

The Female Hurt

Women are more vulnerable than men to certain injuries and may not be getting proper treatment for them

by Marguerite Holloway



TORN: Knee injury felled New York Liberty forward Rebecca Lobo last year. Damage to the anterior cruciate ligament (ACL) is much more frequent in female athletes.

don't want to hear a bunch of thuds," bellows Deborah Saint-Phard from her corner of the basketball court. Several dozen young women and girls, some barefoot, some in jeans and tank tops, some in full athletic regalia, look sheepish. They jump again, trying to keep their knees slightly bent and facing straight forward, trying to make no noise when their feet hit the floor. "I can hear you landing," Saint-Phard nonetheless admonishes, urging them into a softer touchdown. "Control your jump."

Saint-Phard is a doctor with the Women's Sports Medicine Center at the Hospital for Special Surgery in New York City. She and several colleagues have traveled to this gymnasium in Philadelphia for "Hoop City"—a National Collegiate Athletic Association (NCAA) event—to teach young women how to jump safely. Female ath-

letes, particularly those playing basketball, volleyball and soccer, are between five and eight times more likely than men are to injure their anterior cruciate ligament, or ACL, which stabilizes the knee. Some 20,000 high school girls and 10,000 female college students suffer debilitating knee injuries each year, the majority of which are ACL-related, according to the American Orthopedic Society for Sports Medicine. Tearing the ligament can put an athlete out of the game for months, if not forever.

"This is a huge public health problem for women," says Edward M. Wojtys, an orthopedic surgeon at the University of Michigan. "Fourteen- to 18-year-olds are subjected to injuries that many of them will never recover from, that will affect whether they can walk or exercise at 40 and 50." For this reason, physicians are placing new emphasis on teaching female athletes how to jump in such a way that they strengthen their knees and protect their ACLs. "We have to get them when they are young," Saint-Phard says.

Torn ACLs are just one of the medical problems that plague female athletes. Injuries and ailments that occur with higher incidence in women than in men are garnering more attention as women enter sports in record numbers—not only as Olympians and professionals but for fitness and recreation. Today 135,110 women participate in collegiate athletics, according to the NCAA, up from 29,977 in 1972.

The number of girls playing high school sports has shot up from 294,015 to 2.5 million in the same time frame. As a result, re-

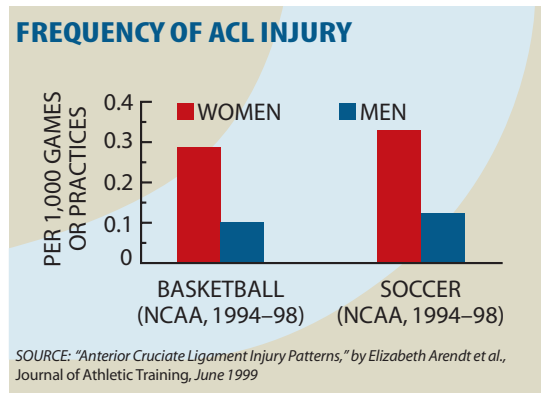


PAUL SUTTON/Duomo

searchers, physicians and coaches are increasingly recognizing that girls and women engaged in sports have some distinct medical concerns.

This makes perfect sense. Women's bodies are shaped differently than men's, and they are influenced by different hormones. They may be at greater risk not only for ACL tears but for other knee problems, as well as for certain shoulder injuries. Women are also uniquely threatened by a condition called the female athlete triad: disordered eating habits, menstrual dysfunction or the loss of their menstrual cycle, and, as a consequence of these two changes, premature and permanent osteoporosis. "We are seeing 25-year-olds with the bones of 70-year-olds," Saint-Phard says.

Although the passage of Title IX legislation in 1972 required that institutions receiving federal funding devote equal resources to men's and women's sports, it has taken a while for the particular needs of female athletes to emerge. As an example, Wojtya points to the ACL: "It took us 15 to 18 years



to realize that this problem existed." Women entering sports even a decade and a half after Title IX received less care from coaches and physicians than male athletes did, says Saint-Phard, who competed in the 1988 Olympic shot-put event. When she was in college, she recalls, "the men's teams got a lot more resources and a different level of coaches than the women's teams."

And today even those conditions that are increasingly well recognized as more problematic for women are not fully understood, and their etiology and treatment remain controversial at times. "There is not enough awareness of the differences," says Regina M. Vidaver of the Society for Women's Health Research. For most of the people treating sports injuries, she explains, "their predominant history is with men."

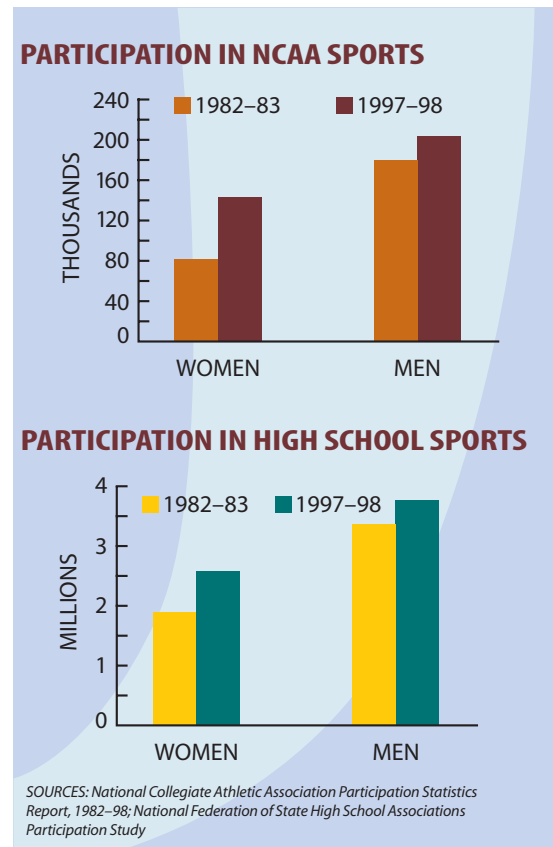
A spate of studies in the past few years on the ACL and the triad have made clear the need for specialized research and care for women. And the medical field seems to be responding accordingly. The Women's Sports Medicine Center is currently the only one of its kind in the U.S., but it won't be alone for much longer. This year the University of California at Los Angeles will open a center devoted to the medical care of female athletes, and Saint-Phard and her

colleagues have had inquiries from universities wanting to start similar programs in Baltimore and Detroit, as well as in Florida, Texas, North Carolina and Tennessee. In addition, this autumn the National Institute of Arthritis and Musculoskeletal and Skin Diseases will solicit research proposals on women and sports—with an emphasis on the long-term consequences of exercise at all levels of participation. This area of medical inquiry is only a beginning, says the institute's Joan A. McGowan. "When you want research in a certain area, you can't just order it up, you have to grow it."

TEARING INTO ACL INJURIES

The most obvious musculoskeletal difference between men and women is the breadth of their hips. Because a woman's pelvis tends to be wider, the muscles that run from the hip down to the knee pull the kneecap (the patella) out to the side more, sometimes causing what is called patellofemoral syndrome—a painful condition that appears to occur more frequently in women. In men, the muscle and bone run more directly vertically, putting less lateral pull on the patella. Some studies also indicate that women's joints and muscles may tend to be more lax than men's; although this adds to greater flexibility, it may mean that female joints and muscles are not necessarily as stable.

Increased laxity and differences in limb alignment may contribute to ACL injuries among female athletes. And yet, even though physicians and coaches



LISA BURNETT

The Inside Story on Injury

The skeletons of women differ from men's most visibly in the width of the pelvis. As a result, women have a wider Q angle (a measure of bone alignment from hip to knee) and carrying angle (from upper to lower arm), which can lead, respectively, to higher rates of knee and elbow or shoulder injuries.

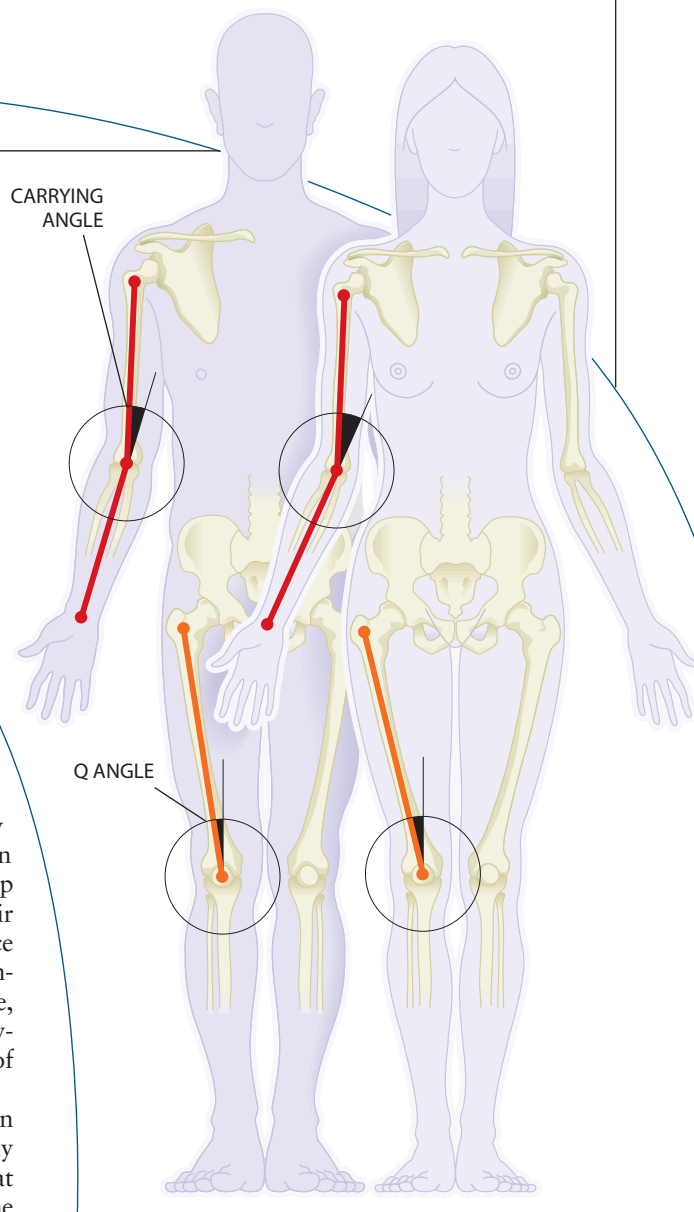
first recognized in the 1980s that female athletes were more prone to this injury, there is still no resolution about the cause. "It is an area of controversy," observes Joseph Bosco, an orthopedic surgeon at New York University.

Some experts place the blame squarely on laxity, musculoskeletal configuration and a few other physiological differences. They note that the bony notch the ACL passes through as it attaches to the lower leg bone may be proportionately smaller in women. Other researchers have shown that women typically favor using their quadriceps muscles (at the front of the thigh) rather than their hamstrings (at the back of the thigh), an imbalance that may rip the ACL. And still others think the injury is more related to the training women receive, their skill level and their overall fitness. Most, however, agree that it is some combination of several of these factors.

Recent studies indicating that ACL injuries can be prevented by training women to jump differently and to develop their hamstring muscles suggest that inadequate training is at least a large part of the problem. "We train and condition women in the same way that we do the men," says Wojtys, who showed in a 1999 study that women tend not to bend their knees as much as men do when they land a jump, thereby increasing the pressure of the impact on the joints. "They probably need their own training programs."

The Cincinnati Sportsmedicine and Orthopaedic Center focuses on just such an approach. In 1996 Frank R. Noyes and his colleagues there followed 11 high school girl volleyball players who went through Sportsmetrics, a grueling six-week jump-training program the researchers had created. They found that all the participants improved their hamstring strength and that all but one were able to reduce their landing forces, placing less stress on their knees as a result (and achieving the "quiet landing" Saint-Phard was looking for in Philadelphia).

The investigators went on to follow two new groups of female athletes—those who did this strength training and those who did not—as well as a group of male athletes without Sportsmetrics. In an article published last year in the *American Jour-*



nal of Sports Medicine, the authors, led by Timothy E. Hewett, reported that only two of the 366 trained female athletes (and two of the 434 male athletes) suffered serious knee injuries, whereas 10 of the 463 untrained women did. They concluded that specially trained female athletes were 1.3 to 2.4 times more likely to have a serious knee injury than the male athletes were, whereas the untrained females were 4.8 to 5.8 times more likely.

The idea that better, or perhaps more, training could have a strong effect on injury rates is supported by work with another set of women: army recruits. According to a recent study by Nicole S. Bell of the Boston University School of Public Health, female recruits were twice as likely to suffer injuries during basic combat training than men were—and two and a half times more likely to have serious injuries. The injuries were not only knee-related but included sprains and stress fractures of the foot and lower leg. Bell found that, overall, the women were not in as good shape as the men were and that a lack of fitness was associated with injury rates in both

HAPPY LANDING: In a Philadelphia gym, one woman tries to land jumps (below) with her knees straight forward instead of knocked to reduce the chance of ACL injury, while another (right) strengthens muscles around her knee.

sexes. Many girls don't participate in sports as they are growing up, typically getting started only in late junior high school or beyond, Noyes says. "The boys have been running around playing tanks and guns, and the girls have been playing house," he says. "That goes along with the theory that girls are less fit."

Despite the growing consensus about the benefits of jump training, the approach is in limited use. Saint-Phard and her colleagues have led the injury prevention workshop they held in Philadelphia in schools around New York City. But they reach a very small group of young women and coaches. The challenge, Noyes and others note, is getting to the

Noyes's work on surgery outcomes and the growing consensus about the importance of neuromuscular control appear to have shifted some attention away from another area of ACL injury investigation: hormonal influences. Researchers have found that the ACL has estrogen and progesterone receptors—target sites that respond to those two hormones. In studies in animals and in vitro, they have discovered that the presence of estrogen decreases the synthesis of collagen fibers, the building blocks of ligaments. It also increases the levels of another hormone, relaxin, which in turn adds to the disorganization of collagen fibers. This change in the ligaments makes the ACL more flexible and, according to the hypothesis, more vulnerable to injury.

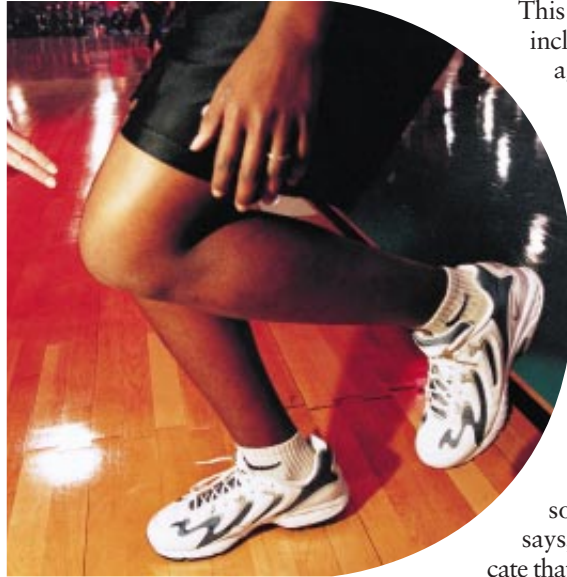
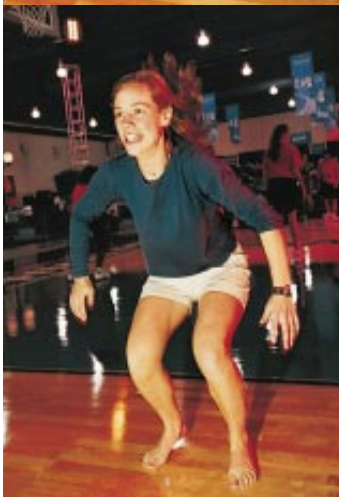
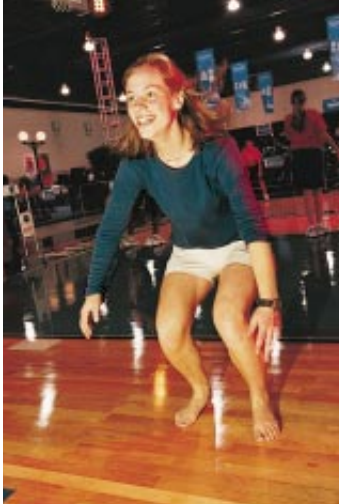
This view seems supported by some studies, including one by Wojtys published two years ago in the *American Journal of Sports Medicine*. He and his team questioned 40 women with ACL injuries; the majority of the tears occurred during ovulation, when estrogen levels were highest. Other studies show some increased muscle laxity in ovulating women, but nothing dramatic.

Wojtys's study has been contested as suspect because it was based on such a small sample size, because the women's ages were so variable and because the researchers were relying on the athletes' recollections. And Wojtys himself agrees that nothing is definite. "It is not something you can hang your hat on," he says, noting, however, that other studies indicate that women on birth-control pills have a much lower rate of injury—presumably because they don't ovulate and their estrogen levels are lower. "It is indirect evidence; none of it is confirmatory. But to ignore it and not investigate doesn't make any sense," he says. Wojtys, whose interest in women's sports medicine was catalyzed by his two daughters' love of sports, says that he is not averse to being proved wrong and adds that, in fact, he hopes he is.

"Estrogen probably has some role," notes Jo A. Hannafin, orthopedic director at the Women's Sports Medicine Center. But, she says, no one is applying the studies' findings to the court—limiting, say, what time of month a player should or should not play. The hormonal result "just reinforces old stereotypes," Bosco adds. "It takes weeks and weeks for the effects [of estrogen] to be seen, so it doesn't make sense. We still strongly encourage women to participate in athletics over the whole month."

TREATING THE TRIAD

Estrogen's role in the other major health threat to female athletes is not at all controversial. Exercise or poor eating, or both, can cause an athlete's body to develop an energy deficit, become stressed and lose essential nutrients. Any or all of these changes can cause levels of follicular-stimulating and luteinizing hormones to fall and ovulation to therefore



wider community of coaches, parents and trainers. "We need training programs nationwide," Noyes insists. He says that although some coaches are happy to see him, the rest consider knee-strength training a six-week regimen that just holds up team practice.

Noyes is also working to redress another sports medicine imbalance. Historically, men have been more likely than women to have knee surgery. Noyes believes that there are two reasons. First, knee surgery used to be a difficult procedure with often poor outcomes, so it was limited to athletes who really "needed" it—in other words, professional male athletes. Second, there has been a perception among physicians that women would not fare as well during the often painful surgery and recovery. So Noyes and his colleagues decided to examine the responses of both men and women to ACL surgery. They determined that although women took slightly longer to heal, both sexes fared equally well in the long run.

cease. Absent their menstrual cycles, young athletes do not have the requisite estrogen at precisely the time they need the hormone the most to help retain calcium and lay down bone. By the age of 17, nearly all a young woman's bone has been established, explains Melinda M. Manore, a professor of nutrition at Arizona State University. If an athlete's level of estrogen remains low, she can start to lose bone mass at a rapid rate, which can lead to stress fractures and, if the process is not curbed, premature osteoporosis.

The phrase "female athlete triad" was coined in 1992 by participants at an American College of Sports Medicine meeting. Since then, anecdotal reports have indicated that the occurrence of the triad is on the rise. "I think young women are more and more aware of their body size," Manore says. Furthermore, female athletes are especially vulnerable. Eating disorders—such as obsessive dieting, calorie restriction or aversion to fat (all labeled disordered eating), as well as anorexia and bulimia (the so-called classic eating disorders)—are disproportionately high in girls and women who participate regularly in sports.

Averaged across various sports, some 30 percent of these individuals have an eating problem, as opposed to 10 to 15 percent of the general population—although no one knows for sure, because no large-scale studies on prevalence have been conducted in the U.S. The proportion may be as high as 70 percent in some sports. "High achievers, perfectionists, goal setters, people who are compulsive and determined—those are the things that characterize our best athletes," says Margot Putukian, a team physician at Pennsylvania State University. Those are also the very qualities that often lead people into problem eating.

And athletic culture—particularly for swimmers, runners, skiers, rowers and gymnasts—only continues to reinforce these behaviors and expectations. Many coaches encourage their athletes to lose weight so they can be faster or have less mass to move through acrobatic maneuvers. According to a recent study, female gymnasts weigh 20 pounds less than those in the 1970s did. And many female athletes at all levels see losing their period as a badge of honor. "They don't see it as a negative," Putukian explains. "They see it as something that happens when you get in shape, a sign that you are training adequately." What they also don't see is what is happening to their bones—until they develop stress fractures. "They fly through their adolescent years with no knowledge of why being too thin is dangerous," Saint-Phard says.

Treating the triad is challenging, and, as Putukian notes, "there is not a lot of great data to tell us what is the best thing." Researchers now recognize that female athletes experiencing these problems need the combined talents of a physician, a nutritionist and, if they have bulimia or anorexia, a psychologist—a multidisciplinary team that most schools and colleges lack. "When you have a kid who has an

eating disorder, it is very frustrating," Putukian says. "It is reversible if you catch it early on, irreversible if you don't." She tells her athletes—who are all questioned about their menses and their eating habits during their initial physical—that if they haven't had their period for three months, they are in danger. Putukian tries to get them on a birth-control pill and works with them to change their eating habits if they have a problem. But although the pill restores some hormonal activity, it does not provide the requisite levels for normal bone development. And hormone replacement therapy, which is used by some physicians, has not been extensively tested in young women.

Nevertheless, Putukian notes that athletes may be easier to treat than women in the general population because there is an incentive: competition. "It is an incredible tool," she says. "You can help kids come back." Putukian has refused to let several athletes compete until they got their weight up to healthy levels; their desire to participate drove them to improve their eating habits.

Putukian, Manore and others would like to see young women better educated about the consequences of excessive dieting and amenorrhea. They admit that little can be done about the cultural pressures facing young women—the unrealistic icons of emaciated beauty that destroy many self-images. But they believe that if girls understand that they may be jeopardizing their freedom to take a simple jog in their 30s without fracturing their osteoporotic hips or leg bones, they will change their behavior. The investigators hope that athletes will focus on how they feel and how they perform, rather than on how much they weigh. But as with the jump-training program to prevent ACL injuries, there remains a great divide between the medical community's recommendations and the reality of the track or court or gymnasium. Only when those are fully integrated will Title IX have truly fulfilled its promise.

MARGUERITE HOLLOWAY is a contributing editor at *Scientific American*.

FURTHER INFORMATION

A variety of entries on women's injuries and sports medicine can be found in *The International Encyclopedia of Women and Sports*, edited by Karen Christensen et al. (Macmillan, 2000).



CROSSING THE LINE: U.S. gymnast Christy Henrich weighed 47 pounds when she died in 1994 at age 22. Many female athletes are urged, or urge themselves, to lose weight in an effort to hone their performance. This pressure can lead to the female athlete triad—with tragic consequences.