovered and we're able to show when they're kind of above their average line for recovery, they had 5.04 shots. When they were below, 4.26. Passes, when they were above their average line, 47.74. When they were below, 38.43. Puck touches, 71 when they were above their average line; 60 when they were below. So they had 11 more puck touches on average when they were higher, more highly recovered and goals, 4.41 and then below, they were 0.26. So, um, this is just, I think, a really great example of showing that the more recovered the athlete is, the more efficient they're going to be on the ice and this is going to result in some pretty meaningful kind of statistical improvements.
Ben Shields: 10:59 Kristen, those are some impressive stats.

Kristen Holmes: I know, right.

Ben Shields: They are and I do, though, want to get into some of the counterarguments here because I’m hearing a lot about sleep being the most important performance driver, but there are other performance drivers. So you think about an athlete’s healthy nutrition or their discipline training regimen or maybe even their positive attitude. How do, how do we know that sleep is the most important variable of all? I mean, isn't it just that the people that get more sleep are, are people that focus on their performance overall and are more likely to improve if they do get sleep because they have so many other great habits? Kind of give us a sense of the relative importance of sleep compared to other performance drivers.

Kristen Holmes: 11:48 Sure. So I think you’re right. You know, there are obviously a lot of factors that influence one’s ability to kind of perform consistently over time. Um, I think for some of the reasons I kind of stated previously, that I think sleep at a foundational level, like you can't optimize your training and you can't—it's very difficult to make good decisions around nutrition when you're not getting enough sleep. There are things that are happening biologically, um, uh, when you are getting insufficient sleep. You know, you're just not as efficient in terms of how you metabolize food, for example. You're gonna, um, you know, your, your hormones, ghrelin and leptin, you know, you're going to be, you know, you're going to be hungrier the less sleep that you get. So, you know, from a nutritional standpoint, for example, you're going to be making not as great decisions the less sleep you get.

Kristen Holmes: 12:35 You can't adapt your—it's very difficult to adapt your training in a, in a proactive way and you know, kind of get into the zones where you're kind of functionally overreaching when you're, you have insufficient sleep. So I think at a foundational level, you know, sleep is, is really, um, it is absolutely critical if you want to effectively leverage, you know, kind of your genetic potential, um, and you know, the skills and expertise that you have in your sport. And I think when I speak to kind of the best athletes in the world, you know, like, "I'm already good, you know? How is sleep really going to help me?" And it's, and that's where we see some really, um, you know, transformative moments in, in careers when, when guys do start to spend more time in bed, you know, they start scoring more points and, and they, um, have more assists and they generally feel better. They're in a better mood, you know, um, so their ability to kind
of access their leadership and resiliency and that mindset that you, that you know, that, that is really critical for elite level performance.

Kristen Holmes: 13:38 Um, you know, when you're operating on short sleep, you're just not going to be able to access those things in a way that you would if you're meeting your, your sleep need consistently. You know, you can only talk yourself into a better future until, you know, biology is gonna take over and that's just, that's what all the science points to.

Ben Shields: 13:57 Right. It kind of sounds like sleep is the rising tide lifts all boats in a lot of ways as it relates to athlete performance,

Kristen Holmes: 14:05 It, it, it really does. Um, and in a lot of, you know, I was trying to give you some kind of hard data, but, you know, just the, the anecdotes, too. You know, um, I was talking to a swim coach the other day and he said just that my athletes are just happier, you know? They're just, they come to the pool deck and they're just in a better mood, you know, and they're spending, you know, about 51 more minutes in bed on average a night and you know, these are, you know, these are, these are meaningful changes and um, you know, and I think it's really irresponsible, I think, for, for folks not to create an environment where they're enabling their athletes to really be in tune with their biological preferences as it relates to, to, to sleep. And, um, you know, I think just to digress for a second, you know, just being at an academic institution where, you know, performance is really important and people care about it, you know, there really isn't enough done to create policies and, and, and really educate students and student athletes, you know, around, I think what's, what's one of, again, one of the most important behavioral experiences we have and um, we do a lot of other education. But um, you know, I think sleep education is really lacking certainly at the professional level, but um, you know, definitely at the NCAA II level as well. And there's just so much more that we can do to kind of, I think bring this, this advantage that we all have access to, you know, to the forefront.

Ben Shields: 15:32 I think that's totally fair, Kristen, and I do though want to push a little bit more on the counterpoints here and this idea of talent and experience and I can just hear someone that is new to sleep studies and been around the games for a long time and saying, "Well at the end of the day, the player with the most talent or the most experience is going to win and that's the player that's going to rise to the top." So you know, just playing out a hypothetical, you could imagine a one-on-one game between Steph Curry and Trae Young. They're both similar type players,
but Steph clearly—at least at this point in his career—has the superior talent and he's also got more experience. So isn't Steph even on just like four hours of sleep going to beat Trae Young who's well rested from the night before? I mean, doesn't talent and experience always win out here?

Kristen Holmes: 16:27 I will say if you, if you look at it, you know, I think you are going to, you know, Steph Curry on four hours of sleep, yes, absolutely. You know, if he's just better, more talented, he could certainly still beat Trae Young, but will Steph Curry over time, adapt to a lower-level performance? Will he be more vulnerable to injury? Absolutely, right. So, you know, I think it again, is it, are you after optimizing potential or are you just into kind of getting away with the talent that already exists. And I think that's where the opportunity exists, is that you have by meeting your sleep need and really figuring out how to optimize biological sleep, you have this incredible opportunity to maximize your individual potential. It doesn't mean that you're not going to still win, right, if you're not optimizing your sleep because you might just be that talented. But in terms of setting your own bar for what you can do as an individual, you know, you, you 100% are missing out if you're not trying to figure out how you can optimally regenerate physically and mentally, um, you know, on a, on a consistent basis night-after-night.

Ben Shields: 17:35 All right, that's good. Let's, let's talk about caffeine, a historic performance optimizer.

Kristen Holmes: Yeah.

Ben Shields: And can't caffeine mask sleep deprivation in athletes the same way that it does for the typical 9:00 a.m.-to- 5:00 p.m. worker? I mean, isn't, isn't caffeine another potential advantage that can sort of mask some of the challenges of not getting enough sleep?

Kristen Holmes: 18:00 For sure. You know, it's not a good long-term strategy, but for short-term, you know, you're basically just blocking the receptor in the brain that makes you feel sleepy, right? That's what caffeine does. You know, by muting, you know, that kind of sleep pressure that you would face when you're, when you're sleepy, um, you know, which caffeine does, you know, it's going to make you feel more alert and, you know, enable, enable you to perform kind of in that moment. That doesn't mean some of the other things that could be happening, you know, physically, you know, for example, the stability muscles and some of the other things that are going on, you're not regenerating, right? Like you're, you're basically kind of impinging on your body's
ability to kind of regenerate because you're forcing it into a state where you're not getting the sleep that you need.

Kristen Holmes: 18:48 You know, when you feel sleepy, you should, you should really, you should take a nap, right? But, um, if you're consistently kind of blocking and, and putting yourself, you know, kind of in a, in a position where you're artificially, you know, muting what should be happening naturally, um, you know, that again, the long-term consequences of that are not good. You know, as a short-term strategy, sure. Um, and you know, caffeine has certainly been shown to kind of enhance performance and that said, you know, you don't want to layer stimulants on an under-recovered body, right? You know, you're not really providing an enhancement at, at that point. It's better to use caffeine on a recovered body um, and you'll really see huge performance improvements.

Ben Shields: 19:29 Kristen, you're giving me a lot to think about here in my own life, by the way. I do want to get to some future considerations here on this topic. And you know, you've talked a lot about correlations between sleep and performance. At what point in the research will we get to more of causal relationships? Is that possible in your work going forward?

Kristen Holmes: 19:57 Yeah. I think as it relates to kind of the physical and cognitive consequences of short sleep, I mean, I think, you know, there there's absolutely a causal relationship there, so I think foundationally we can kind of take that and transfer that over to kind of what's happening, you know, in terms of athletic performance. So, you know, and then I kind of feel confident in saying, saying that. But yeah, I mean I think, you know, I, I would never say that, you know. I think we're probably not too far off from being able to say that, but in sports, there, there are a lot of variables. You know, there's a lot of factors that influence performance, but I feel pretty confident saying that, um, you know, insufficient short sleep is going to impair your physical and mental performance on the field, off the field. And um, and yes, there, there is in—and the research has proven that, that there, there is a causal relationship and um, you know, I think uh, you know, folks need to start to prioritize sleep in their environments and really help their athletes understand how they can, how they can optimize.

Ben Shields: 21:03 Yeah. And to that point about helping athletes understand how they can optimize their sleep, it's interesting. You've clearly made a case that sleep can help athletes. Why aren't more athletes increasing their sleep? I know you mentioned the policy point, but I wonder if there are some of the best approaches,
the best approaches that you've seen to convince athletes to change their behavior and sleep more? So we have more evidence, right, that sleep can improve a poor performance. But how do you actually change an athlete's behavior so that they do get the better-quality sleep to help their performance?

Kristen Holmes: 21:40

Right, um, well I think, you know, when you're talking about a kind of a team environment, you know, it really does start at the top. I think where we've seen the biggest increases in performance improvements and behavior change across the athletes, the head coach really bought in. I think that's kind of important. So from thinking about it from perspective of putting nap pods in the clubhouse or making sure guys aren't having to get up for a, you know, 5:00 a.m. lift; um, you know, kind of putting policies into place in the environment that enables the athletes to meet their sleep need and then layering in education. So not just posting a flyer, you know, in the locker room about, you know, yeah, sleep is important, but actually doing some meaningful education and, and, you know, doing little bits of education every day so it's really in the front of, of these guys' minds.

Kristen Holmes: 22:32

And I think the other piece obviously is, you know, it's hard to manage something that you're not measuring consistently. And I think having, you know, some, some technology that can tell you, you know, exactly how much sleep they're getting and the quality of their sleep. Once you have access to that, to that data, you can start to actually make changes. You know, is it, is it my, my environment that's—my sleep hygiene that's causing, you know, uh, you know, is getting in the way of the quality? Is it, is it my daytime behaviors? Am I playing too much Fortnite? Am I, um, you know, is my nutrition off a pre-bed? Am I not drinking enough water? You know, what are some of the things that are, that people can start to look at their daytime behaviors a little bit more closely and start to understand how, how those things might be affecting their, their nighttime, you know, their biological sleep.

Kristen Holmes: 23:23

So I think kind of coming at it from the top is really important. And then once we have some data, we can start to dial in on, on what the athletes need to focus on to really improve their sleep and maximize the time that they're spending in bed. We do see, you know, once athletes come onto the platform, you know, within four months they're dedicating about 41 more minutes to bed a night. Now that we've layered in a lot more education at Whoop with the athletes, I think it's probably more than that. Um, but then, we also see a lot of behavioral changes. You know, we see a lot, obviously 89% less alcohol consumption,
um, in, in the first four months. And a lot of this is, you see very quickly how alcohol impacts your sleep, so there's more disturbances. Physiologically, you know, your heart rate variability is going to be suppressed.

Kristen Holmes: 24:14

Higher HRV is, is, is a sign that you can adapt mentally, physically. So when athletes see the, a lower, uh, HRV off, off their baseline, they are able to pretty quickly realize that, "Oh, wow, okay. The more alcohol I drink, you know, the, the less recovered I'm going to be next day." Um, and, and mind you, alcohol, that doesn't just hang around for a day. We see athlete's recovery suppressed relative to their baseline for up to five days. So, you know, many of the professional athletes who are on the platform, literally stop drinking altogether because it's just hard to get back to your baseline. It's hard to recover from those big night, nights out. So, you know, we see a lot of these behavioral modifications that lead to these really cool physiological improvements in terms of, um, you know—and cardiovascular improvements in terms of decrease in resting heart rate, increase in heart rate variability, um, you know, which translates into being able to take on, you know, cardiovascularly being able to take on more load, um, you know, just being a more effective athlete. So, um, I think the, the, the, the application that's been developed, you know, at Whoop, um, you know, the mobile app, really nudges some of these behavioral changes, uh, in a, in a very subtle kind of elegant way that, that really does help their performance.

Ben Shield: 25:33

All right, I've got Paul, my cohost here, and Mary, our producer extraordinaire. What did you think of the interview?

Paul Michelman:

Kristen makes a powerful case and she's building it on the kind of specificity of data that's almost impossible to argue with. Being able to measure changes in bat speed or changes in exit velocity based on proper amounts of sleep is really persuasive, but being the natural cynic that I am—and you're going to see a recurring pattern, listeners—I'm always gonna be some combination of, "Yeah, and but." So, yeah, does sleep matter more than I ever realized? Absolutely. Is it the single most powerful legal competitive advantage in sports? I don't know. Not that I can necessarily think of anything off hand that would beat it, but also a quick aside to my friend, Jeff, I enjoyed that tour through your sleep pattern on your Fitbit once, but let's not make a habit of it. And also a note to my daughter, Georgia, the college student who doesn't sleep enough. I hope you're listening to this episode. Mary, what's your take?
Mary: 26:36 Yeah, I, um, I unfortunately have not had the benefit of playing with a Fitbit and figuring out my sleep patterns. I can, I can tell you anecdotally that they're probably not the best. Um, and that as an athlete, I probably could have benefited in my younger years from sleeping a bit more. But I think, you know, while she does have this compelling case of data, I do think it's, it's a situation where that data isn't necessarily telling us something counterintuitive or something that we didn't know, right? Like we all know that we should be sleeping enough. We see studies that it helps with work. We see studies that it helps with other kinds of things, with, with health issues. So why wouldn't it help with athletic performance, as well? And so I think, you know, the data is nice, but it's something that we already knew. It would be a definitely something that I would think about if I were a coach or an owner of all these teams to be designating a curfew for all my players, but at the same time I agree with you that I think I'd love to see more of a comparison of, you know, what are the other top advantages and really how do those compare to sleep.

Paul Michelman: 27:35 So Mary, when you mention curfew, it makes me think of the Vegas Flu, which is this phenomenon that's been used to describe how the Las Vegas Golden Knights last year in their inaugural season as an NHL expansion team went so deep into the playoffs.

Ben Shields: 27:51 Yeah. Paul. So for those of you that don't know, the Vegas Flu was a term discussed last NHL hockey season to refer to potentially why the Las Vegas Golden Knights had such a tremendous home record. The away teams would come in, maybe get lulled into some of the distractions of Las Vegas and not exactly get eight-to-nine hours of sleep the night before the game. As a result, their performance suffered. I would love in the future to do a longitudinal sleep study about the Vegas Flu and actually see if there is a strong enough correlation between lack of sleep in Vegas to the performance of the team on the ice against the Golden Knights. But I do think that Kristin presented a wide range of evidence based on what you said. For me, one of the more interesting future questions about this line of our field is how coaches can actually change players' behavior. To Mary's point, yes, we have more and more information to suggest that this is a "rising tide lifts all boats" scenario where if you do get more sleep, your performance will improve as a result. But the question is how can coaches actually change the behavior of players to put into practice some of these ideas and I'm very excited to see how that evolves. And with that I've been waiting all episode to say this. I think we need to sign off because I would like to go get some rest.
If you're still awake, this has been Counterpoints, the sports analytics podcast from MIT Sloan Management Review.

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