

The Long Run:
Inside the race to keep young female runners healthy and performing at the top of their game

by

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ABSTRACT

Athletic participation is overwhelmingly positive for girls and women, but it is not without risk. Many female runners — and other female athletes — don't eat enough given how much they exercise. The motivations driving this underfueling are complex and range from short-term improvements in performance to societal pressures on women to be thin. In the long run, underfueling causes a host of health complications that may end seasons or athletic careers. Many girls and women will do lasting damage to their bodies.

The issue has gotten increasing attention over the last few years as professional and collegiate runners have shared their experiences with the condition, known as Relative Energy Deficiency in Sport (RED-S). The conversation has largely overlooked the middle- and high-school aged girls who are also affected, however. Doctors and researchers are now in a race of their own to understand RED-S and keep young female runners healthy and performing at the top of their game.

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Twice a week in the spring and fall, girls across the United States trickle into school cafeterias and onto playgrounds and soccer fields. From Boston to Honolulu, as they put on their sneakers and settle in for snack — perhaps clementines and ZBars or apples and pretzels — they chat about their days at school and check in with their coaches.

They're part of Girls on the Run, a nationwide program that combines running with community-building activities to promote confidence and health in girls ages 8 to 13. "At Girls on the Run, it is fine to walk, skip, gallop, hop or run — as long as we are moving in a forward direction and trying our best — just like in life!" the program guide explains.

Over 200,000 girls participate annually, and the program has reached two million girls since it was founded in 1996. The coaches are volunteers from the community equipped with a detailed curriculum from the national organization to guide their sessions.

At the fourth practice of the season, the lesson is "Self-Talk Matters." Each activity for the afternoon is designed to encourage positive self-talk and foster confidence. For their opening activity, the girls practice identifying positive and negative self-talk and write down negative examples they've thought or overheard.

Then, it's time to move around. Girls across the country stretch and complete a warm-up that involves converting negative self-talk into positive affirmations. "I can't run a 5K" becomes "I can practice and run a 5K," for example. Next comes running laps, which is as much a time for team building and self-reflection as it is for working out. Each girl sets a goal distance to walk, run, skip, or hop over the next half hour or so. On the first lap, coaches ask the girls to think about how they can change one of the examples of negative self-talk they wrote at the beginning of practice into something positive. Upon completing the lap, each girl affixes her example of negative self-talk onto a balloon and shouts her positive statement. When the girls have gone through the negative statements, they run just for fun, sharing their affirmations with each other.

The practice wraps up with another circle, where coaches and athletes reflect on the day's activities. A coach pops the balloon covered with negative self-talk. The group concludes by giving "Energy Awards" for accomplishments at practice (running with someone who had a bad day at school, for example) and reflecting on the individual goals each girl set at the beginning of the program. Last up is a closing cheer and nutritious snack before the girls head home.

When Sarah Becker coached for Girls on the Run at Williamstown Elementary School in Massachusetts in 2017, she frequently saw girls surpass their own expectations. When she and her fellow coaches announced the workout for the day, girls sometimes questioned whether they could complete it. "There would be a lot of gentle coaxing," Becker recalls. "After, they would be so pleased with themselves," she says. "They had done this thing that they totally thought that they couldn't do, and I think the cumulative effect of doing that, week after week, was really powerful."

The increase in confidence is perceptible, even over the course of the 10- to 12-week program. “You could see it in how they carried themselves, standing up a little taller, holding the chin out, and speaking up more,” Becker says.

Her observations are reflected in the data. Eighty five percent of girls in Girls on the Run felt increased confidence, caring, competence, character development, or connection to others. The effect was most pronounced in girls who had entered the program with the least confidence. And according to an independent study from 2016, 97 percent of program participants developed essential life skills like conflict resolution, emotion management, and decision-making that they used beyond the program.

These benefits aren’t limited to Girls on the Run. Research shows that, in general, girls and women who participate in sports are more confident, have a stronger sense of belonging, and better mental health than those who don’t do sports.

But athletic participation is not without risk. Female runners — like many other female athletes — frequently train in unsustainable ways. In particular, they often don’t eat enough given the amount they are exercising. The motivations for this chronic underfueling are complex and varied, but one primary driver is that in the short-term, it can help boost athletic performance. In the long-term, however, running at an energy deficit catches up to athletes in the form of fractures, fatigue, and failing on runs. Left unresolved, it can be career-ending. Some girls and women will unwittingly do lasting damage to their bodies. I was one of them.

In recent years, a number of high-profile runners, including Mary Cain and Lauren Fleshman, have come forward to share their experiences with what is known as Relative Energy Deficiency in Sport (RED-S) and the training environments that give rise to it. The young and amateur athletes facing this same issue have received less attention, however. Doctors, researchers, and coaches are now in a race of their own to help young female athletes reap the benefits of running and perform at the top of their game without doing long-term damage to their health.

In the late 1990s, Kathryn Ackerman took an unconventional break from medical school. Ackerman, a skilled athlete and member of the U.S. national rowing team, put her classes at Johns Hopkins on pause and flew to San Diego to train. At the time, she was still trying to figure out exactly what kind of doctor she wanted to be, but she was hoping to find a way to incorporate her athletic background. When she got to San Diego, she saw that many of her teammates were struggling. They were dealing with anxiety, depression, and eating disorders, as well as overtraining and stress fractures.

One reason they weren’t receiving the necessary support, Ackerman realized, was because there was insufficient understanding of female athletes’ specific needs, in large part due to a dearth of research. “There was just this world of information that was lacking,” she says. Her career plans suddenly crystallized: She would combine sports medicine and endocrinology to help treat female athletes.

Over a decade later, lack of research is still a problem. One analysis found that of 188 studies published between January and May 2015 in two prominent sports medicine journals, just four percent focused specifically on women, compared to 27 percent on men. Women made up only three percent of participants across 29 studies looking at performance.

Once, Ackerman says, she wondered if her emphasis on female athletes was sexist. The concern was quickly laid to rest when a colleague reminded her, “Until we are caught up, there needs to be this hyper focus to get the answers for women.”

Today, Ackerman is an assistant professor at Harvard Medical School and director of the Female Athlete Program at Children’s Hospital Boston. The program, which treats athletes of all levels, is considered one of the world’s leading clinics for girls and young women who participate in sports. Its clinicians specialize in an array of topics, from knee injuries and concussions to sports psychology and RED-S.

Relative energy deficiency describes a gap between how many calories someone eats and how many their body uses. Many athletes — and non-athletes — create this energy deficiency deliberately, through eating less or exercising more, because it often results in weight loss. When it comes to running, many women do get faster — at least for a while — as they get lighter. This early improvement drives coaches and athletes alike to associate thinness with speed.

Over the long run, however, energy deficiency causes hormonal imbalances that lead to a host of complex and interrelated issues, including low bone density and menstrual dysfunction. In the 1990s, the American College of Sports Medicine adopted the term “Female Athlete Triad” to describe the common trio of disordered eating, amenorrhea, and osteoporosis afflicting many female athletes. The syndrome was rebranded as RED-S in 2014 to acknowledge the range of issues energy deficiency causes and the fact that it can affect anyone, including people of any gender identity and biological sex. However, most RED-S patients are cis-gender women, which Ackerman says is the result of two factors: first, pressure on women to have a particular physique, and second, that female-bodied people can’t tolerate large energy deficits.

Low energy availability disrupts two hormones that are essential for building and maintaining bone density. One is IGF-1, a growth hormone that stimulates bone formation. Energy deficiency causes levels of IGF-1 to drop, and as a result, energy deficient athletes don’t increase their bone mass. For younger women in particular, this is bad news. Humans build up bone mass until they’re in their mid-twenties, but the bulk of that development happens much earlier. “I generally tell my patients that 90 percent of your peak bone mass is reached by the age of 18,” Ackerman says. By early adulthood, there’s no longer room for significant improvements in bone density.

Low energy availability also causes a decrease in estrogen, a hormone that, at healthy levels, prevents bone resorption, or the process of breaking down bone and releasing that calcium into the blood. “If you don’t have enough estrogen, your bone is breaking down too much,” Ackerman explains. So when girls and young women underfuel, their bones get weaker during the narrow window in which they should be getting stronger. “Bone loss in these athletes may be

irreversible,” according to the International Olympic Committee’s 2014 consensus statement on RED-S.

Estrogen is also essential for maintaining a healthy menstrual cycle, so when levels dip, women stop getting their periods regularly. The condition, known as amenorrhea, is essentially an early and reversible form of menopause. It affects as many as 65 percent of female collegiate long-distance runners and many younger athletes as well. While not getting a period is normalized on many sports teams, missing periods is not normal for a young woman. It’s a warning sign that her body isn’t keeping up with its regular functions.

Despite these and other health consequences, RED-S continues to pervade women’s sports. Sometimes, athletes are still losing weight and improving performance when they show up at Ackerman’s office. They are often the most resistant to treatment. “They don’t buy into recovery because they’re still successful,” Ackerman says.

But she has seen enough energy deficient athletes to know what happens next. “I haven’t had one patient have it not finally come to a head in some way,” she says. Whether it’s a stress fracture or gradually worsening race times, “It always hits eventually.”

I first met Ackerman in the fall of 2013, when I was a junior in high school. Her sixth-floor clinic is housed in a yellow brick building which was, conveniently, just a few hundred meters away from my high school. My cross-country teammates and I learned from each other that there was a doctor just down the street who worked to keep runners healthy and performing well. We scheduled appointments during free periods to address our nagging injuries and fraught relationships with food. The wait was inevitably long, appointments sometimes starting hours late, but we tried to squeeze them into breaks in our school schedules.

I arrived at Ackerman’s office with amenorrhea, hip and back pain, and a diet that consisted primarily of fat-free Greek yogurt, walnuts, and raisins. Two years earlier, I’d developed a stress fracture in my back that continued to cause me pain even after I’d spent a year in a back brace. It was a classic presentation of RED-S.

In one of my early appointments, Ackerman ordered a DEXA (dual-energy X-ray absorptiometry) scan, which measures bone mineral density. My DEXA scan was dismal; my bone density was well below what it should have been for someone of my age and athletic background. In fact, it put me squarely in the category of having osteopenia, the precursor to osteoporosis. I was sixteen.

While my low bone density was not a surprise, it was a wakeup call. By then, at least some of the damage was irreversible. I began the many-pronged rehabilitation program that characterizes the Female Athlete Program. Treatment included scaling back on running and focusing instead on cross training and strengthening, working with a nutritionist, and continuing to see Ackerman as various injuries flared up.

The next summer, I attended a running camp. We ran twice a day, and I was putting in more miles than I had since the previous cross country season. On the second to last day of the weeklong program, I felt a deep pain in my right leg. I attributed the discomfort to a tight iliotibial (IT) band, the connective tissue that runs from hip to knee on the outside of the thigh. I kept running. After I returned from the camp, my leg was still throbbing. An x-ray revealed that it was not, as I had self-diagnosed, a knot in my IT band, but rather a stress reaction in my femur. Stress reactions are a precursor to stress fractures, and I had just developed one in the strongest bone in the human body.

Regret and shame linger. I'm not sure I've fully forgiven my younger self for the damage I did. This sentiment is a common one, Ackerman says, and one of the harder-to-overcome effects of RED-S.

"You're like, what the heck? Why didn't I know better when I was 14 or 15?" Ackerman says when we reconnect seven years after my treatment. "You've got to let that go."

What's haunted me, though, is that I did know better, at least once Ackerman explained it to me. I knew I needed to eat more and run less. But I still resisted.

As an undergraduate at Pennsylvania State University in 2008, Heather Caplan worked in a lab for a researcher who studied amenorrhea. One of Caplan's duties was to post flyers around campus that posed a personal question: *Have you been missing your period?* Tear-off strips at the bottom listed a phone number students could call to participate in a scientific study. Women who enrolled were asked to stop exercising, wear a fitness tracker, document their food intake, and eat two extra energy bars each day. Then, the researchers waited to see if participants' periods returned.

That was Caplan's first exposure to amenorrhea and its relationship to underfueling and exercise. Now a registered dietician, running coach, and co-founder of the Lane 9 Project, an organization dedicated to raising awareness about female athlete health, Caplan is intimately familiar with RED-S and the recovery process.

On the surface at least, RED-S recovery seems straightforward. Doctors often recommend that athletes cut back on training and increase their food intake. The hard part is getting athletes to do that. A significant hurdle: Recovery can lead to "a little bit of regression" in terms of running times, Caplan says.

So when working with clients, Caplan is quick to emphasize that any performance gains they've seen at a low weight will be short-lived. "The body is super fragile in that state and so even though there may be that short term boost in performance, it comes at a very high cost," she says. It's normal for runners to get slower when they begin to recover, she tells them. The body is storing resources. "It's slowing down, and it's trying to tell you to rest," she says.

Caplan uses the analogy of a slingshot to explain the relationship between health and performance to her clients. “Here’s the slingshot, where you are right now,” she says, gesturing just in front of the Y-shaped handle she’d made with her hands. “What we’re going to do is pull you back a little bit because you need to rest, you need to fuel, you need to let your body catch up to what’s happening.”

It’s frustrating to cut down on training and see race times suffer or to sit out for a season entirely. “But the truth is, if you keep trying to exist here,” she says, gesturing again to that space somewhere just in front of the slingshot, “you’re going to end up in that back spot permanently because your body’s broken, and you can’t keep going.” Instead of pushing to the breaking point, Caplan urges athletes to be proactive about recovery and rebuild in a sustainable way. Anyone who’s used a slingshot, or taken high school physics, knows that pulling back on the elastic stores up potential energy for eventual release. “Then we let you go,” she says, and I can almost hear the snap of the imaginary rubber band.

Rose Kelly, a four-time All American runner, spent her fair share of time in the back of the slingshot. She’d played sports for her entire life and started running competitively as a high school sophomore. She had also struggled with an eating disorder since she was twelve. As a runner, Kelly derived her confidence in large part from her thinness. “I felt like an imposter,” Kelly recalled. Standing at the starting line, she’d look around and think “I know I’m fast because I’m the thinnest one here.”

She headed to college and tried to join the running team, but her health form was flagged by one of the school’s physicians. The college had a program in place to prevent energy-deficient female athletes from participating in sports. Kelly’s low weight meant she didn’t meet the requirements to join the team. In fact, to be eligible to run, she would have to weigh more than she ever had.

Aware that something had to change, Kelly took the rest of the year off from school and checked into an in-patient program for athletes with eating disorders to focus on her recovery. She thought back to an athletic trainer she’d worked with in high school who had told her that her power was in her strength and mental toughness, not her weight. Maybe she could be fast when she was healthy, too, Kelly thought. She could at least try. “I can swing for it,” Kelly decided. “I might get my heart broken, but I also might find something in that journey that I can’t even imagine right now.”

When she returned to her small liberal arts college in 2015, though, the cross country coach didn’t want her on the team because of her medical history. *Eating disorders are contagious*, her coach told her, *and you might infect our team*. To Kelly, who had been cleared by her doctors to return to sports, the words stung. But she persisted, winning a time trial against some of the team’s slower runners. She made the team as a walk-on.

Kelly noticed that the team’s fastest runner was committed to taking care of herself. She ate enough, cut out of runs early if something felt off, and took it slow when her body told her to. Having a top athlete who prioritized health — and still excelled — set a good precedent for Kelly and her teammates. “I would think about how sometimes she would cut out halfway

through workouts and just say, ‘I feel too tired to do this, I’m gonna jog for 10 minutes and then I’m done for today,’” Kelly recalled. “I would think about that, and then make a healthy choice for myself.”

That’s not to say having a healthy top athlete is a cure-all. There were athletes on the team who struggled at various points with body image and disordered eating. Kelly, who was open about her own experience with RED-S, became a confidant for her teammates — and living proof that an athlete could bounce back stronger. By then, Kelly was healthy and running faster than she ever had before. She had gone from being a walk-on the coach was reluctant to accept — the coach had gone so far as to say the team didn’t have enough lockers for Kelly to join — to being her team’s top scorer and a four-time All American.

Kelly passed her hard-won insight on to her teammates. “You have no idea what you are capable of,” she told them. “You’ve got to believe in yourself because if you have that and you’re healthy, you’re going to go way farther than you ever could sick.”

Running is not an aesthetic sport the way dance, diving, or gymnastics are, but athletes’ bodies are still on display in flimsy tank tops and shorts or bikini-like bottoms. And runners don’t train or compete in a vacuum. Outside of a sports context, women receive constant input that thinness is preferable, thinness is restraint, thinness is discipline. In a society with an aesthetic preference for thinness — and sports like running that seem to favor the same — it’s hard to tease out athletes’ motivations for pushing their bodies to the brink.

That’s why, for sociologist Holly Thorpe, RED-S isn’t just about performance — it’s also a response to broader societal pressures. As is the case for so many women who have dedicated their careers to advocating for RED-S awareness and female athlete health, Thorpe’s connection to the issue is personal. When Thorpe, now a researcher at the University of Waikato in New Zealand, finished her PhD on women in sports and started working as a lecturer, her life got busy. She was juggling her teaching responsibilities, research, and a desire to maintain an active lifestyle, which included regular hour-long runs. She watched her diet and craved the self-discipline she felt as a result. “I learned to quite enjoy the feeling of not fueling 100 percent,” she recalls.

Thorpe soon realized her situation was not unique. Many women who no longer participate in competitive sports, but who exercise regularly and monitor their diets in order to look and feel the way they want to, share her experience. Beginning in 2010, she started including recreational female athletes in her research.

In sports that privilege strength and different body types, Thorpe has found an interesting pattern: The most elite athletes were the least concerned about how their bodies looked. “They’re like ‘I don’t care what I look like if I’m performing,’” she says. With identities rooted in their sports, they prioritized performance over everything else.

The same phenomenon can occur in running, at least for a while. Accomplished athletes who are performing well can sometimes resist the pressure to lose weight. In a 2019 [opinion piece](#) in *The New York Times*, elite runner Lauren Fleshman recalled a dinner she'd had two decades earlier, the night before the 1998 National Foot Locker Cross Country Championships. The race would determine the fastest high school cross country runner in the United States. Fleshman watched her competitors pick at salads the night before one of the most important races of their lives. Fleshman opted for pasta and went on to finish second. "If I hadn't made the medal podium, I might have doubted my choice of pasta at that dinner," she wrote. (Even winning medals doesn't guarantee protection, however. Fleshman would later go on to develop RED-S, dashing her Olympic dreams.)

As a slower runner, I felt a different kind of pressure. I would never have medaled at Foot Locker, no matter what I'd eaten the night before, or at any meal before that. It didn't matter how many hill intervals I ran during the summer or how many days I spent aqua jogging while sidelined by injury — I couldn't seem to get faster.

What I *could* do was make myself look like a runner by putting in the miles and forgoing dessert. (I made the occasional exception for ice cubes with a dusting of cocoa powder and a drizzle of honey.) Because my conception of a runner's body aligned with society's idea of a conventionally attractive female body, it is hard to distinguish my motivations for pursuing that physique. I had initially joined the track team "to get in shape for soccer," by which I really meant "to slim down."

I stuck with cross country because of the team culture, which, overall, was healthy. Every summer, we had a preseason camp in New Hampshire filled with runs on dirt roads, farm-to-table dinners, charades, T-shirt decorating, and plenty of swimming breaks. During the school year, we ran on trails around the Boston area, sometimes venturing to a local ice cream parlor and walking back, cones in hand. My teammates had a range of body types, and there were numerous multi-sport athletes.

And yet, my teammates and I were constantly sidelined by injury. Even if the messages weren't coming from our team, they came from running culture more broadly and everywhere else around us. The competitive girls' school we attended demanded excellence and pushed us to the edge academically. A lot of us were high achievers and perfectionists. We won our league most seasons.

Even if disordered eating or overtraining behaviors stem from an athlete's genuine desire to improve performance, not from a desire to change her body, the two are inherently intertwined. They're part of each person's quest for acceptance, confidence, and wholeness. "We are conditioned to feel like that feeling of enough-ness can come through accolades, can come through success, can come through winning," says Sarah Becker, the former Girls on the Run coach. And so we'll do whatever we can to pursue that goal, whether it's fueling up to win a race or making ourselves small in a search for self- and societal- acceptance.

After all, whether the team perpetuates it or not, we live in a society that ties our value to how we look and what we can produce. Competitive running, with its skimpy uniforms and stark focus on metrics like time and place, is no exception.

Julie McCleery, an expert on youth sports culture at the University of Seattle, hosts trainings for coaches on building healthy team cultures. She likens team cultures to icebergs, with only a fraction of what's going on visible from above. "There's all of this stuff below the waterline which tends to be where the eating and body image stuff gets hidden," she says. "Your team has a culture around this stuff whether you talk about it or not."

The first step in beginning to address the complex problem of RED-S is to bring these issues to the surface. That is starting to happen. More and more athletes are speaking out. In March 2020, a Wesleyan University track and cross country alumna exposed the toxic climate her coach perpetuated in an [open letter](#) to the school community. She described a team culture of "fat talks" and dangerous (and false) claims from the coach that for every five pounds an athlete lost, she would shave 30 seconds off her 5K time. Twenty five other alumnae offered their own testimonials, and 36 signed a petition calling for the school to better support its endurance athletes. One-time phenom Mary Cain revealed the emotional abuse and body-shaming she experienced from Alberto Salazar and others at the Nike Oregon Project in an [opinion piece](#) in the New York Times. Other collegiate and elite athletes have since come forward with similar stories.

But RED-S also affects recreational and amateur athletes, and the message that shedding pounds could have a lasting impact on female runners' health hasn't yet reached many girls, parents, and coaches. When I was in middle and high school, I had health class twice a week. Even so, I didn't know it was abnormal to miss my period until my teammate said her mom had signed her up for a clinical trial because she hadn't gotten hers. I arrived in Ackerman's office soon after. By then, I already had osteopenia.

A decade later, this education still isn't happening for athletes or their coaches. Kelly, who struggled with RED-S before becoming a four-time All American, is now an assistant cross country coach at my former school. Her coaching training didn't include any discussion of female athlete health, RED-S, or eating disorders. Last fall, a runner approached Kelly at practice. She felt tired and was struggling through the workout. "Does that happen when people are on their periods?" she asked Kelly, explaining that the same thing had happened the previous month, too, when the athlete had her first period in half a year. She wanted to know if it was normal to feel especially tired during this time.

"I was like 'Oh my God, nobody tells you these things,'" Kelly says. But they should. "While teaching girls how to stretch and build strength in other ways and how to approach races, we also need to talk about their bodies because they're really complex," Kelly says. "It doesn't work to ignore that part of the whole athlete."

These conversations are important all the time, but particularly during puberty when many female athletes experience a dip in performance. Adults in kids' lives, particularly coaches, need to be prepared to support and nurture athletes through this time, Ackerman says. "If you're a kid going, 'I'm working really hard. Why is this happening to me?' And no one's putting it in a context for you, how is that 13-, 14-, 15-year-old girl supposed to understand it?" she asks. It's a rhetorical question; she knows the answer. "She's just gonna beat herself up for what she can control, and that might be food or overtraining."

Improving sports for kids starts with changing the narrative around what it means to be a good coach, Ackerman says. She has seen, firsthand, what a difference it can make. As a child, she was not a good athlete. That changed, of course; she went on to row at Cornell and then on the U.S. Women's National Team before becoming the team's doctor. But in sixth grade, she struggled to pass the 50-yard dash in the President's Physical Fitness Test, an assessment required of public-school students across the country.

In the week leading up to the test, Ackerman's gym teacher, Mrs. Lennertz, invited her to come into school early to train. In retrospect, Ackerman realizes it was unlikely that a week of practice would get her up to speed. Indeed, it did not, and Ackerman recalls receiving awards for just about everything except the fitness test at her sixth-grade graduation. She remembers something else as well: In lieu of the certificate bestowed upon kids who passed every exercise, Mrs. Lennertz crocheted Ackerman a "Perseverance Award." Ackerman hasn't spoken to Mrs. Lennertz since she was 11, but she never forgot the teacher who rewarded her for her effort instead of the result. "She didn't like me because I was a good athlete," Ackerman says. "But I felt like she cared."

The issue of priorities in sports runs deeper than any single team's culture. There are perverse incentives for athletes and coaches of all levels. Funding and scholarships are based on performance. Coaches know it, athletes know it, and everyone feels the pressure to win. Kids are specializing in sports earlier, and college scholarships depend on their performance in middle and high school. For a lot of girls, that's right when they hit puberty. Their bodies are changing, and slowing down, while girls adjust to their new center of gravity and learn to move in their adult bodies.

Meanwhile, coaches work with young people for just a few years, and their job security sometimes hinges on the team's performance. The incentives are in place to squeeze as many wins out of the athletes as possible. There's no long game built into the system. "If you have a whole bunch of athletes, and you want to win the division, you can run a bunch of people into the ground," Ackerman says. Athletes become disposable. "Some of them are going to get stress fractures, and some of them won't be there at the end, but your team might win."

Thorpe has noticed the same problem from her vantage point as a sociologist. Thorpe says, of athletes: "The ways they hear themselves being talked about is often as if they're these machines that we're trying to get the best performance out of. They're not robots."

What if we flip the incentives, Thorpe asks, and instead of funneling money to the programs with the most wins, we funded the programs that kept athletes healthy both mentally and physically? It's easier said than done, of course. "Leadership in sport, as we know, continues to be dominated by old white men—pale, male, stale," Thorpe says, and the reprioritization she imagines would have to come from the top. She adds that these leaders, who rose to power within the existing system, tend to resist change. But the current system and incentives are harmful to female athletes. Where many experts work to treat RED-S athlete by athlete, Thorpe takes a zoomed-out view. "This is not an individual problem," she says. "This is a problem in our sporting cultures."

Young athletes require particular attention, since adolescence is characterized by an inability to take a long-term view. But athletes and experts across the board agree that taking a holistic view of athletes of all ages — recognizing them as people first and taking care of their emotional and physical wellbeing — is the way to go. Not doing so can have serious consequences. "You might get a personal best this year, but what's the situation next year? Do you want to be able to walk and run and play with your grandchildren?" Thorpe asks. "These things are crippling women at quite young ages, and that's horrible."

Experts say we also need to take a longer-term view of success, one that involves staying engaged in sports at the highest level an athlete can for as long as possible.

"Long term success, I think, is what everybody's after, and you have to be healthy to get there," says Julie McCleery, the expert on youth sports culture. Ultimately, athletes will do better if they can train sustainably without seasons sidelined by injury or illness that eventually accompany RED-S. "The investment in holistic athlete development leads to long-term, sustainable success. So they're not mutually exclusive, they're actually mutually reinforcing," McCleery says.

Reminding recreational and amateur athletes that they are valuable for more than just how well they perform is an important form of psychological support. Emphasizing goal setting, personal improvement, attitude, and effort, is a good model, especially for younger athletes. "I think that's something that gets lost as you move into competitive athletics" and the focus shifts to winning races, says Becker, who was a Division 1 Nordic Skier at Williams College in Williamstown, MA while coaching for Girls on the Run. "You can lose yourself in pursuit of that goal and you forget why you're actually doing it in the first place."

From a scientific and medical standpoint, there's a lot left to learn about RED-S. "Obviously," says Ackerman, a leading expert in the growing field of RED-S research, "we need to be studying this in way more people than just white women." It's an issue that comes up all the time in RED-S research, which has focused on the girls and women who visit clinics like Ackerman's. In one of Ackerman's recent RED-S studies, 92.7 percent of the thousand participants were white.

The Female Athlete Program is working to address this disparity. Ackerman and her colleagues are now recruiting athletes from medically underserved communities for surveys and studies to

understand how RED-S affects these populations. What causes RED-S in athletes in these communities? “Are the motivations the same?” Ackerman asks. She adds, “Is it that they’re not eating because they want to be thin, or not eating because they don’t have the food available?” This work is long overdue. “Only this year are we really putting a spotlight on that,” Ackerman says.

Now, Ackerman is waiting for the pandemic to subside so that she can resume her clinical studies. In one forthcoming study, she and a team of international collaborators hope to learn what kind of energy deficiency the body can tolerate temporarily versus what might cause irreparable damage. To do so, they will monitor athletes’ hormones over the course of a year.

The upcoming study is geared toward elite athletes, but Ackerman expects that the findings will be illuminating to other athletes as well. “What is the sweet spot where they can really be performing at their top and not doing anything detrimental to their health?” Ackerman and her fellow researchers want to know. So do female athletes everywhere. The findings will enable doctors and coaches to advise female athletes on how far they can safely push their bodies in the name of performance.

An increasing scientific understanding of female performance points the way to other kinds of solutions as well. There has long seemed to be a tradeoff between health and race times. Implicit in the push to focus on *long-term* health and performance is the assumption that training at a low weight is advantageous in the short term. But what we’re learning now is that there could be ways to boost performance that rely on staying healthy.

Sports physiologist Stacy Sims believes that girls and women can improve their athletic performance by leveraging their healthy hormonal cycles. Sims is a proponent of phase-based training, which involves tailoring training to different stages of the menstrual cycle. That could mean focusing on speed and power during menstruation, when estrogen and progesterone levels are lowest, and prioritizing stretching and gentler activity in the last week of the cycle when hormones are elevated. The idea, according to Sims, is to help women use their regular menstrual cycle to their performance advantage.

Ackerman is reserving judgement about phase-based training until she sees data and more published papers. “I think there could be some huge benefits there,” she says, particularly for athletes who compete in endurance and individual sports. But she’s not totally sold on it. “I think we need more data to prove that it’s a thing.”

Of course, RED-S will persist. Girls and young women will still slow down around puberty, and phase-based training won’t make everyone equally fast. But it could help at least some female athletes find an advantage in health. The underlying cultural causes are harder to deal with, but when women feel proud of what their bodies can do, sometimes how they look becomes secondary.

Girls and women have far more opportunities and visibility in sports than ever before. But those opportunities come with increased scrutiny and pressure. “The conversation is increasing, and

the research is building, but so are the pressures on our female athletes,” Thorpe says. “We need to keep upping our game.”

For many years, my identity and sense of self-worth were wrapped up in my 5K times, and I never talked about that mindset with anyone. A lot of that was internal; my perfectionist tendencies, competitive personality, and insecurities were in many ways independent of cross country. But they did play out on the course. I’d get in bed early the night before races, but I could never fall asleep. On the starting line, I’d be exhausted and wish there were no spectators, sure I’d only embarrass myself. I was ashamed that my best effort was so slow. The boxy red digits on the portable clock broadcast that slowness — my failure — for all to see with each second that passed. For a while, I thought having RED-S was the most athletic thing about me.

It’s been six years since I last ran competitively, and I’m faster now than I was in high school. I’ve put in quite a few miles since then, too. I’ve backpacked through Patagonia solo and biked down the coast of California. I am currently training for a 3,000-mile ride down the Great Divide Mountain Bike Route with a few friends.

On a recent March morning, I ran with one of them in the Arnold Arboretum, where my high school team often practiced. We retraced a route I hadn’t run since the fall of 2014, when I was a high school senior. It’s a time trial we ran periodically during the season. Just thinking about it used to make me nauseous. That day though, it was fun. My friend and I laughed and chatted the whole way, just as we did for the rest of our hour-long run. Hemlock Hill, which always felt menacing, seemed a little smaller.

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