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**CrossFit: Remember What You Have Learned; Apply
What You Know**

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ABSTRACT

Mullins NM. CrossFit: Remember What You Have Learned; Apply What You Know. **JEPonline** 2015;18(6):32-44. The purpose of this article is to present important considerations regarding participation in CrossFit programming. CrossFit has motivated many people to incorporate regular exercise into their lifestyles, and to achieve real changes in physical fitness. However, some CrossFit customs impose very high risk-benefit training and conflict with standards of professional fitness practice. The objectives are to educate and minimize risk, not to criticize.

Key Words: CrossFit, Risk-benefit, Education, Standards of practice

INTRODUCTION

Tremendous numbers of people are now familiar, in some way, with CrossFit (CrossFit, Inc., Washington, DC). As a business entity CrossFit has been extraordinarily successful, expanding to more than 11,000 affiliated gyms (<http://www.crossfit.com/cf-info/what-is-crossfit.html>) since its incorporation in the year 2000. CrossFit has inspired many people to incorporate regular exercise into their lifestyles, and has helped many people associate challenging physical work with positive feelings of accomplishment and camaraderie. However, some CrossFit methods conflict with principles of sound exercise training and standards of professional fitness practice. While many CrossFit affiliates succeed in helping clients gain fitness and confidence, some do so through very high risk-benefit programming that can precipitate injuries (16). In order to promote long-term participation in exercise programs, which is necessary for maintaining health and fitness gains, it is important that more people become better educated about CrossFit customs that impose undue risk. Many people come to appreciate the need for injury prevention in hindsight, but it is our duty as fitness professionals to use foresight to recognize and reduce potential risks. To do that, we must remember what we have learned and apply what we know.

Bergeron et al. (6) and Petersen et al. (33) have already expressed some concerns regarding CrossFit programming. This article aims to add more thoughts for consideration, for the purposes of educating and reducing risks, not for criticizing CrossFit. Some CrossFit affiliates are run by colleagues who are well-educated in the exercise sciences and who ensure proper technique, sound progressions, and tailored training for individuals. Others, however, are run by those lacking exercise science education and failing at what should be central goals of all fitness leaders (i.e., minimizing risks and promoting lifetime physical activity). Fitness specialists must question methods that conflict with well-established science and professional standards, even if extremely popular, fun, and profitable.

This article arose from a need to address student questions about CrossFit, and a desire to educate as many people as possible about high-risk practices reported by students interning at CrossFit facilities, communicated by individuals injured during CrossFit participation, and experienced personally during CrossFit workouts. In each situation, it has been challenging to address practices that I know to be dangerous and to oppose well-established, research-based recommendations for exercise programming (38,39). Some CrossFit enthusiasts allege that scrutinizers of its practices are not “tough enough” to handle the workouts, or that they are simply “haters.” Neither allegation is true for me. First, as an exercise professional, I strive to advocate regular exercise training to as many people as possible, for as long as possible. Therein lies one dilemma. While CrossFit motivates many people to exercise (32) and can contribute to real changes in physical fitness (37), it can also precipitate and exacerbate injuries (2,12,14-16,19,20,25,37). Second, high-intensity workouts are my preference and I have “Rx’d” several CrossFit workouts (i.e., performed them as prescribed, without any adjustments). In doing so, however, I knew that I was imposing unnecessary strain on my body. I feel it is my duty to apply what I know.

Some CrossFit devotees have presented their own health and fitness as evidence of its safety and effectiveness. Such a defense is groundless where attrition bias may be in effect, such that those remaining in a population may systemically differ from those who dropout (24). Indeed, CrossFit programs have been labeled, on more than one occasion, as exercises in “survival of the fittest” (10,31). CrossFit participants have sustained very severe, acute injuries, including

exertional rhabdomyolysis (15,25) and carotid artery dissection (12,20), and high percentages have developed overuse injuries within relatively short periods of time (14,16). In a recent study characterizing the types and rates of CrossFit-related injuries, Hak et al. (16) found that 73.5% of participants, averaging only 18.6 months of CrossFit training, sustained an injury that prevented them from training, competing, or working. A total of 186 injuries were reported by 132 respondents, with shoulder and back injuries accounting for more than 45%. Feito and Paul (11) reported that 51% of 738 individuals sustained a CrossFit-related injury within the previous 12 months, and that 84% of all injuries were to the shoulder and back. Any program that may contribute to such high rates of injury to major joints warrants attention.

Consider Carefully: Fitness Leaders Lacking Industry-Specific Education

In efforts to reduce risks, it is crucial to scrutinize the education of CrossFit leaders. Importantly, recognize that CrossFit Inc. is a company, that is, a business organization that provides services in exchange for money. However, according to its corporate website (<http://www.crossfit.com/cf-info/what-is-crossfit.html> accessed October 23, 2015), CrossFit is much more:

CrossFit is many things. Primarily, it's a fitness regimen developed by Coach Greg Glassman over several decades. He was the first person in history to define fitness in a meaningful, measurable way (increased work capacity across broad time and modal domains). CrossFit itself is defined as that which optimizes fitness (constantly varied functional movements performed at relatively high intensity). CrossFit is also the community that spontaneously arises when people do these workouts together. In fact, the communal aspect of CrossFit is a key component of why it's so effective.

It is disconcerting that any one person would take credit for being the first to define fitness, much less someone with no formal education in the exercise sciences. Readers are encouraged to reflect on the following "insight" of Glassman, posted on the CrossFit website: "The world's most successful athletes and coaches rely on exercise science the way deer hunters rely on the accordion" (<http://www.crossfit.com/cf-info/faq.html#WOD1>). Regarding the definition of fitness above, not only should its vague and nonsensical nature raise a credibility red flag, but so too should its dissimilarity with standardized industry terminology (9). CrossFit is also neither the first type of program to engage people in high-intensity workouts with diverse exercises, nor to foster a sense of community among participants. CrossFit activities may seem new to people who have never engaged in similar training, just as obstacle course training may seem new to many, though it is ancient practice (26). What is relatively new is CrossFit's expansive use of social media to publicize and promote everything associated with it. Propagating enthusiasm for exercise training is a very favorable effect, as long as the training is sound. In some CrossFit affiliates, it is; in others, it is not.

Not only do most people expect their trainers to be well-educated, but the leading entities in exercise science – including the American College of Sports Medicine (ACSM), National Strength and Conditioning Association (NSCA), American Society of Exercise Physiologists (ASEP), and Commission on Accreditation of Allied Health Education Programs (CAAHEP); all specify the requirement that leaders of exercise training programs should be degreed professionals (38,39, www.asep.org/index.php/organization/practice/, www.caahep.org/Content.aspx?ID=41).

However, neither owners, nor trainers need a degree to operate a CrossFit franchise. The following is an excerpt from the transcript of the CBS 60 Minutes segment, "King of CrossFit," first aired on May 10, 2015 (<http://www.cbsnews.com/news/crossfit-creator-greg-glassman-60-minutes/>):

Narrator: "One reason CrossFit's grown so fast is because just about anyone who wants to open a "box" can after paying a \$3,000 yearly fee and passing a two-day seminar. It's how the company makes most of its money."

Sharyn Alfonsi: "Two days to take a course, then I can open a gym?"

Greg Glassman: "Amazing, huh?"

To simultaneously advocate increased professionalism in the fitness industry and support those lacking the most fundamental of credentials are inconsistent actions. Allowing undereducated people to work in a field, which requires extensive knowledge, skills, experience, and judgment, greatly increases risks of injury, ineffective training, wasted resources, dissatisfaction, and propagation of misinformation. These negative effects seldom emerge immediately, making their contributors harder to recognize, particularly where those contributors have inspired positive changes and become friends. To attain the CrossFit Level 1 (CF-L1) Trainer Certificate, an individual must be at least 17 years old, pay a \$1000.00 fee, attend a two-day training course, and correctly answer 33 of 50 (66%) multiple choice questions on the certification exam (for requirements, as of 10-23-15, see <https://training.crossfit.com/level-one> and the Participant Handbook at: www.crossfit.com/cf-seminars/CertRefs/CFD_L1_ParticipantHandbook_Revised_02.pdf). Should one fail the exam, "he/she will have unlimited opportunities to retake the test during test sessions as scheduled by CrossFit, Inc. within one year from the date of the initial attempt," as long as each retest fee is paid (\$150.00). The CF-L1 Certificate Course is accredited by the American National Standards Institute (ANSI). Though "accredited" generally refers to the condition of meeting standards set forth by an accrediting body, not all accrediting bodies dictate industry-specific standards. The ANSI, by its own definition, is an overseer of "norms and guidelines that directly impact businesses in nearly every sector: from acoustical devices to construction equipment, from dairy and livestock production to energy distribution, and many more" (http://www.ansi.org/about_ansi/overview/overview.aspx?menuid=1). So, while the CF-L1 course may be accredited, it is not accredited by an organization that seeks to ensure the credibility and/or academic preparedness of exercise leaders within CrossFit, Inc. Until it is a requirement for fitness facilities to be run by degreed fitness professionals, more people must be educated on the deficiencies of those lacking credentials and running high-risk programs.

Consider Carefully: Preparation for Peak Performance

A custom of some CrossFit affiliates is that of keeping secret the "workout of the day" or "WOD" until participants arrive. Performance excellence and injury prevention arise from conscientious preparation of the body and mind, and one cannot be optimally prepared without knowledge of the tasks to be assigned. When I ask students if they would like to join me for a conditioning session, they always ask some form of: "What will we be doing?" It is a logical question. While many CrossFit participants find it empowering to accomplish whatever tasks are assigned, it is important to recognize that "getting through" a workout is not the same as performing optimally. Moreover, everyone has limitations and everyone must, at times, modify activities. Not disclosing

the WOD is a business strategy, not a performance one. It minimizes the chances that individuals will skip workouts, even if opting out might be wise. Consider the following:

- If you were managing some knee pain and taking care to avoid excessive running impact, how would you know whether it is wise to go for a morning run on a day that you have CrossFit in the evening? If the WOD will not involve running, a morning run would be fine; if the WOD will involve running, then morning and evening running may impose more impact than is wise.
- If the WOD required 50 pull-ups, is it possible that you might regret having done so many on your own the previous day?
- If you suffer from urinary incontinence, might you want to know when box jumps are scheduled?
- If you know that you personally find it difficult to modify prescribed workouts within a competitive atmosphere, yet you have an ankle sprain that is not healing, might it help to know that the WOD will entail five rounds of 50 “double unders” (jumping rope, with two rope passes underfoot per jump)? Might that knowledge make it easier to opt out? Might that knowledge prompt taping of the ankle?

CrossFit leaders often state that anyone is free to modify any exercise according to fitness or ability, but some people may not even recognize a need to modify. What people *actually* know about fitness and exercise is often very different from what they *think* they know (1). Moreover, many followers trust leaders to “do the right thing” and intervene when appropriate, especially those they want to emulate (17). In the fitness industry, a leader’s “fit-appearing physique is often read as representing willpower, knowledge, and morality” (18) and, indeed, many CrossFit facilities are run by fit-looking leaders with considerable exercise training experience. However, experience is not synonymous with knowledge and professionalism (22). It is one thing to teach a group of people a skill, and another to ensure that every individual understands what has been taught and why, can safely perform the skill, and knows when and how to modify it. It is one thing to run an exercise session, and another to supervise all participants carefully, while providing clear, constructive feedback to motivate participants, modify their movements, and stop unsafe actions. It is one thing to teach people with whom one has a lot in common, and another to teach those who are very different (physically, psychologically, intellectually, etc.). Teaching is not the same as ensuring learning.

Consider Carefully: Abilities to Explain Recommendations

An important characteristic of well-educated fitness professionals is that they can provide clear explanations for the recommendations that they provide. Many self-proclaimed “experts” make recommendations for or against training techniques, nutritional strategies, products, etc., but cannot clearly provide any scientific basis for them. The following is a recent example of an unfounded recommendation provided by a CrossFit trainer because CrossFit advocates the “Paleolithic Model of Nutrition” (<http://www.crossfit.com/cf-info/start-diet.html>). After examining the diet record of a “carbophobic” student, and calculating an average protein intake of 2.2 grams per kilogram of body weight per day ($\text{g}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$), I asked him why, as a high-intensity exercise enthusiast, he was consuming so much protein and so little carbohydrate. He replied that his

“trainer at CrossFit told him that he needed to eat more protein.” I then asked if his trainer had conducted a diet analysis and calculated his protein intake. He said, “No.” I followed up by asking if his trainer explained the protein recommendations of $1.2-1.7 \text{ g}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$ for athletes (4), and the fate of protein consumed in excess of body needs (34). “No,” was the answer to both questions. Readers should recognize the impropriety of the trainer’s baseless recommendation.

Consider Carefully: Risk-Benefit Ratios

Some CrossFit workouts involve exercises with very high risk-benefit ratios. “Pistol squats” (a form of deep, single-leg squats) are an example (<http://www.crossfit.com/cf-info/faq.html#Exercises11>). Educated strength and conditioning specialists know that sound squat form involves maintaining a lordotic curve, tracking the knees over the toes with minimal mediolateral movement, and keeping the heels in contact with the ground (28). However, many CrossFit affiliates regularly use the pistol squat, an exercise that relatively few people can perform without rounding the back, allowing side-to-side knee movement, and losing heel contact. These technical errors are very common, in part because flexing the spine and raising the heel at the bottom of a deep, single-leg squat are biomechanically effective actions for helping to maintain the center of gravity over the foot, thus preserving balance. One simple way that CrossFit could reduce injury risk is to stop advocating an exercise that most perform with flawed technique.

Another staple of Crossfit WODs is the “kipping toes-to-bar” exercise (<https://www.crossfit.com/exercisedemos/>). It has long been known that double leg raising exercises place large loads on the lumbar spine (36). During double leg raises, the iliopsoas pulls strongly to flex the hip, such that “the force of contraction of the iliopsoas is at a maximum when the lever arm of the leg is greatest, near the horizontal” (30). As individuals with weak abdominals raise the legs towards vertical, the pelvis tends to tilt anteriorly and the lumbar spine to hyperextend. Lumbar hyperextension is widely recognized as a contraindicated exercise, due to its high potential for injuring spinal discs, nerves, and joints (21,23). The “kipping toes-to-bar” exercise not only involves double leg raises, but forceful hyperextension of the lumbar spine, and should not be advocated as a staple of any mass exercise program.

“High-risk” should not be confused with “ineffective.” Virtually all exercises provide some benefit. However, a major goal of fitness programming should always be to maximize benefits, while minimizing risks. Where there are many exercises from which to choose to train a particular body part, it is the duty of fitness leaders to choose those with low risks of collateral damage. Heated debates can arise over contraindicated exercises and those who defend their safety are often relatively young. Young people “can get away with many unsafe activities and unhealthy habits because the human body is very resilient” (1). However, it is crucial to recognize that overuse injuries are “related to repeated micro-trauma without a single, identifiable event” and that their onset typically “occurs well before the physical complaints” (41). Overuse injuries take time to manifest, but many do, as evidenced by the fact that 26% of adults in the United States have chronic joint pain or stiffness (7). Education is essential to injury prevention, but preventative strategies also require implementation, which is likely only where there is a belief in their need (41).

Consider Carefully: More ≠ Better

Bergeron et al. (6) and Petersen et al. (33) have described CrossFit's inattention to the principles of progressive overload and individualization (8), wherein training intensity, frequency, and overall volume are systematically manipulated to optimize adaptation with mindful attention to the needs, goals, limitations, and adaptive abilities of unique individuals. Both groups (6,33) have also noted CrossFit's problematic assignment of very high volumes of technically-demanding exercises – typically used for strength and power development – to participants of all levels of proficiency. Additional concerns are inspired by the CrossFit regimens in Table 1.

Table 1. Sample WODs and Open Workouts for the CrossFit Games.

http://www.crossfit.com/cf-info/faq.html#WOD1			
“Angie”	<u>For time:</u> <ul style="list-style-type: none"> ▪ 100 pull-ups ▪ 100 push-ups ▪ 100 sit-ups ▪ 100 squats 	“Kelly”	<u>For time, five rounds:</u> <ul style="list-style-type: none"> ▪ 400 meter run ▪ 30 box jump, 24 inch box ▪ 30 wall ball shots, 20 pound ball
“Adam Brown”	<u>For time, two rounds:</u> <ul style="list-style-type: none"> ▪ 295 pound deadlift, 24 reps ▪ 24 box jumps, 24 inch box ▪ 24 wall ball shots, 20 pound ball ▪ 195 pound Bench press, 24 reps ▪ 24 box jumps, 24 inch box ▪ 24 wall ball shots, 20 pound ball ▪ 145 pound Clean, 24 reps 	“Mary”	<u>Complete AMRAP** in 20 minutes of:</u> <ul style="list-style-type: none"> ▪ 5 handstand push-ups ▪ 10 one-legged squats ▪ 15 pull-ups
“Arnie”	<u>For time, with single 2 pood* kettlebell:</u> <ul style="list-style-type: none"> ▪ 21 Turkish get-ups, right arm, ▪ 50 swings ▪ 21 overhead squats, left arm ▪ 50 swings ▪ 21 overhead squats, right arm ▪ 50 swings ▪ 21 Turkish get-ups, left arm 	“McClusky”	<u>Three rounds of:</u> <ul style="list-style-type: none"> ▪ 9 muscle-ups ▪ 15 burpee pull-ups ▪ 21 pull-ups ▪ 800 meter run
“Grace”	<u>For time, 30 reps:</u> <ul style="list-style-type: none"> ▪ Clean and jerk 135 pounds 	“Morrison”	<u>50-40-30-20 and 10 rep rounds of:</u> <ul style="list-style-type: none"> ▪ Wall ball shots, 20 pound ball ▪ Box jumps, 24 inch box ▪ Kettlebell swings, 1.5 pood
“Isabel”	<u>For time, 30 reps:</u> <ul style="list-style-type: none"> ▪ Snatch 135 pounds 	“Murph”	<ul style="list-style-type: none"> ▪ 1 mile run ▪ 100 pull-ups ▪ 200 push-ups ▪ 300 squats ▪ 1 mile run
“Jason”	<ul style="list-style-type: none"> ▪ 100 squats, 5 muscle-ups ▪ 75 squats, 10 muscle-ups ▪ 50 squats, 15 muscle-ups ▪ 25 squats, 20 muscle-ups 	“Randy”	<u>For time, 75 reps:</u> <ul style="list-style-type: none"> ▪ Power snatch

*Russian measure used for kettlebells; common ones: 1 pood = 36 lb; **AMRAP = as many rounds and repetitions as possible

Table 1 (continued). Sample WODs and Open Workouts for the CrossFit Games.

Sample "Open Workout" for the CrossFit Games: (http://games.crossfit.com/workouts/the-open)		
15.1 Complete AMRAP* in 9 minutes of:	MEN – men up to 54 years old <ul style="list-style-type: none"> ▪ 15 toes-to-bars ▪ 10 deadlifts (115 lb) ▪ 5 snatches (115 lb) 	MASTERS MEN – 55 years + <ul style="list-style-type: none"> ▪ 15 toes-to-bars ▪ 10 deadlifts (85 lb) ▪ 5 snatches (85 lb)
	WOMEN – women up to 54 years old <ul style="list-style-type: none"> ▪ 15 toes-to-bars ▪ 10 deadlifts (75 lb) ▪ 5 snatches (75 lb) 	MASTERS WOMEN – 55 years + <ul style="list-style-type: none"> ▪ 15 toes-to-bars ▪ 10 deadlifts (55 lb) ▪ 5 snatches (55 lb)

*Russian measure used for kettlebells; common ones: 1 pood = 36 lb; **AMRAP = as many rounds and repetitions as possible

As indicated in Table 1, some CrossFit workouts involve extremely high repetitions for Olympic lifts and powerlifting exercises. Such exercises can be very beneficial if performed correctly, but for several reasons, many people do not perform them properly during CrossFit WODs. First, the technical intricacies of these exercises generally require extensive individualized instruction, supervision, feedback, sound progressions, and use of appropriate weights. USA Weightlifting (40) emphasizes technicality of the Olympic lifts in its summary of key points, which include:

- Athletes should not perform an exercise under significant load unless they have sufficient flexibility to perform that exercise correctly (i.e., have an adequate range of motion to assume correct positions throughout the lift).
- The almost exclusive focus of early training should be on developing correct technique, and this focus is maintained for months, if not years.
- Generally keep repetitions to three or less on technical exercises (e.g., snatches or cleans) and five or less when performing strength exercises (e.g., squats), and never continue repetitions if form is breaking down.
- Beginners should train, especially on the technical exercises, with very light loads (often just a stick).

Such high quality instruction is not practical in many CrossFit facilities, where large numbers of diverse individuals participate in relatively short classes, under the supervision of one or few instructors. Most CrossFit instructors do teach proper form for all exercises, but teaching is different than ensuring learning. Since many of the WODs are done "for time," meaning as fast as possible, or for AMRAP, meaning as many rounds and repetitions as possible within a given time frame, instructors are often focused on timing and motivating participants rather than on addressing technical errors with due diligence. Sound technique is not required to perform an exercise, like an Olympic lift, but performing with "anything other than proper form both shortchanges the participant in terms of benefits, and it greatly increases the chances of injury" (29).

Second, training loads that allow no more than 5 to 6 repetitions are recommended as optimal for enhancing muscular strength and power (3,5,40). These recommendations are not arbitrary, but rather based on extensive research into the neural and metabolic responses to resistance training (3). Performing a clean and jerk as fast as possible for 30 repetitions (See “Grace, Table 1), or a “power snatch” for 75 repetitions (See “Randy”, Table 1), not only contradicts science, but imposes undue stress and strain on the body. Since fatigue is an inherent effect of such WODs, form will suffer. As form suffers, so will joints and soft tissues. The NSCA’s *Essentials of Strength Training and Conditioning* text (5) – one of the most comprehensive references for strength and conditioning specialists states that:

Power exercises require the highest level of skill and concentration of all the exercises and are most affected by fatigue. Athletes who become fatigued are prone to using poor technique and consequently are at higher risk of injury. The explosive movements and extensive muscular involvement of power exercises also result in a significant energy expenditure. This is another reason to have athletes perform such exercises first, while they are still metabolically fresh.

Safety issues aside, decisions about the order of exercises should be “based on how one exercise affects the quality of effort or the technique of another exercise,” with the goal of ensuring that “an athlete’s maximal force capabilities are available” (5). It is generally recommended that power exercises be performed first in a training session, and that recommendation is ignored in any workout where participants perform power exercises for AMRAP within circuits.

Some CrossFit WODs ignore the physiological basis and general recommendations for plyometric exercises. Plyometric training aims to potentiate the stretch reflex and depends on immediate concentric muscle action following an eccentric phase (35). Where concentric action is delayed, the elastic energy stored during the eccentric phase dissipates as heat. “Because plyometric drills involve maximal efforts to improve anaerobic power, complete and adequate recovery is required,” and plyometric exercises “should not be thought of as cardiorespiratory conditioning.” Appropriate volumes of lower body plyometric exercise, expressed as foot contacts per session range from 80 for beginners to 140 for advanced athletes. The “Kelly” and “Morrison” WODs (See Table 1), for example, both include 150 box jumps for all participants. This volume is high for the most well-conditioned athletes, not to mention those for whom the risks of plyometric exercise are greatly increased, especially: (a) individuals who cannot squat at least 1.5 times his or her body weight; (b) those who weigh more than 100 kg (220 lb); and (c) those who have a history of spinal or lower extremity joint dysfunction or degeneration (35).

During WODs that prescribe high volumes of exercises like box jumps, larger athletes will sustain greater stress than smaller athletes while the reverse will be true during WODs that prescribe absolute loads. A 110-lb woman performing a 75-lb snatch (See Table 1, WOD 15.1) has to lift 68% of her body weight. In contrast, a 150-lb woman has only to lift 50%. The negative effects of absolute loading can be seen in the log entry of an exercise science student interning at a CrossFit facility (27):

I did not at all like that the trainer was working out with the group. Several people were performing exercises incorrectly, which I could easily see, but which he did not. There were also both 'regulars' and 'first-timers' in the class, but they were all doing the same workout, with the same weights. The participants had to see how many sets they could get done in 15 minutes, but the first-timers were just too weak for the weight. This was VERY obvious from the VERY first set. Seeing these people push through for five more sets hurt me just to watch. I think that the beginners should have done a different workout, or should have at least changed the weights to be more appropriate.

Consider Carefully: Why Are So Many Training Fundamentals Ignored?

It is more than reasonable to suggest that it is because many CrossFit affiliates are run by individuals who lack comprehensive knowledge of exercise physiology. Most CrossFit WODs are extremely easy to design and to run. It takes very little time or thought to devise a regimen that merely requires the repeated performance of three to four exercises (SEE all WODs in Table 1). Another reason is that, in making everyday decisions, including those about health, humans show strong tendencies to choose immediate, over delayed rewards, even if the latter are likely to be greater (42). Thus, in making decisions related to exercise training, many people will give greater weight to immediate benefits, like fun, fitness improvements, and fellowship, than to future well-being. Grice et al. (13) recently reported that, among regularly active and avid, but non-elite exercisers, the "physical and psychological benefits of exercise were considered more valuable than any potential injury-associated risks." Moreover, those who did express injury-related concerns worried most about short-term consequences, such as injury recurrence and fitness loss. The majority showed little concern for potential long-term consequences, such as osteoarthritis, and some thought that new treatment developments reduced the need for concern.

CONCLUSIONS

The purpose of this article is not to bash CrossFit and is not to reduce CrossFit participation. The purpose is to urge students and working professionals to always think carefully about methods that oppose established science and standards of practice. The purpose is to urge cautious attention to how WODs affect unique individuals, in terms of physical abilities and limitations, injury potential, training goals, and other physical demands (for sport, work, or recreation). Not only do different individuals differ, but all individuals differ from time to time. A given WOD may be very well-suited to one person, and entirely inappropriate for another. A WOD may be appropriate for a particular individual one day, and unwise for that same person on another. CrossFit workouts are often novel for many, and novel can be challenging, fun, and invigorating. CrossFit gyms can foster a sense of community, which is a strong positive for many. However, exercise specialists must understand, and they must help others understand, the risks associated with participation in fitness programs that disregard scientific research in exercise physiology. Remember what you have learned and apply what you know.

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