Forty years after its implementation, Title IX continues to change the lives of girls and young women by enabling active participation in sports at all levels. The AAOS Women’s Health Issues Advisory Board examines how the practice of orthopaedic surgery has been influenced by the influx of female athletes of all ages.

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"No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance..."

The women's civil rights movement of the 1960s brought to light the pervasive earnings gap between men and women in the workforce. This, in turn, led to an examination of the factors contributing to the earnings gap, and the discrimination against women in the education system. Numerous lawsuits were filed against educational institutions, led by Dr. Bernice Sanders, who had been turned down several times because she was a woman, when she applied for tenure-track positions. Educational institutions for which the law applies include any public or private preschool, elementary school, secondary school, institution of vocational, professional or higher education. The terms "activity" and program" are far-reaching, and include departments and agencies of State and local government, colleges, universities, corporations and private organizations that receive Federal financial assistance.

The 10 "key" areas addressed by Title IX included access to higher education; math and science; career education; sexual harassment; education for pregnant and parenting students; standardized testing; employment technology; learning environment; and athletics. The initial legislation did not specifically address athletic participation.

Women continue to lag behind men in the STEM (Science, Technology, Engineering, and Mathematics) professions. This is the case for all levels of education. For example, 85% of students enrolled in high school cosmetology, health aide and child-care courses are women. The median hourly wage for these careers is $7.50 - $8.50. Young men fill 90% of the enrolment in high school plumbing, electrical work, welding and carpentry courses where the median hourly wage is $18-19. (http://titleix.info)

Women's participation in sports has steadily increased since Title IX, however opportunities for men in athletics at the high school and college levels continue to outnumber those for women. Women's sports received 40% of the overall athletic money spent for Division I schools in 2011 (48% of total athletic scholarship dollars), with 53% of the student body being female. There are national championships sponsored by the NCAA in 19 male sports and 20 female sports. Over the past 20 years, men's sports have had a net gain of nearly 1,000 additional men's teams across the educational system. The net gain for women's sports was approximately 2,500 teams, though male collegiate athletes in 2011 still outnumbered female athletes by nearly 62,000. In 1972, over 90% of coaches for college women's teams were female. That number has dropped to less than 50% today.

There are misconceptions in the public about what Title IX requires. The law does require that schools treat males and females equally with regard to opportunities to participate, scholarships (in proportion to the number of male and female students participating in intercollegiate athletics) and treatment of teams. Title IX does not mandate quotas for participation, and does not dictate how schools must implement compliance. It does not mandate equal spending on male and female sports. While its impact on athletics has received the most attention, Title IX applies to the entire educational system receiving federal financial funding, and the "key" areas above remain critical areas of concern in achieving equality for men and women within the educational system and beyond.

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1963: Equal Pay Act addresses equal pay for men and women, did not include education.

1964: Title VI and Title VII of the Civil Rights Act prohibited discrimination on the basis of race, color, national origin, not sex. Title VII excluded employment in the education system. Neither was specific to women.

1971: Edith Green proposes legislation to prohibit sex discrimination (fails).

1972: Title IX of Education Amendments Act, introduced by Senator Byrch Bayh, passes on June 23rd, with an amendment specifying no quotas.

1974: Javits Amendment passes, providing Title IX regulations be issued and include provisions for sports.

1975: Department of Health, Education, and Welfare (HEW) issues final Title IX regulations.

1976: NCAA files unsuccessful lawsuit against Title IX athletics regulations.

1979: HEW issues “3 part test” to assess institutional compliance with Title IX.

1981: NCAA convention passes governance legislation, bringing women’s sports and championships under the NCAA umbrella.


1997: Office for Civil Rights (OCR) issues guidelines for institutional compliance with sexual harassment prevention.

2000: Department of Justice issues “Final Common Rule” on Title IX enforcement for all federal agencies.

2005: Department of Education issues clarification that weakens schools’ obligations under Title IX.

2010: Department of Education rescinds clarification, restores enforcement of Title IX to previous standard.

Excerpted from National Coalition for Women and Girls in Education (NCWGE).

Epidemiology of Participation, Injury Rates by Sport and Level of Participation

While we can obtain numbers of participants in organized sports at the high school and college levels, it is more difficult to track these trends in the realm of recreational sports. Some sports do track demographics and there is limited injury reporting for recreational sports.

Women were not allowed to enter the Boston Marathon officially until 1972, when 9 women entered the race. In 1967, a female runner, Katherine Switzer entered the Boston Marathon under initials and last name only, and a race official attempted to shove her off the course. Women currently account for 41% of marathon runners. Women have also made progress in the sport of triathlon. Triathlon became an Olympic sport in 2000, for men and women alike. Women currently make up 37% of USAT members.

Women did not compete in the first modern day Olympics (1896). In 2012, the US women earned 56% of our nation’s medals and 66% of its gold medals. It is also the first Olympiad in which all participating teams sent a female athlete. The success of the US women in the London Olympics has been directly attributed to Title IX.

Injury rates for organized sports are tracked through the various governing bodies and through the CDC, with research being done at the local and regional level as well. Powel and Barber- Foss studied sex-related injury rates in a high school population using certified athletic trainers in 1995-97. They found an increased injury rate for high school girls compared to boys in the sports studied.

The NCAA also tracks injury rates in men’s and women’s sports. Numerous studies have been published. Hootman et al. published an epidemiologic summary report covering 15 men’s and women’s sports for the period 1988-2004.

Injury rates are higher for competition, with football having the highest rates. Women’s soccer, in particular, and women’s basketball have been shown to have higher ACL injury rates than their male counterparts.

References

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Outcomes of Musculoskeletal Injuries: Comparison Between the Sexes

With Title IX and the influx of females participating in sports, a corresponding increase in musculoskeletal injury and disease has been reported. Many of these have been previously reviewed in poster segments for the WHIAB Scientific Exhibit, but several continue to undergo rapid change in the understanding of the epidemiology, etiology, treatment of and outcomes of these conditions.

Anterior Cruciate Ligament Injury
Non-contact anterior cruciate ligament disruption has been reported to occur at a much higher rate in female athletes, particularly in soccer and basketball, where women compete under the same general rules as men. Numerous factors have been cited as playing a role in the increased rate of ACL tear in women. Early studies centered on anatomic factors (ACL ligament size, shape of the intracondylar notch, Quadriceps vector or Q-angle, foot pronation) hormonal issues (effects of estrogen and relaxin on tissue strength and flexibility, phase of the menstrual cycle, use of oral contraceptives) and neuromuscular issues (hamstring flexibility, Quadriceps muscle dominance, muscle firing sequence.) More recent work has focused on tibial slope, genetic predisposition, neuromuscular control, proprioceptive deficits, and muscle fatigue. Several groups have developed neuromuscular training programs that have demonstrated some success in decreasing the rate of ACL tears in the female athletic population studied. Successful ACL injury prevention programs generally have included a plyometric training component, technique feedback, balance/core strength training. Though ACL surgery has been found to be of benefit to both males and females, surgical outcomes for ACL reconstruction have been found to differ between men and women as well. More women experiencing objective laxity post-surgery, as well as increased graft failure rate in teenage females athletes. These differences may be associated with graft type (hamstring autograft vs. B-T-B autograft). Female sex is also associated with radiographic knee osteoarthritis after ACL reconstruction, though previous medial meniscectomy, increased BMI and chondrosis were more strongly associated with knee osteoarthritis after ACL reconstruction.

Ankle Sprains
Ankle sprain has been found to occur more frequently in female athletes both at the high school as well as collegiate level. This is particularly true for basketball and soccer, as well as volleyball and lacrosse. Increased postural sway, less accurate passive joint inversion sense, and higher extension range of motion at the first metatarsophalangeal joint have been shown to be associated with increased rate of ankle sprain injury in high school male and female athletes. Female dancers were found to have longer time to stability than men in landing from vertical jump. This may explain the increased rate of ankle sprain in female dancers compared to male dancers.

Shoulder Instability
Shoulder instability has been shown to occur at a higher rate in males compared to females in NCAA collegiate athletes and in military populations. Though population based studies are lacking, females experience a higher incidence of benign hypermobility syndrome, as well as an increased rate of atraumatic, multidirectional instability compared to males. Studies have shown decreased joint proprioception in the female shoulder compared to males. Most studies reporting surgical management have a preponderance of male patients, and male sex is associated with a higher rate of failure of surgical stabilization.

Concussion
One high school study reporting on multiple sports, showed no difference in incidence of concussion, though symptoms differed by sex. Headache was the primary symptom reported among athletes of both sexes. Males reported amnesia and confusion/disorientation more than females to a statistically significant extent; however, females reported significantly more drowsiness (a neurobehavioral symptom) and sensitivity to noise (a somatic symptom) more often than did males. No differences were observed for symptom resolution time or return-to-play time between sexes. A few studies since have shown an increased injury rate for concussion in female compared to male athletes for sex-comparable sports (soccer, basketball, softball/baseball). Female soccer players with history of concussion have been found to experience more symptoms and perform worse on neurocognitive testing. They may also experience more protracted recovery.

Osteoarthrosis
Osteoarthrosis, particularly of the hand and knee, occurs more commonly in females than males. Females experience more severe symptoms and often delay joint replacement longer than men. Women experience more pain and reach a lower functional level after arthroplasty than men. This may contribute to lower success rate of joint arthroplasty in women. It is not yet known how increased athletic participation in high school and college in females will affect the rate of osteoarthrosis in later adulthood.

Reference list available below.

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The Female Athlete Triad: Disordered Eating, Amenorrhea, and Osteoporosis

Although the diagnosis and care of the Female Athlete Triad and the related concerns fall largely out of the field of orthopaedic surgery, it is important that the orthopedic community participate in recognition of this problem. Often a young female athlete will make a priority of seeking orthopaedic care and the orthopaedist is in a unique position of potentially recognizing and referring some of these young women to appropriate care.

The Female Athlete Triad was first described in 1992 by the American College of Sports Medicine (ACSM) talk force. The triad includes the relationship among disordered eating, amenorrhea, and osteoporosis. The importance of the impact of energy availability on menstrual function and bone health has been greatly emphasized in the two decades since this introduction. Energy availability is defined as the “Amount of dietary energy remaining to support other physiologic functions after subtracting out exercise training.” It can also be thought of as “calories consumed – calories expended.” Actual Energy Availability can be calculated:

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\text{Energy Availability = Dietary Energy Intake – Exercise Energy Expenditure} \quad \frac{\text{Fat Free Mass}}{\text{Fat Free Mass}}
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Amenorrheic athletes have been shown to restrict energy availability by 44 to 67%. This disrupts leutinizing hormone pulsatility, which in turn impairs bone turnover. (Loucks et al; 2003 & 2004). Reduction in energy availability may be reduced with or without disordered eating. It may be unintentional due to inadequate dietary intake and or excessive exercise. Nonetheless, inadequate energy availability effects the ovaries, which in turn decrease estrogen output, which decreases calcium absorption. Decrease in estradiol not only decreases bone formation, it also increases bone resorption.

Regarding menstrual function, some definitions to keep in mind are as follows: Eumenorrhea is the state of regular cycles of 28 days plus or minus 7 days. Amenorrhea is defined as no menses for 90 days. Primary amenorrhea is defined as no menarche by age 15 and no signs of puberty. Secondary amenorrhea is defined as amenorrhea beginning after menarche. Oligomenorrhea is defined as menstrual cycles with interval greater than 35 days. Some other menstrual disorders include luteal suppression, which is a luteal phase of less than 11 days with low progesterone. Anovulation is defined as menstrual cycle with no ovulation. Pulsatility in leutinizing hormone is disrupted within 5 days of drop in energy availability by 33% in young women. This can be restored with increase in calorie intake alone. Some women may be less susceptible to drop in energy availability, so individual consideration and care are important to recognize each individual’s threshold. (DeSouza et al; 1998 & 2004, Loucks et al; 1998 & 2003)

An amenorrheic female athlete is 2 to 4 times as likely to sustain a stress fracture than her eumenorrheic counterpart.

Osteoporosis is defined as a skeletal disorder with decrease in bone strength which correlates to an increase risk for fracture. In 2005, the Society for Clinical Densitometry recommended for a change in measurement of osteoporosis in premenopausal women and children. Post menopausal women are evaluated using the T score, which compares an individual to a mean. The new recommendation in 2005 was to use z-scores for premenopausal women and children, so as to compare them to age and sex matched controls. Before this change, it was easier to miss an outlier in the younger age group, because the young women were being compared to the older women. The diagnosis of osteoporosis has since been made in this age group by z-score more than 2 standard deviations below the mean of age and sex matched controls and secondary clinical risk factors. These risk factors include chronic malnutrition, eating disorders, hypogonadism, glucocorticoid exposure, and previous fractures. Furthermore, because athletes’ normal bone density is normally 5-15% than nonathletes, osteoporosis is defined in the young female athlete to be below 1 standard deviation of normal. The secondary clinical risk factors for athletes are: history of nutritional deficiencies, low estrogen, stress fractures, and/or other secondary clinical risk factors as mentioned above.

Risk factors for low energy availability include restricted dietary intake, prolonged exercise, vegetarians, and limitations placed on food types. (Cobb 2003; Manore 1999 & 2000) Risk factors for disordered eating and exercise disorder include dieting, low self-esteem, family dysfunction, abuse, genetics, and disordered eating behaviors. (Rome et al; 2003) Athletes have additional risk factors, including an early start to sport-specific training, injury, sudden increase in training volume, and sports favoring leanness. (Sungot-Borgen 1994)

When evaluating a young woman, the following should be kept in mind. Important points in history include eating behavior, weight fluctuation, exercise volume, menstrual history, and stress/low impact fractures. On exam, watch for bradychardia, orthostatic hypotension, lanugo hair, parotid gland enlargement, signs of self induced vomiting, and cold or discolored hands and feet. Consideration for DEXA scanning is appropriate in the setting of 6 or more months of disordered exercise or eating or oligo or amenorrhea. If concerns continue and rescan is performed, wait a year and repeat on the same machine.

The treatment of female athlete triad includes a multidisciplinary team consisting of physician, dietician/nutritionist, possible mental health specialist, parents, coaches, trainers, and exercise physiologist. Intervention focuses on increase in calorie intake, decrease in exercise, and restoration of menstrual cycles. Early intervention is necessary.

Some practical advice includes recommendation of increase in calories by 300-400 kcal per day, decrease in training by one day per week, and small, frequent meals and eating strategies. It may take months to restore menstrual cycle. (Casper et al; AMSSM 2006) Recommendation for vitamin intake is as follows: calcium: 1000-1300 mg/day, vitamin D 400-800 IU/day, and vitamin K 60-90 μg/day. Written contracts should be considered among athlete, coach, parents and medical professionals. Medications such as antidepressants may be considered, but oral contraceptive pills are currently less commonly prescribed for this population.

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Effect of Athletics on Mental and Physical Health

Title IX has afforded young women greater opportunity for collegiate sports participation and jump started a heightened awareness of all female athletics. Several new and important challenges for the care of the female athlete have risen along with this increased sports participation.

Athletics and Chronic Disease

In a nation facing an obesity epidemic, there is no doubt that an active lifestyle results in tremendous health benefit. Athletics in adolescence and young adulthood promote lifelong patterns of an active life style which benefit cardiovascular health, maintenance of healthy body mass index, and prevention of diabetes and some cancers. One study on breast cancer risk reported a significantly lower risk in former college athletes compared to women who did not play sports. In this study, the odds ratio for developing breast cancer for athletes compared to non-athletes was 0.6 and even lower for athletic women under the age of 45. Among the greatest benefits associated with the female athlete is the establishment and maintenance of optimal bone mineral density due to the positive effects of weight bearing exercise on bone mass accrual. Female high school varsity athletes have greater hip and spine bone mineral densities in their mid-thirties compared to sedentary individuals. Consistent exercise during adolescence has been shown to be the main lifestyle factor associated with improved bone mineral density later in life, providing a greater impact than calcium intake. The maintenance of bone mass as well as a higher muscle proportion in body composition is also evident after menopause in former athletes.

Athletics and Mental and Social Well-Being

Physical activity and sports participation also has a positive effect on overall well-being and self esteem. Once recent study found that NCAA female athletes had higher Short Form-36 scores for general health, vitality, social well being, emotional well-being, and mental health compared to the general population. Collegiate athletes report higher measures of self esteem and sense of social connectedness. Most female athletes also have a higher body image and lower rates of disordered eating to lose weight compared to non-athletes. A physically active lifestyle is also credited with lower rates of depression and depressive disorders. Beginning in adolescence, females typically experience more depression, with rates up to twice that of their male counterparts; however, athletes overall experienced less depression than non-athletes. Similarly, female former college athletes are diagnosed with depression 50% less often as non-athletic counterparts even ten years following their collegiate sports careers. Suicidal ideation and attempts are also less prevalent in female high school athletes and collegiate athletes compared to those who did not participate in sports.

Athletics and Behaviors of Risk

Female athletes are less likely to use illicit drugs and tobacco products compared to non-athletes. They may also be less likely to use banned performance enhancing substances compared to male collegiate athletes. Published data on the female collegiate athlete and alcohol consumption are mixed. Some studies indicate a lower overall alcohol consumption by athletes versus non-athletes while others indicate higher or no difference between the two populations. Overall, athletic participation seems to be correlated with higher college alcohol consumption, high risk drinking behavior such as binge drinking, and negative consequences secondary to alcohol; the female athlete is not immune to this trend. In a recent meta-analysis, of the 34 reviewed studies indicated a positive relationship between sports participation and drinking. Specifically, female soccer players were more likely to drink heavily and use marijuana compared to athletes in other sport and versus non-athletes. It is believed this is due to the social environment, teammate or peer expectations, and need for stress relief accompanying competitive sports participation. Female athletes participated in lower rates of high risk sexual behavior (fewer partners, unprotected sex) and lower incidence of teenage pregnancy compared to girls who did not participate in sports. This was largely due to the fear of compromising an athletic season because of a pregnancy.

The Athlete’s Paradox

While participation in athletics can greatly benefit girls and boys of all ages, the same factors can also create an opposite effect. Sports participation can impart an additional stress on time, sleep, and energy for high school and college aged athletes. Greater sense of social well-being, social connectedness and perceived socially privileged status of athletes on campus may also present undue pressures for risk taking behaviors. The constant strive to succeed, especially at the highest level of athletics, also lends toward higher levels of anxiety, disordered sleep, and pathogenic eating behaviors. The “aesthetic” sports, such as cheer, dance, gymnastics, and skating, have been found to have greater negative influences on participants’ body image and higher incidences of anxiety disorders compared to male athletes. The very act of training for sport can develop into a pattern of disordered coping mechanisms and “addictive” exercise. These concerning problems can also be exacerbated in the setting of a injury when athletes’ perception of support and self-image can significantly decline.

As orthopaedic surgeons caring for female athletes, we should be aware of the social implications of sport and injury. Utilization of a sports psychologist, especially for athletes with signs of disordered eating, substance abuse, exercise addiction, and coping with injury, is appropriate.

Reference list available below.

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